

XIV



**ENCONTRO DE QUÍMICA
DOS ALIMENTOS**

6-9 NOVEMBRO, 2018 VIANA DO CASTELO



XIV Encontro de Química dos Alimentos

Indústria, Ciência, Formação e Inovação



LIVRO DE RESUMOS

Escola Superior de Tecnologia e Gestão

Instituto Politécnico de Viana

6 a 9 de novembro de 2018

Ficha Técnica

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Livro de Resumos do XIV Encontro de Química dos Alimentos
Indústria, Ciência, Formação e Inovação

Autores

Ana Paula Vale, Carla Barbosa, Manuela Vaz Velho, Manuel Rui Alves, Maria Alberta
Araújo, Mário Barros, Preciosa Pires, Rita Pinheiro, Susana Rocha

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Esta publicação reúne os resumos das comunicações apresentadas no XIV Encontro de Química dos Alimentos. Todas as comunicações orais e em painel foram avaliadas pela Comissão Científica do Encontro.

Nota de Abertura

O XIV Encontro de Química dos Alimentos (XIV EQA) foi organizado pelo Instituto Politécnico de Viana do Castelo, e decorreu nas instalações da Escola Superior de Tecnologia e Gestão, na cidade de Viana do Castelo, entre os dias 6 e 9 de Novembro de 2018. Este encontro, que se realiza bianualmente sob a égide da Divisão de Química dos Alimentos, da Sociedade Portuguesa de Química (SPQ), é um dos poucos fóruns nacionais onde a indústria e a ciência alimentares se podem cruzar de forma regular para um debate de ideias e conhecimento mútuo.

A Divisão de Química dos Alimentos da SPQ é uma das poucas organizações de carácter nacional que, reunindo investigadores oriundos de diversas áreas do saber, permite uma ampla discussão entre a química, a ciência, a tecnologia e a engenharia alimentares. Por essa razão, o Encontro de Química dos Alimentos tem vindo a tornar-se um dos mais importantes fóruns nacionais onde se cruzam investigadores das mais diversas proveniências e onde se debatem e potenciam as múltiplas facetas pelas quais o alimento pode ser estudado.

O XIV EQA foi organizado de modo a permitir às indústrias verificar o que de mais recente se faz em Portugal ao nível da investigação científica na área alimentar e simultaneamente permitir aos investigadores inteirar-se das necessidades de desenvolvimento do sector industrial, promovendo e facilitando colaborações cada vez mais necessárias.

O XIV EQA contou com workshops pré-evento, no dia 6 (que antecedem a recepção). No dia 7, sob o tema "um dia com a indústria", colaboradores da indústria e afins expuseram projetos de desenvolvimento e necessidades de colaborações com o sector científico nacional. No dia 8 do Encontro, sob o tema "um dia com a ciência", os investigadores apresentaram os seus mais recentes desenvolvimentos científicos e tecnológicos e avaliaram possibilidades de implementação das suas descobertas nas indústrias alimentares. O encerramento do Encontro, sob o tema "sessão formação e inovação", foi dedicado à análise e discussão da formação na área alimentar em Portugal.

A Comissão Organizadora do XIV EQA

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Comissões

ORGANIZAÇÃO

Manuel Rui Alves ESTG-IPVC

Manuela Vaz Velho ESTG-IPVC

COMISSÃO ORGANIZADORA

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Carla Barbosa IPVC - ESTG-IPVC

Maria Alberta Araújo ESTG-IPVC

Mário Barros ESTG-IPVC

Preciosa Pires ESTG-IPVC

Rita Pinheiro ESTG-IPVC

Susana Rocha ESTG-IPVC

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Apoios



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Programa

6 DE NOVEMBRO DE 2018 (3ª-FEIRA) workshops

14h00-18h00 Embalamento de alimentos em atmosfera modificada
Análise sensorial e textura em alimentos
Introdução à análise de dados com o R
Análise de dados avançada com o R
Aplicação de campos elétricos pulsados

18h00-19h00 **Receção - Verde D'Honra no Museu das Artes Decorativas de Viana do Castelo**

7 DE NOVEMBRO DE 2018 (4ª-FEIRA) um dia com a indústria

8h30-9h00 **Registo dos participantes**

9h00-9h30 **Cerimónia de abertura**

José Maria Costa (Presidente da Câmara Municipal de Viana do Castelo)
Rui Teixeira (Presidente do IPVC)
Joana Santos (Diretora da ESTG-IPVC)
Manuel Rui Alves (Presidente da Divisão de Química dos Alimentos da SPQ)
Manuela Vaz Velho (Organização do 14º EQA)

9h30 **Nutrição, saúde e tecnologia de alimentos**

Moderador: Victor Freitas (Faculdade de Ciências da Universidade do Porto)

9h30-10h00 **Sessão Plenária: Eurico Martins (Docapesca)**

Cadeia de valor da Pesca- A valorização do pescado nas lotas portuguesas

Sessão 1 Apresentações orais

10h00 **Cristina Pinheiro (ICAAM, Universidade de Évora)**

Proteolysis of PDO Serpa cheese made with *Cynara cardunculus* l. ecotypes during ripening

10h10 **Carmo Serrano (INIAV-I.P)**

Microencapsulated aromatic plants extracts for salt replacement and sensorial evaluation in cooked dishes

10h20 **Elsa F. Vieira (LAQV/REQUIMTE - Universidade do Porto)**

Anti-inflammatory potential of a brewer's spent yeast extract in a co-culture model of intestinal caco-2 and endothelial ea.hy926 cells

10h30 *Discussão*

10h45-11h30 **Coffee-break / sessão de posters (CP001-CP060)**

11h30 **Industria 4.0**

Moderador: Jorge Saraiva (Universidade de Aveiro)

11h30-12h00 **Sessão Plenária: Pilar Morais (Frulect)**

Conhecimento - O ecossistema Frulect

Sessão 2 Apresentações orais

12h00 **Telmo Francisco (LAQV/REQUINTE-Universidade do Porto)**

	Colagens emergentes: influência na composição fenólica e características organolépticas dos vinhos
12h10	Lisete Paiva (CBA-Universidade dos Açores) Variation in the amino acids profile and l-theanine of different parts of azorean camellia sinensis shoots
12h20	Rupesh Kumar Singha (Centro de Química de Vila Real-UTAD) Increased accumulation of anthocyanins in vine stems upon chitosan application: alternate use of winery waste produce to extract natural color additives for the food/cosmetic industry
12h30	Cátia Martins (Departamento de Química & QOPNA-Universidade de Aveiro) Beeromics: from small metabolites to understand beer aroma properties
12h40	Carlos Rodrigues (Instituto Politécnico de Viana do Castelo) Projeto ATIVAR
12h50	<i>Discussão</i>
13h00-14h30	Almoço
14h30	Alimentação do futuro <i>Moderador:</i> Manuela Vaz Velho (Instituto Politécnico de Viana do Castelo)
14h30-15h00	Sessão Plenária: Deolinda Silva (PortugalFoods) <i>O papel da PortugalFoods nos processos de investigação e inovação colaborativa</i>
Sessão 3	Apresentações orais
15h00	Rita Borges (CIMO-IPB e CQ-VR-UTAD) Tartrate stabilization of Rosé wine using ion exchange resins: Impact on wine sensory characteristics
15h10	Maria Lopes (Faculty of Pharmacy-University of Coimbra) Nutritional potential of <i>Salicornia ramosissima</i> j. woods from Figueira da Foz
15h20	<i>Discussão</i>
15h30-16h	Sessão Plenária: Ana Machado Silva (SONAE) <i>Inovação no retalho alimentar: a importância da colaboração</i>
	Apresentações orais
16h10	Mauro D. Santos (QOPNA-Universidade de Aveiro) Hyperbaric storage of fresh raw meat as an alternative/complement to refrigeration
16h20	Carla Graça (Universidade de Lisboa-Instituto Superior de Agronomia) Dairy products as ingredients in bakery foods to improve protein and mineral intake on daily diet
16h30	<i>Discussão</i>
16h30-17h00	Coffee-break / sessão de posters (CP001-CP060)
17h00	Visita ao Navio Hospital-Gil Eannes/Centro histórico de Viana do Castelo

8 DE NOVEMBRO DE 2018 (5ª-FEIRA) um dia com a ciência	
9h30	Qualidade e segurança de alimentos <i>Moderador:</i> Silvina Palma (Instituto Politécnico de Beja)
9h30-10h00	Sessão Plenária: Cristina Delerue (ISEP) Challenges and trends in the analysis of micropollutants and contaminants in foods
Sessão 4	Apresentações orais
10h00	João P. Trigo (QOPNA-Universidade de Aveiro) Impact of addition of pomegranate peel extract and high-pressure on carrot juice preservation: quality, safety and sensorial aspects
10h10	Preciosa Pires (Escola Superior de Tecnologia e Gestão-Instituto Politécnico de Viana do Castelo) Feeding and production system effects on the levels of androstenone and skatole in belly fat of entire male pigs
10h20	Hugo Félix Silva (ISEL-DEQ e CQE-Universidade de Lisboa) Uso de águas residuais na rega de vegetais comestíveis: avaliação do risco de contaminação por metais tóxicos
10h30	<i>Discussão</i>
10h45-11h30	Coffee-break / sessão de posters (CP061-CP120)
11h30	Questões relevantes em torno da embalagem e rotulagem <i>Moderador:</i> Isabel Coelho (Universidade Nova de Lisboa) <i>(a confirmar)</i>
11h30-12h00	Sessão Plenária: Camino García (Centro Tecnológico de la Carne) <i>Innovando en la seguridad y calidad alimentaria en el sector cárnico</i>
Sessão 5	Apresentações orais
12h00	Joana Lopes (CICECO - Aveiro Institute of Materials) Development of potato starch/phenolics films with potential to preserve smoked fish fillets during refrigerated conditions
12h10	Tânia Gonçalves Albuquerque (INSA e LAQV/REQUIMTE-UP) Alimentos processados: avaliação da conformidade da rotulagem
12h20	Victor Gomes Lauriano de Souza (MEtRiCS-Universidade Nova de Lisboa) Estabilidade oxidativa da carne de frango fresca com filmes de quitosano incorporados com extratos ativos naturais
12h30	<i>Discussão</i>
12h45-14h30	Almoço
14h30	Produção alimentar sustentável e novos métodos amigos do ambiente <i>Moderador:</i> Anabela Raymundo (ISA- Universidade de Lisboa)
14h30-15h00	Sessão Plenária: Beatriz Oliveira (FF-UP/REQUIMTE) <i>Inovação sustentável: do desafio à realidade</i>
Sessão 6	Apresentações orais
15h00	M. Cristiana Nunes (Universidade de Lisboa-Instituto Superior de Agronomia) Incorporação de biomassa microalgal em pão isento de glúten: avaliação do impacto na estrutura
15h10	Lillian Barros (CIMO- Instituto Politécnico de Bragança)

15h20	Phenolic profile of different <i>Cichorium spinosum</i> L. ecotypes José S. Câmara (CQM-Universidade da Madeira) Exploring the high throughput potential of recent microextraction strategies in the analytical workflow. the case study of food samples
15h30	José A. Figueira (CQM-Universidade da Madeira) Discrimination of lemon fruits from different geographical regions, based on a new analytical approach – nme/gc-ms and chemometric analysis
15h40	<i>Discussão</i>
15h50-16.30h	Coffee-break / sessão de posters (CP061-CP120)
16h30	Desafios na valorização produtos tradicionais e Novos potenciais para os produtos secundários da produção <i>Moderador: Joana Amaral (Instituto Politécnico de Bragança)</i>
16h30-17h00	Sessão Plenária: Manuela Pintado (ESB-UCP) Valorização de subprodutos agroalimentares na resposta à economia circular
Sessão 7	Apresentações orais
17h00	Helena Araújo-Rodrigues (Centro de Biotecnologia e Química Fina, Universidade Católica Portuguesa) Serpa PDO cheese: towards identification of chemical markers involved in organoleptic attributes
17h10	Nuno B. Alvarenga (UTI-INIAV e LEAF-ISA) Influência da utilização de diferentes ecótipos de <i>Cynara cardunculus</i> L. nas características físico químicas de queijo Évora DOP
17h20	Thelma B. Machado (Faculdade de Farmácia-Universidade Federal Fluminense e Faculdade de Farmácia-UP) Adding value to agrifood by-products as therapeutic alternatives: a case study of herbal medicine research
17h30	Catarina Vieito (Escola Superior de Tecnologia e Gestão- Instituto Politécnico de Viana do Castelo) Extraction yield and antioxidant activity of pine bark (<i>Pinus pinaster</i> Aiton subsp. <i>atlantica</i>) extracts: effect of solvent and extraction method
17h40	<i>Discussão</i>
17h50-18h45	SPQ - food chemistry division meeting
19h30	Jantar do encontro (entrega de prémios)

9 DE NOVEMBRO DE 2018 (6ª-FEIRA) formação e inovação	
9h30	Métodos e ferramentas da qualidade para avaliar e melhorar a formação Novas funcionalidades alimentares <i>Moderador: Isabel Ferreira (CIMO- Instituto Politécnico de Bragança)</i>
9h30-10h00	Sessão Plenária: Marco Dalla Rosa (Universidade de Bolonha) <i>Industrial Food research at the University of Bologna</i>
Sessão 8	Apresentações orais
10h00	Bernardo Lopes (CIMO- Instituto Politécnico de Bragança) Descodificar os “E”: plataforma online de acesso aberto de aditivos alimentares
10h10	Inês M. Ferreira (LAQV-REQUIMTE_UP) Looking for the best analytical markers of beer aging by HS-SPME-GC/MS
10h20	José Carlos Ribeiro (DGAOT-Universidade do Porto) Sensory profile of innovative grass pea-based cookies by children: application of the CATA technique
10h30	Rui P. Queirós (QOPNA-Universidade de Aveiro) Effects of high pressure on selected properties of pea protein isolates
10h40	Daniel Ettlin (Unicam Sistemas Analíticos) Development of a New Total Fat Quantification workflow Method in feed and food Cheese using Microwave Assisted Extraction (MAE)
10h50	<i>Discussão</i>
11h00-11h30	Coffee-break
11h30-13h00	Mesa Redonda: Formação e Inovação <i>Cooperação academia/indústria no desenvolvimento de modelos educacionais Inovação e empreendedorismo na formação em ciência alimentar</i> <i>Moderador: Rui Alves (IPVC)</i> Cristina Silva (ESB-UCP) Isabel de Sousa (ISA) Sílvia Peixoto (Grupo Primor) Ricardo Silva (Adega Cooperativa de Ponte de Lima)
13h00	Sessão de Encerramento Manuel Rui Alves (Organização do 14º EQA) Manuela Vaz Velho (Organização do 14º EQA)

Informação Útil

XIV Encontro de Química dos Alimentos:

Local: Escola Superior de Tecnologia e Gestão do Instituto Politécnico de Viana do Castelo

Como chegar à ESTG?

A Escola Superior de Tecnologia e Gestão (ESTG) de Viana do Castelo situa-se na cidade de Viana do Castelo. Esta cidade é a Capital do Distrito com o mesmo nome e corresponde, em termos gerais, à sub-região do Alto-Minho.

Dista 70 Km do Porto e 90 Km de Vigo, ocupando um campus com uma área total de 50.000m², e confinando a Oeste com o Oceano Atlântico (praia Norte), a Sul com os Estaleiros Navais de Viana do Castelo e a Este com o Monte de Santa Luzia.

A cidade pode ser acedida por via aérea através dos aeroportos do Porto (Francisco Sá Carneiro) ou de Vigo (em Espanha), e a partir daí por via rodoviária ou ferroviária.

Coordenadas GPS: N 41º 41' 36" W 8º 50' 48"

<http://www.estg.ipvc.pt/>

Registo:

O registo inclui o acesso a todos os materiais da conferência, almoços, *coffee-breaks*, visita ao Gil Eannes/centro histórico, Verde D'Honra e jantar do congresso.

Conferências e Posters:

As conferências irão decorrer no Auditório Francisco Sampaio, Piso 0.

Os posters serão afixados nas salas do Piso 0 do edifício da Biblioteca Barbosa Romero da ESTG.

Acesso à Internet:

O local dispõe de internet wifi. Rede Eventos; eventos@estg; PASSWORD: www.estg.ipvc.pt

Documentação:

O livro de Atas (ISBN 978-989-98936-9-6) e o livro de Resumos (ISBN 978-989-98936-8-9) serão disponibilizados no site do congresso (<http://xivega.eventos.chemistry.pt/>).

Almoços e coffee-breaks:

Os *coffee-breaks* e os almoços decorrem no piso 0 e 3, respetivamente, do edifício da Biblioteca da ESTG.

Eventos Sociais:

6 de novembro

18h00: Verde D'Honra - Museu de Artes Decorativas de Viana do Castelo.

Largo de S. Domingos, 4900-330 Viana do Castelo



7 de novembro

17h00: Visita ao Navio-Hospital Gil Eannes. Com transporte em autocarro, desde o local do congresso (ESTG) até ao local do Navio.

Navio Gil Eannes - Doca Comercial.

17h00: Visita guiada ao centro histórico de Viana do Castelo. Com transporte em autocarro, desde o local do congresso (ESTG) até ao local do encontro com o guia (Nuno Barbosa - Viv'Experiência).



8 de novembro

19h30: Jantar do Congresso –Restaurante “Camelo”. Com transporte em autocarro, desde o local do congresso (ESTG) até ao local do Restaurante. <http://camelorestaurantes.com/camelo/>



Comunicações Orais Convidadas

CADEIA DE VALOR DA PESCA- A VALORIZAÇÃO DO PESCADO NAS LOTAS PORTUGUESAS

Eurico Martins | Docapesca

CONHECIMENTO - O ECOSISTEMA FRULACT

Pilar Morais | Frulact

O PAPEL DA PORTUGALFOODS NOS PROCESSOS DE INVESTIGAÇÃO E INOVAÇÃO COLABORATIVA

Deolinda Silva | PortugalFoods

INOVAÇÃO NO RETALHO ALIMENTAR: A IMPORTÂNCIA DA COLABORAÇÃO

Ana Machado Silva | SONAE

CHALLENGES AND TRENDS IN THE ANALYSIS OF MICROPOLLUTANTS AND CONTAMINANTS IN FOODS

Cristina Delerue | ISEP

INNOVANDO EN LA SEGURIDAD Y CALIDAD ALIMENTARIA EN EL SECTOR CÁRNICO

Camino García | Centro Tecnológico de la Carne

INOVAÇÃO SUSTENTÁVEL: DO DESAFIO À REALIDADE

Beatriz Oliveira | FF-UP/REQUIMTE

VALORIZAÇÃO DE SUBPRODUTOS AGROALIMENTARES NA RESPOSTA À ECONOMIA CIRCULAR

Manuela Pintado | ESB-UCP

INDUSTRIAL FOOD RESEARCH AT THE UNIVERSITY OF BOLOGNA

Marco Dalla Rosa | Universidade de Bolonha

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CO01 PROTEOLYSIS OF PDO SERPA CHEESE MADE WITH CYNARA CARDUNCULUS L. ECOTYPES DURING RIPENING

Pinheiro, C.^{1,2}, Garrido, A. L.², Lage, P.³, Lamy, E.¹, Rodrigues, L.¹, Alvarenga, N. B.^{3,4,5}, Dias, J.^{3,6}, Martins, A. P. L.^{4,5} and Duarte, M. F.^{1,7}

¹ICAAM, U. Evora, Ap. 94, 7006-554 Évora

²Departamento de Zootecnia, ECT, U. Evora, Ap. 94, 7006-554 Évora

³ESA-Instituto Politécnico de Beja, Rua Pedro Soares, 7800-295 Beja, Portugal

⁴UTI-INIAV, Quinta do Marquês, Oeiras, Portugal

⁵LEAF-ISA, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisbon, Portugal

⁶GeoBioTec, Un. Nova de Lisboa, Campus da Caparica, 2829-516 Caparica, Portugal

⁷CEBAL/IPBeja, Rua Pedro Soares, s.n, Campus IPBeja, 7801-908 Beja, Portugal

Portugal and Spain have a strong tradition of cheesemaking from raw ewe's cheese made with the aqueous extracts of *Cynara cardunculus* L. dried flowers. Serpa cheese is an example of a Portuguese regional cheese with the label of Protected Designation of Origin (PDO), that is characterized with a semi-soft texture and an exquisite flavor.

The renewed interest in the enzymes of the *Cynara cardunculus* L. coagulant prompted to the aim of this work that was to evaluate the effect of *Cynara cardunculus* L. three ecotypes on Serpa cheese proteolysis. Therefore, cheese samples were analysed by urea-PAGE, and nitrogen fractions (total nitrogen, water soluble nitrogen and non-protein nitrogen) and three ecotypes were used (*Cynara* 1, *Cynara* 2, *Cynara* 3) and compared with a commercial animal rennet (Animal) after 0, 2 and 5 weeks of ripening. It was possible to establish the pattern of the casein fractions degradation and, at the end of ripening (5weeks), results showed that no significant differences were found in cheeses made with the three ecotypes, and they showed a higher degradation of α_s -caseins (47,42%) than β -caseins (24,27%). However, differences were found between cheeses made with the vegetable coagulant and those made with animal coagulant, especially regarding β -caseins results. Observing the nitrogen fractions, all samples obtained with vegetable coagulant presented a higher degree of proteolysis than the samples coagulated with rennet, being *Cynara* 1 the coagulant that presented higher proteolytic power.

Keywords: urea-PAGE; *Cynara cardunculus* L; proteolysis; caseins; Serpa cheese.

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CO02

HYPERBARIC STORAGE OF FRESH RAW MEAT AS AN ALTERNATIVE/COMPLEMENT TO REFRIGERATION

Mauro D. Santos, Ivonne Delgadillo, Jorge A. Saraiva

QOPNA - Organic Chemistry, Natural and Agro-Food Products Research Unit Department of Chemistry, University of Aveiro, Portugal
mdb@ua.pt

Hyperbaric Storage (HS) has been studied as a new food preservation methodology for different food products. This new food preservation methodology relies on food preservation under pressure, usually between 50 and 150 MPa, at room temperature (RT) as an alternative to refrigeration (RF), or at cold temperatures to become a complement to it since usually allows a shelf-life extension when compared to RF at atmospheric pressure (AP). HS has demonstrated to be capable not only to inhibit microbial growth but also to inactivate microorganisms while overall physicochemical parameters are maintained.

The aim of this work was to study the HS feasibility for fresh raw meat, pork and bovine, in pieces and minced, respectively. For that, all samples were stored at different conditions: 75 MPa at variable RT, 60 MPa/10 °C, AP/5 °C and AP at variable RT, up to 60 days. To assess HS impact on samples, microbiological and physicochemical analyses were performed.

As expected, throughout storage it was possible to observe a microbial load increase for total aerobic mesophiles (TAM), *Enterobacteriaceae* (ENT), lactic acid bacteria (LAB), and yeasts and moulds (YM) for both samples (pork and bovine) when stored at AP/RT, reaching values above 7.00 log CFU/g. Concerning samples stored at RF/AP, TAM and LAB counts slowly increased (>2.00 log units) during 30 days, being the values of ENT and YM more similar to the initial ones (microbial inhibition), except for YM on minced bovine meat where values increased ≈1.5 CFU/g at the 7th day of storage, lowering after that up to the 30th day. When these samples were stored under hyperbaric conditions, an overall microbial load decrease was observed for all microorganisms, for instance, ≈2 Log CFU/g for TAM on pork meat and >3 Log CFU/g for ENT and YM on bovine meat. When the two HS conditions are compared, it is possible to observe similar tendencies on the microbial load control over 60 days of storage, where an overall inactivation effect is present.

In the physicochemical analyses performed, i.e., pH, drip loss, color and lipid oxidation (TBARS), the main differences detected were due to samples heterogeneity, except for TBARS where in bovine meat 60 MPa/10 °C lower values were found, being more similar to RF than 75 MPa/RT. Nonetheless, for pork meat both HS conditions presented higher values than on RF at the 30th day of storage (≈0.9 and ≈1.80 μg MDA/g for RF and HS conditions, respectively).

At the end, it was possible to conclude that HS could be an alternative or a complement to RF, allowing a possible shelf-life extension when compared to RF. Further analyses should be carried out to assess HS impact on organoleptic characteristics since it could affect, for instance, lipid oxidation in some cases.

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CO03

Tartrate stabilization of rosé wine using ion exchange resins: Impact on wine sensory characteristics

Rita Borges^{1,3}, Conceição Fernandes¹, Celeste Marques², Carlos Matos³, Alice Vilela³, Filipe-Ribeiro, L. ³, Fernando M. Nunes³, Fernanda Cosme³

¹Mountain Research Centre (CIMO), ESA-Polytechnic Institute of Bragança, Portugal

²AEB Bioquímica Portuguesa SA, Zona Industrial de Coimbrões, Viseu, Portugal

³Chemical Research Centre (CQ-VR), Food and Wine Chemistry Lab, UTAD, Vila Real, Portugal.

Email: ritaborges_17@hotmail.com

Tartaric precipitation in bottled wine is an important problem for the wine industry by the sensory undesirable aspect and, therefore, wineries employed several treatments to prevent this precipitation to satisfy the quality criteria of wine consumers.

For example, according to Resolution 43/2000 [1], the addition of certain stabilizers, such as metatartaric acid and carboxymethylcellulose (CMC) or the treatment of the wine with ion exchange resins, are accepted and have been successfully used to prevent tartaric precipitation in white and red wine [2,3]. However, there are few studies regarding rosé wine. The main difference concerning these two stabilization processes is that the ion exchange resins removes the compounds that contribute to tartrate instability. Anion exchangers are not allowed by the OIV [1] due to the negative effects on the wine physiochemical and sensory quality [4,5].

Therefore, the aim of this study was to evaluate the effect of cation exchange resins on rosé wine tartaric stabilization efficiency and wine sensory quality compared to the effect of the addition of different enological stabilizers. In this study a rosé wine from the Douro Valley demarcated region, 2015 vintage, was used, and ion exchange resin *versus* CMC's, with different structural features [2], as well as metatartaric acid, were tested concerning their tartaric stabilization efficiency and sensory quality. In this work almost 30% from the total rosé wine volume was treated by ion exchange resins. As expected, all treatments assayed stabilized the rosé wine. The cation exchange resins process could be a useful tool to maintain wine quality, as the sensory analysis data showed. Main differences were obtained for the wine visual descriptor, namely limpidity attributes, which was higher scored in the wine treated with ion exchange resins. These results show that ion exchange resins could be an interesting process for rosé wine tartaric stabilization.

Keywords: Rosé wine, ion exchange resins, tartaric stability, enological stabilizers, sensory quality.

References:

[1] O.I.V. Resolution OENO 43/2000

[2] Guise, R.; Filipe-Ribeiro, L.; Nascimento, D.; Bessa, O.; Nunes, F. M.; Cosme, F. *Food Chemistry*, **2014**, 156, 250-257.

[3] Ibeas, V.; Correia, A.; Jordao, A. *Food Research International* **2015**, 69, 364-372.

[4] Mira, H.; Leite, P.; Ricardo-Da-Silva, J.M.; Curvelo-Garcia, A.S. *International des Sciences de la Vigne et du Vin* **2006**, 40, 223-246.

[5] Lasanta, C.; Caro, I.; Pérez, L. *Food Chemistry* **2013**, 138, 1072-1078.

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CO04

DESCODIFICAR OS “E”: PLATAFORMA ONLINE DE ACESSO ABERTO DE ADITIVOS ALIMENTARES

Bernardo Lopes¹, Tiago Padrão¹, Márcio Carochó^{1,2}, Rui Pedro Lopes³,
Isabel C.F.R. Ferreira¹

¹*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253, Bragança*

²*Laboratory of Separation and Reaction Engineering – Laboratory of Catalysis and Materials (LRE-LCM), Faculty of Engineering, University of Porto, Portugal*

³*Centro de Investigação em Digitalização e Robótica Inteligente, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253, Bragança*

O crescimento da população tem levado ao desenvolvimento de novas formas de produção, conservação e distribuição de bens alimentares. Além disso, tem havido também, uma maior preocupação e procura por formas de alimentação saudável, estimulando a curiosidade em conhecer os constituintes e os processos de fabrico. Caracterizados inicialmente por alguma controvérsia, em particular na década de noventa e nos inícios do milénio, os aditivos alimentares são ainda olhados com desconfiança pela população, que desconhece grande parte da sua função, origem e segurança. A informação sobre eles, cuja fonte principal é a Internet, é escassa, retalhada, dificilmente acessível ou de fontes pouco fidedignas. Desmistificar e informar a população para os aditivos que são adicionados aos alimentos é uma tarefa que requer um acesso fácil, constante, simples e integrativo, permitindo que o consumidor saiba facilmente aquilo que está a comer. Por outro lado, existem empresas que requerem informações relativas às quantidades legalmente permitidas de aditivos em alimentos, informação essa que está condensada e de difícil acesso na página da EFSA (*European Food Safety Authority*).

O trabalho aqui descrito descreve e justifica uma solução informática que reúne os dados fundamentais dos aditivos alimentares e das suas possibilidades de utilização num portal online de acesso aberto. Desenvolvido em Java e Apache Wicket, constrói as páginas de forma dinâmica com base na informação de uma base de dados que armazena as características mais importantes dos aditivos e das classes a que pertencem. Esta base de dados foi compilada e estruturada com base em várias fontes, online e offline, contendo uma lista de categorias alimentares de modo a especificar os cuidados e as restrições existentes na utilização de certos aditivos em determinadas categorias. Toda esta estrutura facilita a consulta da informação, já que é possível ordenar e filtrar os resultados, relacionando alimentos com aditivos e vice-versa. A funcionalidade da aplicação encontra-se acessível através de uma API aberta baseada em serviços RESTful que permite o acesso por diferentes aplicações, sistemas operativos e tecnologias. Neste momento estão a ser desenvolvidas aplicações para Android e iOS permitindo a consulta mais rápida e acessível em qualquer lugar.

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CO05

Variation in the amino acids profile and L-Theanine of different parts of Azorean *camellia sinensis* shoots

Lisete Paiva^{1,2}, Elisabete Lima^{2,3}, Madalena Motta¹, José Baptista^{2,3}

¹Plantações de Chá Gorreana, Gorreana, 9625-304 Maia, S. Miguel, Azores, Portugal

²Biotechnology Centre of Azores (CBA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal

³Institute of Agricultural and Environmental Research and Technology (IITAA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal. lisete.s.paiva@uac.pt

Tea (*Camellia sinensis*) is one of the most popular beverages worldwide and preclinical and epidemiological investigations suggest that drinking tea may block the development of various disorders, such as cancer, cardiovascular and neurodegenerative diseases [1]. The predominant amino acid in *C. sinensis* is L-theanine (5-*N*-ethyl glutamine) that is a non-protein amino acid and constitutes usually between 0.2 and 2% of the dry weight (DW) accounting for up to 50% of all free amino acids. Theanine has a number of biological effects such as a calming effect on the mental state by lowering blood pressure and inhibit caffeine's side effects, among others [2, 3]. The objective of this study was the determination by HPLC of the amino acid's profiles, including theanine, in different parts of the *C. sinensis*, in order to find the best combination for the most beneficial effects on human health. Results showed that theanine, asparagine, histidine, glutamic acid, methionine and phenylalanine were the major amino acids in various parts of *C. sinensis*. High theanine content was observed in internodes (17.00 mg/g of DW), followed by the combination of bud, 1st, 2nd leaves and internodes (10.59 mg/g of DW) and bud, 1st, 2nd, 3rd leaves and internodes (8.78 mg/g of DW), and the lower value in the combination of bud, 1st and 2nd leaves (1.74 mg/g of DW). Histidine presents higher values in internodes (13.73 mg/g of DW), followed by the combination of bud, 1st, 2nd, 3rd leaves and internodes (10.75 mg/g of DW). Asparagine shows higher levels in bud (7.70 mg/g of DW), 1st leaf (6.40 mg/g of DW) and in internodes (5.00 mg/g of DW). Glutamic acid presents higher level in internodes (3.13 mg/g of DW) and methionine in bud (2.93 mg/g of DW) and in 1st leaf (2.68 mg/g of DW). Phenylalanine was higher in internodes (4.13 mg/g of DW) and in the combination of bud, 1st, 2nd, 3rd leaves and internodes (3.39 mg/g of DW). Internodes presents the higher amount of total amino acids (50.49 mg/g of DW), followed by the combination of bud, 1st, 2nd leaves and internodes (43.78 mg/g of DW), and lowest value in the combination of bud, 1st and 2nd leaves (22.44 mg/g of DW). The results clearly show differences in the amino acids profile and particularly the theanine content in various parts of *C. sinensis*, and the internodes were shown to contain the highest theanine levels as compared to the other shoots.

[1] Chacko, S. M.; Thambi, P. T.; Kuttan, R.; Nishigaki, I. *Chinese Medicine* **2010**, 5, 13.

[2] Baptista, J.; Lima, E.; Andrade, A.; Alves, M.; Paiva, L. *Food Chemistry* **2012**, 132, 2181–2187.

[3] Too, J. C.; Kinyanjui, T.; Wanyoko, J. K.; Wachira, F. N. *Food and Nutrition Sciences* **2015**, 6, 1014–1021.

CO06

COLAGENS EMERGENTES: INFLUÊNCIA NA COMPOSIÇÃO FENÓLICA E CARACTERÍSTICAS ORGANOLÉTICAS DOS VINHOS

Telmo Francisco^{1*}, Rosa Pérez-Gregorio¹, Susana Soares¹, Adriana Xavier², Manuel Figueiredo², João Simões³, Nuno Mateus¹, Filipe Centeno², Maria de Fátima Teixeira², Victor de Freitas¹

¹LAQV-REQUINTE, Departamento de Química e Bioquímica, Faculdade de Ciências da Universidade do Porto, Rua do Campo Alegre 687, 4169-007, Porto, Portugal;

²PROENOL, Indústria Biotecnológica, Lda, Travessa das Lages nº267, Apto 547, Canelas, VNG 4405-194 Portugal;

³BIOCANT – Centro de Inovação em Biotecnologia, BIOCANT PARK – Parque Tecnológico de Cantanhede, Núcleo 04, Lote 3, 3060-197 Cantanhede, Portugal.
tel@fc.up.pt

Os polifenóis desempenham um papel preponderante na indústria enológica, sobretudo ao nível das características organoléticas. No setor vinícola a qualidade é um conceito basilar face às exigências do consumidor [1]. O vinho possui partículas capazes de formar uma turvação que estraga a aparência do mesmo assim como pode afetar o seu sabor. O objetivo da clarificação é eliminar estas partículas estabilizando o vinho de modo a garantir clareza a longo prazo e evitar depósitos. A clarificação pode ser induzida por um processo de colagem, que depende da adição de colas, geralmente de origem animal, que induzem a floculação [2]. A este tipo de colas tem sido associada a incidência de alergias alimentares, surgindo a necessidade de criar novos produtos. Sendo assim foi colocada a hipótese de utilizar extratos proteicos de leveduras (EPL's) como colas enológicas que apresentem um poder clarificante e estabilizante igual ou superior ao das colas comerciais, sendo ainda capazes de potenciar as propriedades organoléticas dos vinhos [3].

Este trabalho tem como objetivo avaliar a influência dos EPL's (desenvolvidos pela Proenol, Indústria Biotecnológica) nas características organoléticas do vinho, nomeadamente no sabor e amargor recorrendo-se a cromatografia líquida acoplada a espectrometria de massa (LC-MS), e no estudo da cor através do sistema CieLab. Pela análise dos resultados de LC-MS foi possível identificar quais os compostos fenólicos presentes no vinho que estavam diretamente relacionados com o amargor e a adstringência, permitindo inferir quais as alterações induzidas pelos diferentes EPL's produzidos e aplicados no vinho. Observou-se que, de forma global, ocorreu uma diminuição significativa da maioria dos compostos amargos identificados. Através do estudo da cor verificou-se que os EPL's aplicados nos vinhos têm um poder clarificante notório, demonstrando capacidade em reduzir os tons amarelos dos vinhos colados com os extratos. Conclui-se que os EPL's apresentam um ótimo potencial como alternativa às colas comerciais atualmente disponíveis no mercado.

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Referências

- [1] Finning Agents, The Australian Wine Research Institute webpage
- [2] Granato, T.M., Nasi, A., Ferranti, P. et al, Eur Food Res Technol (2014), pp. 238- 265.
- Leticia Martínez-Lapuente et al, Food Research International, 2017, pp. 235-243.

CO07**Increased accumulation of anthocyanins in vine stems upon chitosan application: alternate use of winery waste produce to extract natural color additives for the food/cosmetic industry**

Rupesh Kumar Singh^a, Virgílio Falco^a, Isaura Castro^b, Ana L. Pinto e Sintra^b, António Inês^a, Fernanda Cosme^a and Ana Alexandra Oliveira^b

^a*Centro de Química de Vila Real (CQ-VR), UTAD, 5000-801, Vila Real, Portugal*

^b*Centro de Investigação e de Tecnologias Agro-Ambientais e Biológicas (CITAB), UTAD, 5000-801 Vila Real, Portugal*

Chitosan is a biopolymer and has been used in agriculture for different objectives including improved resistance against fungal pathogens, yield, fruit weight, vegetative growth, quality and shelf-life [1]. In the present work, grapevines from Touriga Franca red grape variety was exposed to 0.01% chitosan aqueous solution during veraison, after complete veraison and at maturation stage. Vine stems were collected after harvesting of grapes and samples were extracted in 50% aqueous ethyl alcohol (v/v) and monomeric anthocyanins were studied by HPLC. Malvidin-3-glucoside was the major anthocyanin recorded with 19.91±0.70 mg/L in control stems and 43.57±7.70 mg/L (118.83% increased) in chitosan treated plants. Malvidin-3-coumaroylglucoside was the second major anthocyanin with 11.69±0.38 mg/L in control stems and 25.11±3.99mg/L (114.79% increased) in treated plants followed by Peonidin-3-glucoside (5.53±0.20 mg/L in control and 11.00±1.90 mg/L in treated grapevines) and Malvidin-3-acetylglucoside (5.44±2.48 mg/L in control and 14.96±2.27 mg/L in treated plants). In addition to these major anthocyanins, 11 other anthocyanins were also detected and quantified, with significant increased accumulation in the treated grapevines.

Anthocyanins are natural colorants with health benefits in dietary context and gaining popularity as a replacement of synthetic colors in food and cosmetic industries with huge market growth forecast upto \$387.4 Million by 2021 [2]. Several synthetic colors are being prohibited and regulated by comprehensive sets of new regulation which is major limitations for industrial sector; recently EU and US alleviated the need of natural colors in variety of products to meet new regulations [3]. Present study suggest the use of chitosan application to induce anthocyanin accumulation in grapevine stems and use of this winery waste produce to meet the requirement of natural colorants as well as to establish suspension cell culture scale up factories to extract commercially important anthocyanins for industrial purposes.

Keywords; Anthocyanins, natural colorant, grapevine stems, chitosan.

References;

- [1] Malerba, M.; Cerana, R. *International Journal of Molecular Sciences* 2016, 17(7), 996; <https://doi.org/10.3390/ijms17070996>.
 [2] Appelhagen, I.; Vester, A. K. W.; Wendell, M.; E A. K. H.; Russell, I. J.; Oertel, A.; Martensd, S.; Mock, H. P.; Martina, C.; Matros, A. 2018 *Metabolic Engineering* 48, 218–232.
 [3] Lehto, S.; Buchweitz, M.; Klimm, A.; Strasburger, R.; Bechtold, C; Ulberth, C. *Food additives & contaminants*: 2017, part a, 34 (3), 335–355.

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CO08
LOOKING FOR THE BEST ANALYTICAL MARKERS OF BEER
AGING BY HS-SPME-GC/MS

Inês M. Ferreira¹, Marco G. Silva², Luís F. Guido¹

¹LAQV/REQUIMTE, Faculdade de Ciências da Universidade do Porto, Rua Campo Alegre, 687, 4169-007, Porto, ines.filipa.mourao.ferreira@gmail.com

²LAQV/REQUIMTE, Faculdade de Ciências e Tecnologia/Universidade Nova de Lisboa, Campus da Caparica 2829-516 Caparica

The changes in chemical composition during storage is considered, nowadays, the main quality problem of beer. These chemical changes alter the sensory properties of beverages. A vast variety of flavours may arise, depending on the beer type as well as the storage conditions, and, in contrast with wines, beer aging is usually considered negative for flavour quality [1]. Beer flavour is mainly originated by the formation of aldehydes, esters, higher alcohols, ketones and other some compounds that are formed during fermentation stage, in beer production [2].

The main goal of this work is to investigate the compounds considered the best chemical markers of beer aging. To reach the objective, beers were submitted to different storage conditions varying temperature and time of storage. The most extreme condition was storage at 37°C for 2 weeks. Samples were also stored at 4°C and 20°C during 3 and 6 months. Samples submitted to the different storage conditions were analysed by HS-SPME-GC/MS in two different ways. Firstly, a recent method published by N. Moreira et al. [3] was applied, based on solid phase microextraction with derivatization sample matrix, using O-(2,3,4,5,6- pentafluorobenzyl) hydroxylaminehydrochloride (PFBHA) as derivative. The second one was based on solid phase microextraction of degassed beer matrix. The results obtained show that some compounds are good markers of beer aging, namely furfural whose concentration clearly increase for the different storage conditions. Besides that, isoamyl acetate shows the same behaviour. It has further been found that the concentration of other compounds, such as acetaldehyde, is higher with the increase of storage temperature.

SPSS was used to statistically validate the significance of these findings. ANOVA and the F test were used to compare the differences in the composition of the compounds over time. It is concluded that there are significant differences for the referred compounds at a significance level of 5%.

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- [1] Vanderhaegen, B., et al., *The chemistry of beer aging – a critical review*. Food Chemistry, 2006. **95**(3): p. 357-381.
- [2] Ferreira, I.M. and L. Guido, *Impact of Wort Amino Acids on Beer Flavour: A Review*. Fermentation, 2018. **4**(2): p. 23.
- [3] Moreira, N., et al., *Optimization of the HS-SPME-GC-IT/MS method using a central composite design for volatile carbonyl compounds determination in beers*. Talanta, 2013. **117**: p. 523-31.

CO09

SENSORY PROFILE OF INNOVATIVE GRASS PEA-BASED COOKIES BY CHILDREN: APPLICATION OF THE CATA TECHNIQUE

Célia Rocha^{1,2}, José Ribeiro^{1,2}, Rui Costa Lima², Catarina Prista³, Maria Carlota Vaz Patto⁴, Luís Miguel Cunha^{1,6*}

¹GreenUPorto/DGAOT, Faculty of Sciences, University of Porto, Campus Agrário de Vairão, Vila do Conde, Portugal

²SenseTest Lda., Rua Zeferino Costa, 341, 4400 – 345 Vila Nova de Gaia, Portugal

³DRAT, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda 1349-017 Lisboa, Portugal

⁴LEAF, Linking Landscape, Environment, Agriculture and Food, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda 1349-017 Lisboa, Portugal

⁵Instituto de Tecnologia Química e Biológica António Xavier, Universidade Nova de Lisboa, Oeiras, Portugal

⁶LAQV, REQUIMTE, Campus Agrário de Vairão, Vila do Conde, Portugal

*corresponding author: lmcunha@fc.up.pt

Grass pea (*Lathyrus sativus* L.) is an edible legume with high nutritional value and whose cultivation is suitable for fragile eco-systems due to its ability to survive under extreme climatic conditions. Nonetheless, its utilization was greatly reduced in the last decades and is mostly consumed in developing countries. To reverse this situation, it is necessary to find new ways of increasing its consumption through new products. The aim of this study was to assess children's acceptance of cookies with incorporation of fermented grass pea flour, and characterize them using a Check-All-That-Apply (CATA) approach. Grass pea-based tempeh was developed and was further processed into flour for incorporation into two different cookies, salty and sweet, at different levels of wheat flour substitution (between 0 and 40%). Two sensory panels with 60 children (8-12 years old) evaluated the overall liking of cookies using a 7-point smile scale, and after that were invited to assess the sensory profile using a CATA ballot, previously developed from focus groups with children. 21 sensory terms organized by sensory dimensions (appearance, odour, texture and taste) were used on the ballot development. Results from salty cookies show that children prefer the ones with a low (10%) content or no grass pea-based flour and characterized them as salty taste and tasty. For the sweet cookies the most preferred sample is the one with 10% of flour incorporation but with no significant difference from the ones of 20% or 0% grass pea flour incorporation. Children characterized them as tasty, crunchy, sweet, cereals and "Maria Cookie" taste, water and salt cookie odour and taste. The cookies with a low percentage (less than 20%) of fermented grass pea-based flour incorporation were well accepted by children, being a very promising result for the use of this legume for the production of innovative products.

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CO10

EFFECTS OF HIGH PRESSURE ON SELECTED PROPERTIES OF PEA PROTEIN ISOLATES

Rui P. Queirós, Jorge A. Saraiva, José A. Lopes da Silva

*QOPNA - Organic Chemistry, Natural and Agro-Food Products Research Unit, University of Aveiro, 3810-193 Aveiro, Portugal
rui.queiros@ua.pt*

There has been an increase in the pursuit of technologies and products that allow to tailor properties of macromolecules present in foods. In this sense, the use of vegetable proteins has been the focus of research efforts to develop new products and/or to replace other sources of protein. Several studies using vegetable proteins have shown that high pressure (HP) allows to modify proteins' supramolecular structures thus improving their functionality [1].

In this work, the effects of HP (pressure: 200-600 MPa; holding time: 5-15 min) on solubility, surface hydrophobicity and emulsifying properties of commercial pea protein isolates (PPI) at three pH values (6, 7 and 8) were evaluated.

The PPI presented 21% initial solubility at pH 7 that was increased to 33% with increasing pressure up to 400 MPa and time up to 10 min; further increases in pressure or time above these values did not significantly influence the solubility. A similar behavior was obtained for the other pH values.

The emulsifying activity index (EAI) of the total fraction at pH 8 decreased approximately 17% when pressure below 600 MPa was used regardless the holding time. At pH 6 and 7 no significant differences ($P > 0.05$) were observed. The emulsifying stability index (ESI) increased about 32% at pH 7 with the 600 MPa treatments and the holding time did not have a considerable effect. At the other pH values, no significant differences ($P > 0.05$) were observed. Considering the soluble fraction, a significant increase ($P < 0.05$) in the EAI of about 20% was only observed at pH 8 and 600 MPa, regardless the holding time. The ESI at pH 7 was increased with pressure, particularly at 400 MPa (regardless the holding time) and 600 MPa/10 min.

The initial surface hydrophobicity of PPI was increased with increasing pressure and holding time, particularly at pH 7 at 200 MPa/15 min or higher, surpassing an increase of 40% at 400 MPa/15 min and 600 MPa (10 and 15 min).

In conclusion, HP can be used to improve some techno-functional properties of PPI, particularly the solubility and surface hydrophobicity, and does not majorly impact the emulsifying properties at the selected processing conditions.

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[1] Queirós, R. P.; Saraiva, J. A.; Lopes da Silva, J. A. *Crit Rev Food Sci Nutr* **2018**, *58*, 1538-1556.

C011

ANTI-INFLAMMATORY POTENTIAL OF A BREWER'S SPENT YEAST EXTRACT IN A CO-CULTURE MODEL OF INTESTINAL CACO-2 AND ENDOTHELIAL EA.HY926 CELLS

Elsa F. Vieira¹, Isabel M.P.L.V.O Ferreira², Cristina Delerue-Matos¹

¹REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida, 431, 4249-015, Porto, Portugal

²LAQV/REQUIMTE, Departamento de Ciências Químicas, Laboratório de Bromatologia e Hidrologia, Faculdade de Farmácia, Universidade do Porto, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal
elsavieira@gmail.com

Brewer's spent yeast (BSY) is a valuable resource for production of protein autolysates with promising application as a functional food additive. In this research, the anti-inflammatory activity of a BSY extract prepared by autolysis (36.0°C, 6.0 h) [1], ultrafiltration (3 kDa membrane cut-off) and gastrointestinal digestion was investigated. For this purpose, a co-culture model (Figure 1), which combines the absorption by differentiated Caco-2 cells and sequential effects on endothelial cells (EA.hy926) metabolism, was used to determine the effects of the BSY.GI < 3 kDa extract on the oxidative stress and the secretion of endothelial markers under inflammatory (TNF- α treatment) and non-inflammatory conditions. Results showed that treatment with BSY.GI < 3 kDa extract significantly ($p < 0.05$) decreased all the inflammation markers in a dose-dependent manner when compared to TNF- α -treated control. Overall, these *in vitro* screening results, in which intestinal digestion, absorption and endothelial bioactivity are simulated, show the potential of BSY extract to be used as an alternative therapy for the prevention of inflammatory-related diseases.

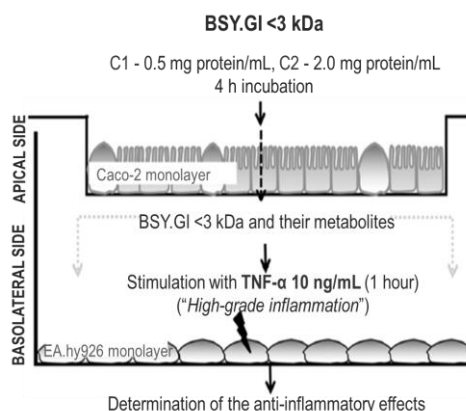


Figure 1: Co-culture model of intestinal Caco-2 and endothelial EA.hy926 cells.

Acknowledgements: This work received financial support from project UID/ QUI/50006/2013 - POCI/01/0145/FEDER/007265.

[1] Vieira, E. F.; das Neves, Melo, A; Ferreira, I. M. P. L. V. O. *LWT - Food Science and Technology* **2017**, *82*, 255-259.

CO12

Dairy products as ingredients in bakery foods to improve protein and mineral intake on daily diet

Carla Graça, Anabela Raymundo, Isabel de Sousa

Universidade de Lisboa, Instituto Superior de Agronomia, LEAF Research Center
(Linking Landscape Environment Agriculture and Food), Tapada da Ajuda, 1349-017
Lisboa, Portugal - Email of author for contact: lopesgraca.carla@gmail.com

As consumers become more and more interested in the relation between diet and health, the development of healthy foods enriched with functional ingredients has increasingly gaining attention. Dairy products (DP), such as yoghurt (Yg) and curd cheese (Cc) represent promising sources for new bakery products and can be used to enhance the functional and nutritional value of bakery products [1,2], with a special focus on improving daily protein and mineral intake in children and elderly people. In this work, the DP content ranging from 10 to 50 g and higher replacements up to 70g Yg and 83g Cc, per 100 g of wheat flour, were tested. The impact on the empirical (extension properties) and fundamental dough rheology, bread texture, aging kinetics and proximate nutritional composition, was evaluated. The different nature of the proteins in play was clearly perceptible. Both DP studied had different impacts on the bread dough extension properties: Yg had a positive effect on the structure of the dough, increasing the extensibility and deformation energy with a positive impact on bread quality and aging kinetics; the Cc additions affected strongly the dough properties in extension, contributing to the increase of the crumb firmness and of the aging kinetics. Considering the nutritional composition, the breads obtained showed a significant improvement on nutrition profile, as protein and mineral contents increased, what can be a considerable contribution to balance the daily diet.

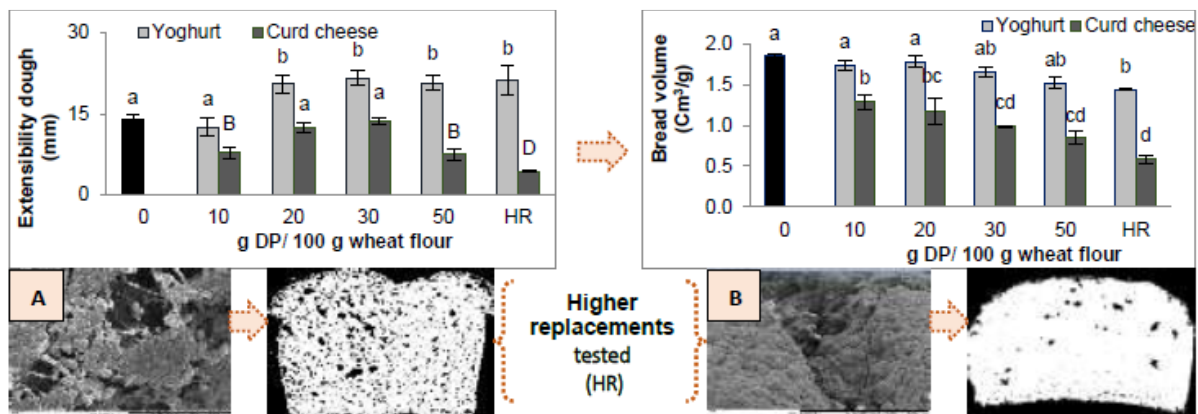


Figure. 1: Impact of the DP on extensibility dough and bread volume; dough microstructure: A-yoghurt and B- Curd cheese

Acknowledgements: work supported and financed by the University of Lisbon [Doctoral Grant reference to C10781w], and by the Portuguese Foundation for Science and Technology (FCT) through the research unit UID/AGR/04129/2013 (LEAF).

- [1] Sharafi, S.; Yousefi, S.; Faraji, A. **2017**, 104, 992-1002;
 [2] Bilgin, B.; Dalioglu, O.; Konyali, M. **2006**, 3, 277–286.

CO13

Microencapsulated aromatic plants extracts for salt replacement and sensorial evaluation in cooked dishes

Carmo Serrano¹, Margarida Sapata¹, André Gerardo² e Cláudia Viegas²

¹*Instituto Nacional de Investigação Agrária e Veterinária (INIAV, I.P.) Oeiras, Portugal*

²*Escola Superior de Hotelaria e Turismo do Estoril (ESHTE), Estoril, Portugal.*

carmo.serrano@iniav.pt

Excessive salt intake has a major impact as a risk factor for cardiovascular disease, and the prevalence of these diseases and their effect on morbidity and overall mortality in Portugal is high. Currently there is extensive scientific evidence supporting the need for salt reduction in food. At the same time, there we lack concrete strategies to reduce the use of salt in food establishments. Thus, this project aims to create formulations of mixtures of aromatic plant extracts in the form of powder, applicable to different types of Portuguese dishes, which allows the reduction of the use of salt in the different preparations. In the study, different encapsulating agents, namely starch, gum arabic, inulin, sodium alginate and maltodextrin, were selected in order to protect their aroma and taste and increase stability. The microencapsules were obtained by spray-drying and analyzed from the sensorial point of view and the obtained yields. The results showed that maldodextrin and inulin were the encapsulating agents that gave the cooked dishes the closest characteristics of the seasoning with salt and those that presented the best processing yields.

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[1] Anderson, C.A., Appel, L.J., Okuda, N., Brown, I.J., Chan, Q., Zhao, L., Ueshima, H., Kesteloot, H., Miura, K., Curb, J.D., Yoshita, K., Elliott, P., Yamamoto, M.E. & Stamler, J. *Journal of the American Dietetic Association*, **2010**, 110 (5), 736-45.

[2] Lacerda, E., Calado, V. Monteiro, M. Finotelli, P., Torres, A. Perrone, D. **2016**, *Carbohydrate Polymers* 151, 500-510.

CO14

DEVELOPMENT OF POTATO STARCH/PHENOLICS FILMS WITH POTENTIAL TO PRESERVE SMOKED FISH FILLETS DURING REFRIGERATED CONDITIONS

Joana Lopes¹, Idalina Gonçalves^{1,2}, Cláudia Nunes^{1,2}, Bárbara Teixeira³, Rogério Mendes³, Paula Ferreira¹, Manuel A. Coimbra²

1. CICECO - Aveiro Institute of Materials, Department of Materials and Ceramic Engineering, University of Aveiro, 3810-193 Aveiro, Portugal.

2. QOPNA, Department of Chemistry, University of Aveiro, 3810-193 Aveiro, Portugal.

3. IPMA - Instituto Português do Mar e da Atmosfera, Rua Alfredo Magalhães Ramalho 6, 1449-006 Lisboa, Portugal.
E-mail: lopesjoana@ua.pt

The development of active biobased packaging materials is a major concern to food industry. Starch, a food industry abundant by-product, accomplishes all the main required features, making it a promising raw material for edible films. However, it leads to quite brittle and hydrophilic materials without active properties. Therefore, efforts have been carried out to overcome these drawbacks. In this work, starch/phenolics films were developed from potato washing slurries and peels discarded from a potato chips industry, as a source of starch and phenolic (Ph) compounds, respectively.

Potato starch presented oval granules with an average size distribution of 43 μm and a gelatinization temperature around 60 °C and allowed to produce transparent and colorless films. The total Ph content and antioxidant capacity (ABTS method) of the recovered Ph were measured and the Ph compounds was incorporated on films, giving rise to yellowish films (potato starch/Ph films) with increased resistance to water conditions. The influence of Ph concentration (0.1%, 0.5%, and 1% w/w related to dry starch weight) on mechanical properties showed that Ph enhanced the potato starch films elasticity, and flexibility due to the lower hydrogen bonds formation between hydroxyl groups of the starch polymeric network caused by Ph. Moreover, the antioxidant activity was evaluated, and potato starch/Ph films evidenced notorious antioxidant activity. Potato starch/Ph films with 0.5% Ph were used to pack hot smoked gilthead seabream fillets, evaluating their effect on the sensory properties of the fish fillets under refrigerated conditions. According to the sensory evaluation panel, after 8 days, smoked fish fillets stored with potato starch/Ph bioplastic maintained their original smell and flavour, and presented a stiffer texture and a golden color than the ones packaged with regular polyamide/polyethylene bags possibly due to the highest water permeation still offered by the bioplastic. Nevertheless, after 14 days of storage, the fillets packaged with the potato starch/Ph bioplastic were extremely dried.

The developed potato starch/Ph films allowed to preserve smoked fish fillets for short storage periods. Targeting longer storage periods, water permeability improvements of the potato starch/Ph films are being carried out.

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CO15

ALIMENTOS PROCESSADOS: AVALIAÇÃO DA CONFORMIDADE DA ROTULAGEM

Tânia Gonçalves Albuquerque^{1,2*}, M. Antónia Nunes², M. Beatriz P.P. Oliveira²,
Helena S. Costa^{1,2}

¹ Departamento de Alimentação e Nutrição, Instituto Nacional de Saúde Doutor Ricardo Jorge, I.P., Lisboa, Portugal

² REQUIMTE, LAQV/Faculdade de Farmácia da Universidade do Porto, Portugal

*tania.g.alb@gmail.com

A rotulagem dos alimentos é crucial para o consumidor fazer, caso queira, uma escolha informada e consciente dos produtos alimentares que adquire. Com a entrada em vigor do Regulamento (UE) n.º 1169/2011, foram estabelecidas regras relativamente à rotulagem dos géneros alimentícios que são aplicáveis a todos os Estados-Membros da União Europeia. No entanto, existem por vezes desvios entre os valores dos nutrientes declarados na informação nutricional e os presentes no alimento. Em 2012, para ultrapassar esta situação, foram fixadas as tolerâncias aplicáveis aos valores de nutrientes declarados no rótulo, uma vez que tais desvios poderiam levar a que os consumidores fossem induzidos em erro.

O objetivo deste trabalho foi verificar a conformidade da rotulagem de 10 categorias de alimentos processados (*snacks*, *fast-food*, frutos secos e sementes oleaginosas, refeições prontas-a-comer, cereais, molhos, sopas, produtos de pastelaria, produtos de panificação, batatas fritas e outros produtos à base de batata) amplamente disponíveis no mercado nacional e internacional.

Foram incluídos 209 alimentos recolhidos em grandes superfícies e restaurantes de *fast-food*. Determinou-se quantitativamente os teores de sal, gordura total e ácidos gordos, pelos métodos de *Charpentier-Volhard*, hidrólise ácida com extração em Soxhlet e cromatografia gasosa com deteção por ionização de chama, respetivamente. Foram aplicadas as tolerâncias de acordo com a legislação em vigor, utilizando os valores declarados no rótulo das embalagens.

Apenas 50% das amostras analisadas estavam dentro dos limites de tolerância para o teor de sal. O menor número de amostras fora dos limites de tolerância foi observado para a gordura. Para os ácidos gordos saturados, 26% das amostras estavam fora dos limites de tolerância. A categoria dos cereais foi a única em que 100% dos produtos estavam em conformidade para os teores de gordura e sal.

Conclui-se, assim, ser de extrema importância que a indústria alimentar atualize continuamente os valores declarados nos rótulos, pois essa informação é crucial para os consumidores e para a elaboração de políticas alimentares. As maiores diferenças foram encontradas nas categorias *snacks* e *fast-food*. Os resultados apresentados podem ser importantes não só para os consumidores, como também para organizações de saúde pública e indústria alimentar.

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CO16

ESTABILIDADE OXIDATIVA DA CARNE DE FRANGO FRESCA COM FILMES DE QUITOSANO INCORPORADOS COM EXTRATOS ATIVOS NATURAIS

João Ricardo Afonso Pires¹, Victor Gomes Lauriano de Souza¹, Karen Miranda Almeida¹, Ana Sofia Augusto¹, Carolina Rodrigues¹, Isabel Coelho², Maria Paula Duarte¹, Ana Luísa Fernando¹

¹MEtRiCS, Departamento de Ciências e Tecnologia da Biomassa, Faculdade de Ciências e Tecnologia, FCT, Universidade Nova de Lisboa, Campus de Caparica, 2829-516 Caparica, Portugal (v.souza@campus.fct.unl.pt)

²LAQV-REQUIMTE, Departamento de Química (DQ), Faculdade de Ciências e Tecnologia, Universidade NOVA de Lisboa, Caparica, Portugal

A carne de frango é um alimento saudável rico em proteína de alto valor biológico, vitaminas, minerais e ácidos gordos essenciais polinsaturados (ómega-3). Devido à sua composição rica em lípidos insaturados é altamente suscetível à oxidação lipídica, sendo, por isso, um alimento altamente perecível. Por esse motivo, a indústria alimentar está em constante procura de soluções que permitam aumentar a vida útil dos seus produtos, com a garantia da segurança/qualidade global.

A substituição dos aditivos sintéticos por compostos naturais é uma tendência atual do mercado, impulsionada por disposições legislativas a nível da União Europeia. Neste contexto, o objetivo do presente estudo foi desenvolver embalagens ativas à base de quitosano (Qui) incorporadas com seis diferentes extratos naturais (alecrim, chá verde, chá preto, gengibre, kenaf e salva) e testar a eficiência destes novos materiais na estabilidade oxidativa da carne de frango fresca. Os extratos hidroalcoólicos (EHA) foram obtidos por meio de extração com solução de etanol a 50% (v/v) e os filmes produzidos pelo método “casting” [1]. Carne fresca picada de frango foi embalada nos biopolímeros produzidos e armazenadas sob refrigeração durante 15 dias. Ao longo do período de armazenamento, a qualidade das carnes foi monitorizada por meio de análises físico-químicas (humidade, pH, acidez titulável, substâncias reativas ao ácido tiobarbitúrico (TBARS) e cor), realizadas nos tempos 0, 3, 7, 10 e 15 dias de armazenamento. Os valores de TBARS aumentaram para todas as amostras ao longo do tempo. As carnes embaladas nos filmes incorporados com os EHAs, apresentaram menor quantidade de metabólitos da oxidação secundária (redução entre 75-93% em relação à carne sem filme) (com exceção dos filmes com EHA-salva). Comportamento semelhante também foi observado nas carnes embaladas nos filmes contendo só Qui, as quais apresentaram reduções de 45% nos teores de malondialdeído, em relação à carne sem filme. O filme incorporado com EHA-alecrim destacou-se como o mais eficiente na preservação da estabilidade oxidativa. Os filmes apresentaram resultados promissores na preservação da descoloração da carne, assim como na manutenção dos valores de pH ao longo do tempo. Conclui-se que tais materiais têm potencial para serem tecnologias alternativas na manutenção da estabilidade oxidativa de carne de frango fresca.

Agradecimentos: Os autores agradecem ao CNPq/Brasil, e à FCT/MCTES pelo apoio financeiro.
[1] Souza, V.G.L.; Fernando, A.L.; Pires, J.R.A.; Rodrigues, P.F.; Lopes, A.A.S.; Fernandes, F.M.B. *Industrial Crops and Products*, **2017**, *107*, 565-572.

CO17
INFLUÊNCIA DA UTILIZAÇÃO DE DIFERENTES ECÓTIPOS DE
***Cynara cardunculus* L. NAS CARACTERÍSTICAS FÍSICO QUÍMICAS**
DE QUEIJO ÉVORA DOP

Olga Amaral¹, João Dias^{1,2}, Nuno B. Alvarenga^{3,6}, Maria João Carvalho¹, Patrícia Lage¹,
Vanessa Regalo¹, R. Chichery¹, M. Starovič¹, Cristina Pinheiro⁴, A.L. Garrido⁴, S.F. Freitas⁴,
E. Machado⁴, A. Belo³, A. Pedro Louro Martins^{3,6} e M. Fátima Duarte^{5,7}

bartolomeu.alvarenga@ipbeja.pt

¹ESA-Instituto Politécnico de Beja, Rua Pedro Soares, 7800-295 Beja, Portugal

²GeoBioTec, Un. Nova de Lisboa, Campus da Caparica, 2829-516 Caparica, Portugal

³UTI-INIAV, Quinta do Marquês, Oeiras, Portugal

⁴ICAAM, ECT, U. Évora, Ap. 94, 7006-554 Évora

⁵CEBAL/IPBeja, Rua Pedro Soares, s.n, Campus IPBeja, 7801-908 Beja, Portugal

⁶LEAF-ISA, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisbon, Portugal

⁷ICAAM, U. Évora, Ap.94 7006-554 Évora, Portugal

A produção de queijos com utilização de coagulante vegetal é muito comum em Portugal e Espanha. O Queijo de Évora DOP é um queijo português de pasta dura ou semi-dura, de cor amarelada, com poucos ou nenhuns olhos e aroma intenso. O processo tecnológico de fabrico consiste na drenagem lenta da coalhada após coagulação de leite cru de ovelha com uma infusão de *Cynara cardunculus* L., como coagulante vegetal. O objetivo deste trabalho foi analisar a influência da utilização de diferentes ecótipos de *C. cardunculus* nas propriedades químicas e reológicas do Queijo de Évora.

De acordo com o processo tradicional de fabrico foram produzidos lotes de queijo, utilizando três ecótipos de coagulante vegetal (C1, C2 e C3), e um coagulante animal comercial (AC). Para cada coagulante, foram efetuadas colheitas de quatro queijos após 1, 3, 7, 14, 21, 35, 49, 60 e 90 dias de maturação. As amostras foram analisadas relativamente a: parâmetros estruturais (medidas viscoelásticas e análise de textura), cor (L^* , a^* e b^*) e parâmetros químicos (humidade, gordura, acidez, pH, azoto total, azoto solúvel, azoto não proteico e azoto aminoacídico). Os dados foram submetidos a análise multivariada.

A análise estatística dos dados evidenciou a influência dos diferentes coagulantes (de origem vegetal ou animal) nas características do Queijo de Évora sobretudo durante o primeiro período de maturação. Foram calculados os coeficientes de correlação de Pearson entre os indicadores estruturais (módulo de armazenamento e dureza) e os indicadores de proteólise, humidade e pH. Foram encontradas correlações negativas significativas entre a humidade e a dureza. Estes resultados indicam que a diminuição da humidade, durante o processo de maturação, é o fator que mais influencia a textura deste tipo de queijo. As alterações causadas pela proteólise não se apresentaram tão relevantes para as características finais do Queijo de Évora como acontece para outros queijos portugueses produzidos com leite cru e coagulante vegetal.

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CO18

Serpa PDO cheese: towards identification of chemical markers involved in organoleptic attributes

Helena Araújo-Rodrigues¹, Freni K. Tavaría¹, Maria Teresa P.G. Dos Santos², Nuno Alvarenga^{3,4}, Manuela M. Pintado¹

¹ *Centro de Biotecnologia e Química Fina, Universidade Católica Portuguesa, R. Arquiteto Lobão Vital, 172, 4200-374 Porto, Portugal. hrodriques@porto.ucp.pt*

² *Escola Superior Agrária, Instituto Politécnico de Beja, R. Pedro Soares, 7800-295 Beja, Portugal.*

³ *Unidade de Tecnologia e Inovação, Instituto Nacional de Investigação Agrária e Veterinária, Quinta do Marquês, Oeiras, Portugal.*

⁴ *LEAF, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal.*

Serpa is a PDO Portuguese cheese manufactured in a demarcated area in the South Alentejo region, using raw ovine milk and extracts of *Cynara cardunculus* L. as rennet, without addition of starter cultures and followed by a minimum (but safe) ripening period. Both the processing technology and ingredients used result in a high microbial biodiversity that allows the development of a characteristic strong and exquisite flavor coupled with a semi-soft and creamy texture [1]. Variations in the manufacturing process and the distinct milk composition among producers result in a cheese that is considerably heterogeneous and unique in terms of sensorial characteristics [2]. Accordingly, the screening of flavor and texture related compounds over time are crucial for the identification of key compounds involved in these properties. In this study, the volatile and some groups of non-volatile compounds present in Serpa cheese with at least thirty days of ripening were investigated, analyzing cheeses from four distinct PDO certified producers and including two consecutive months of production. The results suggested a high diversity and some heterogeneity in chemical composition according to the producer. The free amino acids profile obtained by high-performance liquid chromatography (HPLC) suggested the presence of almost all amino acids in cheeses analyzed, being glutamic acid, alanine, leucine, valine and phenylalanine the most prevalent ones (10.2-96.7 mg 100g⁻¹). Regarding the organic acid profile, lactic, acetic and propionic acids were the dominant groups (7-2037 mg 100g⁻¹), separated and quantified by HPLC. The volatile analysis using headspace solid-phase microextraction (HS-SPME) coupled to gas chromatography–mass spectrometry (GC–MS) suggested a high diversity and variability of volatile composition between cheeses including several chemical groups, namely, ethyl esters, aldehydes, alcohols and ketones. The identification of chemical markers involved in sensorial attributes will guide the selection and development of an autochthonous starter culture that will allow to maintain the authenticity as well as contribute to the improvement of Serpa's quality and safety.

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[1] Roseiro, M.L.B.; Gómez-Ruiz, J.A.; García-Risco, M.; Molina, E. *Le Lait* 2003, 83, 343-350.

[2] Montel, M.C.; Buchin, S.; Mallet, A.; Delbes-Paus, C.; Vuitton, D.A.; Desmasures, N.; Berthier, F. *International Journal of Food Microbiology* 2014, 177, 136-154.

CO19
**EXPLORING THE HIGH THROUGHPUT POTENTIAL OF RECENT
MICROEXTRACTION STRATEGIES IN THE ANALYTICAL
WORKFLOW. THE CASE STUDY OF FOOD SAMPLES**

Priscilla Porto-Figueira¹, José Aldónio Figueira ¹, Jorge Pereira ¹ and José S. Câmara ^{1, 2,*}

¹ CQM - Centro de Química da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal

² Faculdade de Ciências Exatas e da Engenharia da Universidade da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal;
*email: jsc@staff.uma.pt (José S. Câmara)

Polyphenols are widespread constituents of several foods matrices, including fruits, vegetables, cereals, olive and legumes, juices and beverages such as tea, coffee, beer and wine. The preventive effects of these secondary plant metabolites in terms of cardiovascular, neurodegenerative diseases and cancer are deduced from epidemiologic data as well as in vitro and in vivo studies. The selection of the proper analytical strategy for studying phenolics in food matrices depends on the purpose of the study as well as the nature of the sample and the target analyte. Conventional extraction techniques, as solid-phase extraction and or liquid-liquid extraction, represented for long time the gold standard for sample preparation. However, during the last decade, downstream analytical procedures evolved very significantly, making sample preparation a serious bottleneck in the analytical workflow. In the last decade, the Analytical Chemistry and Enology Lab (ACE-lab) was a pioneer in the application of innovative extraction methodologies for the analysis of bioactive compounds in different food matrices. As it will be shown, coupling modern microextraction approaches such as MEPS μ -SPEed and μ -QuEChERS, with ultrafast liquid chromatography, has allowed us to develop “greener” methodologies, involving hundreds of times less sample and solvents volumes without compromising the analytical performance. Nevertheless, there are always challenges to overcome, particularly when complex matrices or compounds with very different chemicals properties are being simultaneously analysed. The potentialities of new sorbents and nanomaterials tailored for microextraction of specific compounds will be also addressed.

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CO20

DISCRIMINATION OF LEMON FRUITS FROM DIFFERENT GEOGRAPHICAL REGIONS, BASED ON A NEW ANALYTICAL APPROACH – NTME/GC-MS AND CHEMOMETRIC ANALYSIS

José A. Figueira¹, Priscilla Porto-Figueira¹ and José S. Câmara^{1,2*}

¹ CQM - Centro de Química da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal

² Faculdade de Ciências Exatas e da Engenharia da Universidade da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal;

*email: jsc@staff.uma.pt (José S. Câmara)

Lemon (*Citrus limonum*) is a well-known citrus fruit widely used throughout the world. It is an important source of secondary metabolites used in human nutrition and industrial applications. In addition to vitamin C, lemon contains several phytochemicals, including polyphenols (flavonoids and non-flavonoids), limonoids and terpenoids, which play a key role as nutraceuticals. Some of these metabolites have been shown to possess anticancer, antimicrobial, antioxidant and antidiabetic properties.

This study was performed to gain deep insights on the volatile composition of lemon (*Eureka* variety) from different geographical origins. Overall, 75 volatile organic compounds (VOCs), belonging to different chemical groups, namely monoterpenes, sesquiterpenes, alcohols and carbonyl compounds, were identified in the peel of targeted citrus fruits by a new analytical approach based on Needle Trap Microextraction (NTME) combined with GC-MS analysis. Several experimental parameters with influence on the extraction efficiency were optimized, namely sample amount, extraction volume, sample temperature, headspace volume and equilibration time, using an experimental design (DoE) procedure. The major identified volatiles belongs to the monoterpenes family being the most dominant the α -pinene, β -pinene, sabinene, β -myrcene, *D*-limonene and γ -terpinene, *D*-limonene accounts to more than half of the total volatonic free fraction. The investigated fruits revealed as important source of bioactive compounds in addition to promising applications in cosmetic industry.

Finally, the data matrix was submitted to partial least squares discriminant analysis (PLS-DA) and the VOCs were able to differentiate the investigated lemons according to its geographic origin. Ethyl octanoate, α -panansinene, hexanal, *o*-cymene, perilla aldehyde, trans- β -terpineol and nerol, are the volatiles that most contributed for the differentiation.

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CO21

BEEROMICS: FROM SMALL METABOLITES TO UNDERSTAND BEER AROMA PROPERTIES

Cátia Martins¹, Tiago Brandão³, Adelaide Almeida², Sílvia M. Rocha¹

¹ *Departamento de Química & QOPNA, Universidade de Aveiro, Campus Universitário Santiago, 3810-193 Aveiro, Portugal, catiamartins@ua.pt*

² *Departamento de Biologia & CESAM, Universidade de Aveiro, Campus Universitário Santiago, 3810-193 Aveiro, Portugal*

³ *Super Bock Bebidas, S.A., Via Norte, 4465-764 Leça do Balio, Portugal*

Beer is one of the most popular alcoholic beverages worldwide, being taste and flavor the main factors which contribute for consumers' acceptance. Its volatile components represent the major contributors for beer global and peculiar aroma properties, which result from a network of biochemical processes. An emergent concept called food metabolomics has been applied to the study of food system processes and it may be useful to understand the nutritional and sensory food properties, through foods metabolites profiling. This work intends to establish a comprehensive study of the beer small metabolites, mainly those associated to raw materials' and yeasts' metabolism: acids, alcohols, esters, monoterpenic compounds, norisoprenoids, sesquiterpenic compounds, sulfur compounds, and volatile phenols. A high throughput and high sensitive methodology combining the direct analysis of beer by headspace solid-phase microextraction (HS-SPME) with comprehensive two-dimensional gas chromatography with time-of-flight mass spectrometry (GCxGC-ToFMS) was used [1,2]. Several beers produced at different countries and breweries were analysed. A wide set of small molecules were identified, including 329 putative metabolites from the 8 targeted chemical families, which was defined as BeerOmics. They may be useful to have deeper and simultaneous information about beer volatile composition and its related factors (e.g. raw materials composition, brewing steps, off-flavors, beer aroma, beer typing). Moreover, considering the literature aroma notes of the identified metabolites, it will be possible to add a new information level to the beer flavor wheel (currently with 3 different levels, with exiguous chemical information), thus allowing to understand their contribution to the beer flavor wheel. Therefore, the BeerOmics, achieved through advanced gas chromatography, may potentially help in the understanding of the distinctive beer styles or beer typing.

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[1] Martins, C.; Brandão, T.; Almeida, A.; Rocha, S.M. *J. Sep. Science* **2015**, *38*, 2140-2148.

[2] Martins, C.; Brandão, T.; Almeida, A.; Rocha, S.M. *Food Res Int.* **2018**, *114*, 199-207.

CO22
ADDING VALUE TO AGRIFOOD BY-PRODUCTS AS THERAPEUTIC
ALTERNATIVES: A CASE STUDY OF HERBAL MEDICINE
RESEARCH

Theлма B. Machado^{1,2}, Maria Beatriz P. P. Oliveira²

¹*Faculdade de Farmácia, Universidade Federal Fluminense, Rua Dr. Mário Viana, 523,
Santa Rosa, Niterói, RJ, Brasil.*

²*Faculdade de Farmácia, Universidade do Porto, Rua de Jorge Viterbo Ferreira, 228, Porto,
Portugal.
thel34@gmail.com*

Traditionally, most crops have been focused on obtaining a single high-value product discarding the remaining parts of the plant or fruit, or exploiting them to obtain low value products [1]. Pomegranate (*Punica granatum*, L.) is used for functional food ingredients in various forms, such as juice, jelly, and alcoholic beverages produced with fresh seeds, as well as spices prepared from dried seeds [2]. Pharmacological activities of many pomegranate components suggest a wide range of applications for the prevention and relief of disease symptoms where chronic inflammation is believed to play an essential etiologic role. Following the premise that agrifood by-products are not residues but raw materials for new products and as part of our effort to identify the responsible substances for the pharmacological activities attributed to plants utilized in traditional medicine, we have studied the pericarp of pomegranate fruits in order to identify the components with antimicrobial activity [3]. In this study we have identified the ellagitannin punicalagin as the biological and chemical marker of *P. granatum* extracts, which were active against multi-resistant bacterial strains. For the extraction optimization of this ellagitannin, we have used extractions assisted by microwave, which furnished higher content levels of this substance in comparison with static extraction techniques. The extracts of *P. granatum* pericarp were then used to develop a topical phytomedicine formulation prescribed for the treatment of infected chronic vascular ulcers of a patient who was not responsive to conventional treatment with antimicrobials and *corticosteroids for, at least, one year*. The complete closure of the wounds was observed after three months *treatment exclusively with a 2% (w/w) P. granatum* formulation. The hydrogel-based formulation was standardized and subjected to physicochemical studies to establish the quality control parameters. The stability and quantitative chromatographic data was assessed and an efficient HPLC-DAD method was established distinguishing the biomarkers punicalin and punicalagin simultaneously in a single 8 min run. The formulation presented suitable sensorial and physicochemical performance, showing that punicalagin was not significantly affected by storage ($p > 0.05$). Formulations containing extracts with not less than 0.49% (w/w) total punicalagin might find good use in wound healing therapy.

[1] Peralbo-Molina, A.; Castro, M. D. L.; *Trends Food Sci Tech* **2013**, 32, 16-24.

[2] Sheng, W.; Tian, L. *Molecules* **2017**, 22, 1606.

[3] Machado, T.B. *et al. J. Braz. Chem. Soc.* **2002**, 13 (5), 606-610.

[4] Machado, T.B. *et al. Molecules* **2016**, 21(8), 1059.

CO23
EXTRACTION YIELD AND ANTIOXIDANT ACTIVITY OF PINE BARK
(Pinus pinaster Aiton subsp. atlantica) **EXTRACTS: EFFECT OF**
SOLVENT AND EXTRACTION METHOD

Catarina Vieito, Preciosa Pires, Élia Fernandes, Carina Lopes, Manuela Vaz Velho

Escola Superior de Tecnologia e Gestão, Instituto Politécnico de Viana do Castelo, Avenida do Atlântico 644, 4900-348 Viana do Castelo, Portugal
cvieito@jpvc.pt

Pine bark extracts have been reported to have several bioactivities, namely antioxidant and antimicrobial, which makes them of great interest to use in foods [1]. The aim of this study was to ascertain the effect of the extraction method on the extraction yield and antioxidant activity of pine bark extracts. Two extraction methods were tested on pine bark, namely Soxhlet and heat assisted extraction. The former was performed under reflux for 4 hours and the latter was achieved by crunching the ground pine bark with a homogenizer and shaken at 300 rpm for 3 hours at 40 °C. Both extraction methods were performed with three solvents: water, bioethanol and a mixture of both (1:1). The pine bark was ground to a particle size inferior to 200 µm. It was measured the extraction yield and antioxidant activity, assessed by the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging method. Overall, Soxhlet method showed higher extraction yield (17.5 ± 0.1 g DM in extract/L extract) and antioxidant activity (59.1 ± 0.0 µg TE/mL extract) compared to the heat assisted extraction (15.9 ± 0.0 g DM in extract/L extract and 54.5 ± 0.1 µg TE/mL extract, respectively), thus being the best extraction method ($p < 0.05$). Regarding the solvent, bioethanol and the mixture of water and bioethanol showed the best results ($p < 0.05$).

Table 1: Extraction yield and antioxidant activity values for both extraction methods.

Method	Solvent	Yield (g DM in extract/L extract)	Antioxidant activity (µg TE/mL extract)
Soxhlet	Water	9.8 ± 0.6 ^a	52.4 ± 3.7 ^{ab}
	Water:Bioethanol (1:1)	17.1 ± 1.0 ^b	58.7 ± 4.5 ^a
	Bioethanol	17.5 ± 0.1 ^b	59.1 ± 0.0 ^a
Heat assisted extraction	Water	6.2 ± 0.3 ^c	45.2 ± 0.7 ^b
	Water:Bioethanol (1:1)	11.4 ± 0.5 ^a	54.5 ± 0.1 ^{ab}
	Bioethanol	15.9 ± 0.0 ^b	50.7 ± 1.8 ^{ab}

Means within the same column with different superscript letters are significantly different ($p < 0.05$).

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[1] Aspé, E.; Fernandez, K. *Industrial Crops and Products* **2011**, *34*, 838-844.

CO24 PHENOLIC PROFILE OF DIFFERENT *Cichorium spinosum* L. ECOTYPES

Lillian Barros^{1,*}, Spyridon A. Petropoulos², Ângela Fernandes¹,
Isabel C.F.R. Ferreira¹

¹ Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

² Laboratory of Vegetable Production, University of Thessaly, Magnissia, Greece

*lillian@ipb.pt

Cichorium spinosum L. is a native plant of the Mediterranean basin and can be found in Balearic Islands, Cyprus, Greece, Italy, and Spain, usually in coastal areas and plateaus of the mainland, and constitutes a very common ingredient of the so-called Mediterranean diet [1]. Phenolic compounds are secondary metabolites of plants with great importance for various physiological and morphological features, such as defense mechanisms, cell wall structure, proteins and enzymes and scavenging of free radicals, among others [2]. The aim of the present study was to identify phenolic compounds of different *C. spinosum* ecotypes from the eastern Mediterranean in order to find the best conditions in increasing these compounds.

The studied ecotypes were commercial products obtained from retail supermarkets in Greece (samples 2 and 3); wild ecotypes collected *in situ* in the area of Velanidia, Greece (samples 4 and 5); and plants cultivated at the farm of the University of Thessaly (samples 1 and 6).

The phenolic compounds were identified and quantified by high-performance liquid chromatography coupled to a diode array detector and a mass spectrometry using the electrospray ionization interface (HPLC-DAD-ESI/MS). Significant differences were observed among the various studied ecotypes in their phenolic compound content and profile, especially between wild and cultivated ecotypes. Wild ecotypes had lower content of total phenolic compounds than cultivated ones, whereas commercial products were very rich in flavonoids, especially in kaempferol-3-O-glucuronide, isorhamnetin-3-O-glucuronide and apigenin-O-glucuronide, in comparison to the other ecotypes (wild and cultivated).

Commercial cultivation of *C. spinosum* should be encouraged since it ensures higher content of phenolic compounds, and according to the results of the present study valorisation of *C. spinosum* species has great potential since it could be used as a new alternative species in the food industry.

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[1] Klados, E.; Tzortzakis, N. Journal of Soil Science and Plant Nutrition **2014**, 14, 211-222.

[2] Pérez-Gregorio, M.R.; Regueiro, J.; Simal-Gándara, J.; Rodrigues, A.S.; Almeida, D.P.F. Critical Reviews in Food Science and Nutrition **2014**, 54,1050-1062.

CO25

INCORPORAÇÃO DE BIOMASSA MICROALGAL EM PÃO ISENTO DE GLÚTEN: AVALIAÇÃO DO IMPACTO NA ESTRUTURA

M. Cristiana Nunes, Joana Duarte, Isabel Sousa, Anabela Raymundo

Universidade de Lisboa / Instituto Superior de Agronomia, LEAF-Linking Landscape, Environment, Agriculture and Food / Tapada da Ajuda, 1349-017 Lisboa, Portugal. anabraymundo@isa.ulisboa.pt

O crescente aumento do número de doentes celíacos a nível mundial tem promovido o interesse nos produtos isentos de glúten. A produção de pão sem glúten representa um desafio para os investigadores e para a indústria, uma vez que o glúten tem um papel essencial no desenvolvimento da estrutura viscoelástica característica do pão. Nos últimos anos, as estratégias de substituição do glúten em massas panares têm passado pela utilização de novas farinhas, agentes de textura, ingredientes funcionais, técnicas de panificação alternativas e combinação de todos estes métodos.

Por outro lado, também tem aumentado a procura de alimentos com ingredientes bioativos e as microalgas são reconhecidas como fonte de inúmeros fitoquímicos com impacto positivo na saúde humana. De facto, as microalgas representam um ingrediente alimentar sustentável com grande interesse no contexto das alterações climáticas existentes. No entanto, a incorporação de microalgas em matrizes alimentares pode conduzir a alterações nas propriedades reológicas dos alimentos, para além do valor nutricional, como tem sido demonstrado para diversos produtos [1-4], incluindo pão tradicional [5].

Neste trabalho, pretende-se avaliar o impacto da incorporação de *Chlorella vulgaris* e *Tetraselmis chuii* na estrutura de pão isento de glúten à base de amido de milho e farinha de arroz. O gelificante HPMC (hidroxipropilmetilcelulose) foi usado para aumentar a viscosidade da massa e melhorar o volume, textura e qualidade geral dos pães obtidos. Utilizaram-se métodos reológicos empíricos para determinar a capacidade da absorção de água das misturas de farinhas e microalgas (MicrodoughLab) e a textura final das massas e pães obtidos (Análise de Perfil de Textura no Texturómetro), assim como métodos reológicos fundamentais (varrimentos de frequência num Reómetro de tensão controlada). Avaliou-se ainda o impacto da adição de microalgas na cor, volume, atividade da água e humidade dos pães isentos de glúten.

Concluiu-se que a adição de biomassa microalgal em formulações de pão isento de glúten representa uma estratégia interessante para aumentar o valor nutricional e a bioatividade dos produtos, apesar do impacto na estrutura depender do tipo de microalga usado.

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[1] Batista, A.P., Raymundo, A., Sousa, I., Empis, J. (2006). Food Hydrocolloids, 20: 44-52.

[2] Gouveia, L., Batista, A.P., Raymundo, A., Bandarra, N. (2008a). Nutrition and Food Science, 38: 492-501.

[3] Batista, A.P., Nunes, M.C., Gouveia, L., Sousa, I., Raymundo, A., Cordobés, F., Guerrero, A., Franco, J.M. (2011). Food Hydrocolloids, 25: 817-825.

[4] Fradique, M., Batista, A.P., Nunes, M.C., Gouveia, L., Bandarra, N.M., Raymundo, A. (2010). Journal of the Science of Food and Agriculture, 90: 1656-1664.

[5] Graça, C., Fradinho, P., Sousa, I., Raymundo, A. (2018). LWT - Food Science and Technology, 89: 466-474.

CO26

IMPACT OF ADDITION OF POMEGRANATE PEEL EXTRACT AND HIGH-PRESSURE ON CARROT JUICE PRESERVATION: QUALITY, SAFETY AND SENSORIAL ASPECTS

João P. Trigo^{1,2}, Elisabete M. C. Alexandre^{1,2}, Sara Silva², Ana Oliveira², Eduardo Costa², Jorge A. Saraiva¹, Manuela Pintado²

¹QOPNA, Universidade de Aveiro, 3810-193 Aveiro, Portugal

²CBQF, Universidade Católica Portuguesa/Porto, 4202-401 Porto, Portugal
joao-trigo@hotmail.com

The consumption of fruit has been increasing as recommended by the World Health Organization and Europe already produces around 74 million metric tons of fruit per year. As a result, large amounts of wastes are generated and their disposal entails environmental problems requiring by-product management. These by-products can be valorized through the extraction of bioactive compounds, however conventional extraction methods, typically thermal-based, present several concerns mainly due to thermo-sensitive compound degradation. Non-thermal, green and emergent extraction technologies such as high-pressure extraction have been studied and its outputs are promising. In this research, pomegranate peel was valorized through the incorporation of its extracts in carrot juice. High-pressure extraction was performed to obtain an aqueous pomegranate peel extract, screened for potential cytotoxicity effects. Later, this extract was added to raw carrot juice subsequently pasteurized by high pressure and conventional heat to compare the results. Throughout storage, several microbiological, physicochemical, enzymatic, and sensorial analyses were conducted.

Pomegranate peel extract did not show significant metabolic inhibition. Indeed, all concentrations tested displayed higher levels of cell viability ($p < 0.05$). Fortified juices showed lower counts ($p < 0.05$) than the non-fortified ones (total aerobic mesophiles and psychrophiles). Increasing doses of extract lowered pH values of carrot juice. Total phenolics, flavonoids, and hydrolysable tannins contents, as well as antioxidant activity (FRAP, ABTS, and ORAC methods), had superior values ($p < 0.05$) in supplemented juices (2.5 mg/mL) during the 28 days of storage. Generally, the extract addition did not affect any colour parameter or sensory descriptor. On the 28th day of storage, pressurized samples exhibited lower microbial loads in comparison to heated samples. Globally, phenolic compounds contents and antioxidant activity was identical between both pasteurization techniques ($p > 0.05$). However, pressurized juices displayed less colour changing and, apart from pectin methyl esterase, exhibited higher residual values for polyphenol oxidase and peroxidase ($p < 0.05$). β - and α - carotene content in high-pressure treated juices decreased with increasing storage time and both preservation methods had similar sensorial scores ($p > 0.05$) for odour, sweet/acid taste, persistency, and mouth-feel. These findings indicate that the incorporation of 2.5 mg/mL of pomegranate peel extract in carrot juice improves microbial safety as well as antioxidant activity over storage without apparent colour and sensorial losses.

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CO27

USO DE ÁGUAS RESIDUAIS NA REGA DE VEGETAIS COMESTÍVEIS: AVALIAÇÃO DO RISCO DE CONTAMINAÇÃO POR METAIS TÓXICOS

Hugo Félix Silva^{1,2}, Nelson Silva^{1,2}, José Coelho^{1,2}, Manuel Matos¹

¹ISEL, DEQ, R. Conselheiro Emídio Navarro, 1, 1959-007 Lisboa, Portugal

²CQE, Universidade de Lisboa, 1049-001 Lisboa, Portugal

A reutilização de água tratada proveniente de Estações de Tratamento de Águas Residuais (ETAR) para rega apresenta desafios que importa clarificar para posteriormente ultrapassar. Um dos desafios é a utilização de águas tratadas em ETAR na rega de produtos hortícolas. O uso da água tratada em rega de relvados de jardins e de campos de golfe coloca o desafio ao nível da proliferação de microrganismos que podem causar doenças no Homem e em animais domésticos. No entanto o uso de águas tratadas para a rega de hortas levanta a questão da contaminação dos produtos hortícolas por metais tóxicos e outros compostos prejudiciais ao Homem [1].

A nossa preocupação centra-se na contaminação dos produtos hortícolas por metais tóxicos e para tal foi delineado um projecto de investigação utilizando águas tratadas sintéticas para a rega de couves (*Brassica oleracea*) e alfaces (*Lactuca sativa*). Simula-se a rega, utilizando água sintética de ETAR, em dois dos vegetais mais comuns nas hortas e na alimentação em Portugal. A alface é habitualmente consumida crua e a couve é habitualmente consumida cozida. Foram utilizadas águas sintéticas com a 1/3 VLE, 2/3 VLE e VLE em que VLE (Valor Limite de Emissão) é a concentração máxima permitida na descarga dos metais considerados na legislação, DL 236/98. Estudou-se o efeito dos metais Cd, Cr, Ni e Pb, utilizados isoladamente na rega mas também em conjunto. O uso de águas sintéticas permite que se controle os teores de metais e que se eliminem os riscos microbiológicos.

Para além da determinação dos teores de metais nas couves, alfaces e solos, efetuou-se também a extração destas espécies hortícolas com etanol e determinou-se a atividade antioxidante, pelo método de DPPH [2]. Foi também determinado o teor total de polifenóis presentes nos extratos, pelo método de Folin Ciocalteu [3] de modo a verificar de que modos os teores de metais utilizados na água de rega afectam os teores de antioxidantes e polifenóis.

Os resultados preliminares mostram que a acumulação dos metais nas couves e alfaces é diminuta e apenas no caso do Pb nas couves ultrapassa o valor recomendado [4] quando se utilizam águas com a concentração máxima de chumbo.

[1] N. Amin, A. Hussain, S. Alamzeb, S. Begum, *Food Chemistry* **2013**, 136, 1515–1523.

[2] R. Apak, S. Gorinstein, V. Böhm, K. M. Schaich, M. Özyürek, K. Güçlü, *Pure Appl. Chem* **2013**, 85, 957–998.

[3] A. Blainski, G. C. Lopes, J. C. P. De Mello, *Molecules* **2013**, 18, 6852–6865.

[4] Commission Regulation (EC) No. 1881/2006.

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FEEDING AND PRODUCTION SYSTEM EFFECTS ON THE LEVELS OF ANDROSTENONE AND SKATOLE IN BELLY FAT OF ENTIRE MALE PIGS

Preciosa Pires, Ricardo Pinto, Mário Barros, Manuela Vaz Velho

Escola Superior de Tecnologia e Gestão, Instituto Politécnico de Viana do Castelo, Avenida do Atlântico 644, 4900-348 Viana do Castelo, Portugal
ppires@estg.ipvc.pt

Abstract: Boar taint is a sensory off-odour/off-flavour found in meat from entire male pigs due to two main compounds: androstenone and skatole. These compounds were analysed in samples of belly fat from 58 boars, raised under six different conditions (normal housing *versus* improved housing, fed with commercial feed with different levels of added inulin: 0%, 3% and 6%). An HPLC method for the simultaneous quantitative determination of skatole and androstenone with a fluorescence detector was used, and quantification levels were determined. No significant differences were observed for androstenone levels in fat either between different feed or system groups. For skatole, there are no significant differences between the two production systems ($p=0,77$) but there are differences between the three diets ($p=0,005$). It was observed that the inclusion of inulin in pig feed has a strong effect in the average skatole concentration, however there is no difference between 3% or 6% of added inulin. It can be concluded that the inclusion of inulin in commercial feeds reduces the skatole concentration in pig's fat and thus lower the boar taint perception by consumers.

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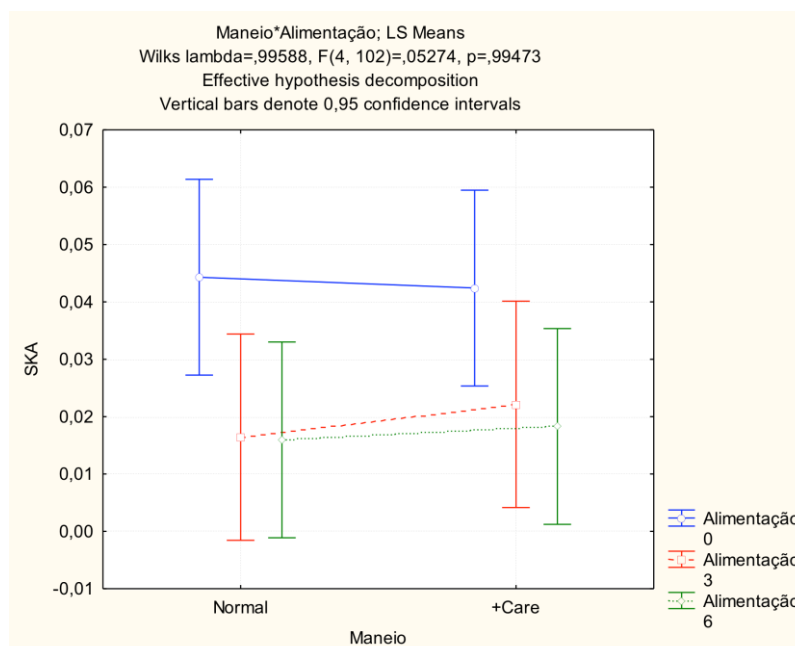


Figure 1: The skatole values (ppm) in belly fat for the six different groups (feed; system).

Keywords: Boar taint, Androstenone, Skatole, Inulin.

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CP001

***Coix lachryma-jobi*: A NEW PROMISING CEREAL AS FUNCTIONAL FOOD WITH IMPORTANT NUTRITIONAL VALUE**

Thelma B. Machado^{1,2}, Anabela S. G. Costa², Maria Beatriz P. P. Oliveira²

¹*Faculdade de Farmácia, Universidade Federal Fluminense, Rua Dr. Mário Viana, 523, Santa Rosa, Niterói, RJ, Brasil.*

²*Faculdade de Farmácia, Universidade do Porto, Rua de Jorge Viterbo Ferreira, 228, Porto, Portugal.
thel34@gmail.com*

The nutritional and physicochemical properties of cereals are very important when they are used as ingredients in functional foods. Adlay (*Coix lachryma-jobi* L.) is a maize related cereal which has gathered a great attention in recent years due to many health-beneficial components reported in its seeds including proteins, polysaccharides, coixenolide, coixol, and lipids [1]. The claimed health benefits include several biological activities like antioxidant, anticarcinogenic, anti-inflammatory, anti-allergy, anti-obesity, antidiabetic, gastric protector, hypolipidemia, immunological enhancing, regulating endocrine functions, and modulating gut microbiota. Various parts of adlay seeds including bran, hull, and testa have been described in literature and its health effects evaluated both *in vitro* and *in vivo* studies [2]. The bioactivity of adlay depends on the varieties as well as the sample preparation methods such as the solvent type. Adlay seed is rich in starch and has similar processing properties of other cereals for food formulation. The seeds of adlay present different sizes and colors reflecting the genetic diversity. This diversity may also be the basis in the variation of the chemical composition of this species, which remains to be better explored. In the present work we have analyzed samples of a Brazilian adlay cultivar (*var. lachryma-jobi*, cultivar Magé, Rio de Janeiro). The chemical characterization of the ethanolic extracts of fruits of adlay showed high amounts of total phenolics ($118,7 \pm 2,083$ mg GAE/g) and flavonoids ($21,2 \pm 0,514$ mg de RE/g) which were analysed by colorimetric methods of Folin-Ciocalteu and $AlCl_3$, respectively. Contents of coixol in ethanolic extracts ($21,3 \pm 5,4$ mg/g) were quantified by HPLC/DAD. Macronutrients analysis showed that adlay contains high amounts of dietary fiber (55,3% insoluble and 1,1% soluble), total proteins (7,8%), carbohydrates (20,3%), ash (9,4%), and low amounts of fatty acids (2,2%). Based on its chemical composition, namely a very high content in fiber, especially insoluble ones, protein and low total amount of fat, adlay is a cereal with a potential for food applications. Further assays should be undertaken to better understand the potential biological activities of this cereal.

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[1] Xu, L. *et al. Food Chemistry* **2017**, 229, 312-318.

[2] F. Zhu. *Trends in Food Science & Technology* **2017**, 61, 160-175.

CP002

Variedade portuguesa de maçã “Bravo de Esmolfe” como fonte de compostos bioativos com propriedades antioxidantes e antibacterianas

Tânia C.S.P. Pires^{1,2}, Maria Inês Dias¹, Lillian Barros¹, Maria José Alves¹, Celestino Santos-Buelga², Isabel C.F.R. Ferreira^{1*}

¹*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal*

²*Grupo de Investigación en Polifenoles (GIP-USAL), Facultad de Farmacia, Universidad de Salamanca, Campus Miguel de Unamuno s/n, 37007 Salamanca, España.*

**iferreira@ipb.pt*

A maçã *Malus domestica* Borkh é uma das frutas mais consumidas no mundo. Apresenta uma composição variada e equilibrada, moderadamente energética com teores de açúcares e ácidos que lhes conferem um sabor e uma doçura agradáveis [1]. Esta maçã é um produto com Denominação de Origem Protegida (DOP), sendo grande parte da sua produção restrita à região do interior norte de Portugal [2]. O objetivo do presente trabalho foi determinar as suas propriedades bioativas e o perfil fenólico individual no extrato hidrometanólico por HPLC-DAD-ESI/MS, sendo a identificação realizada através do padrão de fragmentação dos compostos e da comparação com dados obtidos na literatura. A atividade antioxidante dos extratos foi realizada utilizando 3 ensaios distintos: efeito captador de radicais livres - DPPH, inibição da descoloração de β -caroteno e inibição da peroxidação lipídica - TBARS. A atividade antimicrobiana foi testada usando o método de microdiluição e o ensaio colorimétrico de cloreto de *p*-iodonitrotetrazólio (INT) para determinar a concentração mínima inibitória (MIC).

Foram identificados quinze compostos fenólicos, sendo os mais abundantes o ácido 5-O-cafeoilquínico (52 mg/100 g de massa seca), seguido de procianidina B2 (35 mg/100 g de massa seca). Os menores valores de EC₅₀ foram obtidos para os ensaios de efeito captador de radicais livres e inibição da peroxidação lipídica (EC₅₀ = 0,71 e 0,45 mg/mL, respetivamente). Os extratos hidrometanólicos de maçã mostraram ser efetivos contra todas as estirpes de bactérias Gram-positivo testadas, enquanto que para as bactérias Gram-negativo apenas apresentaram atividade para *Escherichia coli* e *Morganella morganii*. Estes resultados demonstram que a variedade portuguesa de maçã “Bravo de Esmolfe” pode ser utilizada como fonte de compostos bioativos com propriedades antioxidantes e antibacterianas.

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[1] Bhatti, S.; Jha, G. *Plant Cell Reports*, **2010**, 29 1215–1225.

[2] Pires, T.C.S.P.; Dias, M.I.; Barros, L.; Alves, M.J.; Oliveira, M.B.P.P.; Santos-Buelga, C.; Ferreira, I.C.F.R. *Food Chemistry*, **2018**, 240, 701–706.

CP003

RELATION BETWEEN VISCOSITY AND POLYSACCHARIDES STRUCTURE FROM TWO SPECIES OF CINNAMOMUM

M. Filomena J. Raposo¹, Cláudia Nunes², Sílvia Rocha¹, Ivonne Delgadillo¹, Manuel A. Coimbra¹

¹QOPNA & LAQV-REQUIMTE and ²CICECO, Chemistry Department, University of Aveiro, Portugal. fraposo@ua.pt

Cinnamon (*Cinnamomum*, Lauraceae) is one of the most known spice and is used mainly as flavouring in foodstuffs [1]. It is reported to have active biological properties, attributed to the essential oil and phenolic compounds [2], namely anti-inflammatory, antipyretic, antifungal, and antioxidant [2], as well as regulator of the insulin action [3]. The two species analysed in this study were *Cinnamomum burmanii*, known as cassia, and *C. zeylanicum*, known as verum, the most popular varieties. Besides their different organoleptic and visual characteristics, cassia presents gel-like characteristics when in aqueous solution, and the viscosity increases when exposed to hot water, while verum do not present such viscosity. In addition, verum has leafy and thinner sticks and the powder is lighter than cassia.

As the polysaccharides are the gelling agents, the powders of both species of *Cinnamomum* were extracted with hot water and the polysaccharides were fractionated by graded ethanol precipitation. Cassia water extract presented a polysaccharide content (66%, w/w) higher than verum (24%, w/w) with different monosaccharide profile, cassia was richer in Ara (51 mol%) and Xyl (34 mol%) and verum had a higher content of Glc (28 mol%) and uronic acids (27 mol%), and lower contents of Ara (24 mol%) and Xyl (14 mol%). Additionally, most of the soluble polysaccharides of cassia precipitated in 50% ethanol while those from verum remained soluble in 75% ethanol.

Linkage analysis suggested the presence of highly branched arabinoxylans composed by a 1,4-linked Xyl backbone substituted at O-2 and/or O-3 mainly by 1,3-linked Ara. Similar arabinoxylans were observed in verum, along with high amounts of 1,4-linked Glc, suggesting the presence of a glucan. The higher viscosity of cassia extracts seems to be associated with the presence in higher amount of highly branched arabinoxylans. Considering the characteristics observed in this study for the two species of *Cinnamomum*, cassia could be the choice to increase thickness in the product, while verum extracts could be used in foods with low viscosity.

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[1] Jayatilaka, A.; Poole, S.K.; Chichila, T.M.P. *Anal Chim Acta* **1995**, *302*, 147-162.

[2] Abdelwahab, S.I.; Mariod, A.A.; Taha, M.M.E.; et al. *Arabian J Chem* **2017**, *10*, 131-135

[3] Broadhurst, C.L.; Polansky, M.M.; Anderson, R.A. *J Agric Food Chem* **2000**, *43*, 849-852.

[4] Nunes, C.; Silva, L.; Guiné, R.P.F.; et al. *Carbohydr Polym* **2012**, *87*, 620-626.

CP004

COMPARATIVE STUDY OF IMPORTED AND ORGANIC VARIETIES OF CHAYOTE (*Sechium edule*) IN TERMS OF VITAMIN C AND CAROTENOIDS CONTENTS AND ANTIOXIDANT CAPACITY

Elsa F. Vieira¹, Cristina Delerue-Matos¹

¹REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida, 431, 4249-015, Porto, Portugal
elsavieiraf@gmail.com

Chayote (*Sechium edule*) possesses promising health-benefits and recognized antioxidant potential [1]. The present work was designed to compare the contents of vitamin C, reduced sugars, chlorophyll a and b and β -carotene, as well as the antioxidant activities (total phenolic content, DPPH, FRAP and reducing power), of peel and pulp fractions of imported (I.chay) and local organic (O.chay) chayote varieties. For this purpose, two varieties of chayote were studied, “light green” (n = 6) and “pale yellow” (n = 6), see Figure 1. The I.chay samples (originally from Mexico) were store-bought in Porto city (Portugal) and the O.chay samples were acquired from a local farmer in Braga city (Portugal).

Results showed that for I.chay samples, the “light green” chayote varieties presented vitamin C mean contents of 81 mg/100g dw and 75 mg/100g in peel and pulp fractions, respectively. In case of “pale yellow” chayote varieties, these contents were 81 mg/100g dw and 66 mg/100g dw, respectively. For “pale yellow” chayote varieties, the mean content of vitamin C present in peel (81 mg/100g dw) and pulp (99 mg/100g dw) fractions of O.chay were significantly higher ($p < 0.05$) than the contents observed for I.chay samples. The contents of chlorophyll a, b, and β -carotene were significantly higher ($p < 0.05$) in the chayote peel of “light green” chayote varieties. In addition, there was a good correlation (0.88–0.90) between total phenolics and antioxidant activity for both chayote varieties (peel and pulp fractions), although the overall antioxidant activity was significantly ($p < 0.05$) higher in the “light green” of O.chay varieties.



Figure 1: “light green” (left) and “pale yellow” (right) chayote varieties.

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[1] Coronel, O. A. D. Á., León-García, E., Vela-Gutiérrez, G., Medina, J. D. L. C., García-Varela, R., & García, H. S. In: *Fruit and Vegetable Phytochemicals: Chemistry and Human Health*, 2nd Edition, 2017, 979-992.

CP005

THE USE OF ULTRASOUND IN CULINARY EXTRACTION PROCESSES: A STUDY IN STOCKS AND INFUSED OILS ENRICHED WITH CODIUM TOMENTOSUM

A. Salgado¹, B. Moreira Leite¹, B. Campos¹, P. Mata¹, M. Diniz² and J. P. Noronha¹

¹LAQV, REQUIMTE, Departamento de Química, Faculdade de Ciências e Tecnologia/Universidade Nova de Lisboa, 2829-516 Caparica, Portugal
Email: bm.campos@campus.fct.unl.pt

²UCIBIO, REQUIMTE, Departamento de Química, Faculdade de Ciências e Tecnologia/Universidade Nova de Lisboa, 2829-516 Caparica, Portugal

Broths (prepared from meat, fish or vegetables) are savoury liquids commonly used in Western cuisine for various culinary preparations (e.g. soups and sauces). Flavoured oils (for example with herbs or spices) constitute an effective way of homogeneously concentrating the aromas and flavours, allowing the addition of “essences” without the ingredient itself [1]. For both, extraction of components from food matrices usually involve the action of heat, which causes softening and rupture of the cell walls and consequent release of their contents to the solvent [2]. New cooking techniques are used nowadays in the extraction of compounds from food matrices. In addition to the traditional long simmering technique, *sous-vide* (vacuum-sealed food cooked at a low temperature) and, more recently, ultrasound-assisted extraction (UAE), have been used. UAE is still rarely used in cooking, but in recent years has been shown to be a promising technique in the food industry [3]. The comparison of the efficiency of the *sous-vide* and ultrasound extractions for the preparation of *Codium tomentosum* green seaweed broths and flavoured oils was evaluated. The extraction was done using identical time-temperature conditions in both cases (60° C for 45 minutes). The solid-phase microextraction followed by gas chromatography-mass spectrometry method (SPME-GC-MS) was used to compare the volatiles profile. It could be seen that UAE (*sweep* modulation and frequency of 37 KHz) is a more efficient technique particularly for flavoured oils. Subsequently, differential sensory analysis tests (tetrad tests) were performed for broths and flavoured oils. Significant differences were also encountered. Both chromatographic analysis and sensory tests corroborate that the UAE can be a differentiating tool in the production of quality extracts from food matrices allowing results with an increased intensity of *flavour*.

- [1] Myhrvold, N.; Young, C.; Bilet, M. *Modernist Cuisine - The Art and Science of Cooking*, Volume 2 – Techniques and Equipment, 2011, pp. 473.
- [2] McGee, H. *On Food and Cooking: The science and Lore of the kitchen*, 2004, pp. 290.
- [3] Chemat, F. *et al.* Ultrasound Assisted Extraction of Food and Natural Products. Mechanisms, techniques, combinations, protocols and applications. A review', *Ultrasonics Sonochemistry*. Elsevier, 2017, 34 (540–560). doi: 10.1016/j.ultsonch.2016.06.035.

CP006

SELEÇÃO DO SISTEMA GELIFICANTE PARA O DESENVOLVIMENTO DE SNACKS COM ALEGAÇÕES NUTRICIONAIS E DE SAÚDE

Margarida Pina¹, Mayumi Delgado³, Sofia Dinis³, Isabel de Sousa¹, Tiago Oliveira², Marlos Silva², Catarina Prista¹, Anabela Raymundo¹,

¹ *Universidade de Lisboa, Instituto Superior de Agronomia, LEAF Research Center (Linking Landscape Environment Agriculture and Food), Tapada da Ajuda, 1349-017 Lisboa, Portugal*

² *Sonae Center Serviços II S.A., Lugar do Espido, Via Norte, 4470-177 Maia*

³ *Modelo Continente Hipermercados S.A., Rua João Mendonça, nº 505, 4464-503 Senhora da Hora*

Corresponding author: E-mail adress: margaridafpina@gmail.com (Margarida Pina)

Assiste-se atualmente a uma mudança do paradigma da alimentação, a nível global, com a crescente preocupação com a saúde e o bem-estar. Os consumidores estão cada vez mais conscientes do impacto de uma alimentação saudável na sua saúde e dos desenvolvimentos científicos, que apontam para os benefícios de uma alimentação baseada em alimentos frescos e naturais, em oposição a alimentos processados e pré-embalados.

Por outro lado, a problemática de doenças crónicas associadas a uma má alimentação da população mundial, como a diabetes, a hipertensão e a obesidade, incluindo a infantil, tem ainda uma enorme prevalência na sociedade atual. Esta sensibilidade dos consumidores para a saúde e o bem-estar concorre com os estilos de vida e respetivas dinâmicas e rotinas dos indivíduos nas sociedades modernas, preconizando que uma dieta deverá ser nutritiva e deliciosa, mas também conveniente.

O presente trabalho insere-se num projeto mais alargado: “*SnackFresh*”, desenvolvido numa parceria entre o Instituto Superior de Agronomia e a SONAE, que tem por objetivo o desenvolvimento de snacks à base de frutas e vegetais. Pretende-se que o produto a desenvolver possa dar resposta a estas novas exigências dos consumidores, tendo uma composição nutricional equilibrada, com benefícios específicos para a saúde, sendo de fácil e conveniente consumo e conduzindo a uma experiência sensorialmente inovadora. Trata-se de um gelificado que é obtido a partir de uma formulação de hidrocolóides, otimizada de modo a alcançar as características sensoriais e nutricionais definidas como requisitos de partida.

A seleção do sistema de hidrocolóides mais adequado foi o alvo do presente estudo. Testaram-se diversas misturas comerciais e prepararam-se outras misturas com especial interesse em termos de textura. Destacam-se os sistemas formados por diferentes proporções de: i) gelano de alto (HA) e baixo (LA) nível de acilação; ii) k-carragenato e goma de alfarroba (LBG).

Avaliou-se o impacto da adição de sal e do pH nestes sistemas, tendo-se verificado que em ambos os casos a adição de sal reforça a estrutura do respetivo gel. As variações de textura foram reduzidas na gama de pH com aplicação comercial.

Avaliou-se ainda o comportamento reológico dos referidos géis, com recurso a um reómetro de tensão controlada, tendo-se acompanhado as etapas de arrefecimento, maturação e efetuado os respetivos espetros mecânicos. Verificou-se que os sistemas em estudo apresentam uma maturação rápida, com destaque para os géis de gelano, e que os géis obtidos apresentam um elevado grau de estruturação.

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CP007

STRUCTURAL PROPERTIES OF GLUTEN-FREE BREAD FORTIFIED WITH MICROALGAE BIOMASS

Sheyma Khemiri¹, Carla Graça², Alice Ferreira³, M. Cristiana Nunes², Isabel Sousa², Luísa Gouveia³, Issam Smaali¹ Anabela Raymundo²

¹University of Carthage, LIP-MB Laboratory (LR11ES24), INSAT-BP 676, 1080 Tunisia

²Universidade de Lisboa, Instituto Superior de Agronomia, LEAF Research Center (Linking Landscape Environment Agriculture and Food), Tapada da Ajuda, 1349-017 Lisboa, Portugal

³LNEG-UB National Laboratory of Energy and Geology/Bioenergy Unit, Estrada do Paço do Lumiar 22, 1649-038 Lisbon, Portugal.

Corresponding author

e-mail adress: khemirisheyma@gmail.com (Sheyma Khemiri)

Microalgae are able to enhance the nutritional and technological performance of conventional foods while affecting positively human health, due to their original chemical composition. In the last years, several works described innovative and healthy food products enriched with microalgae biomass [1-4]. However, few studies have been developed about the incorporation of microalgae in bread [5]. Bread is a staple food with very specific characteristics in terms of fermentation and development of the dough structure, and baking without gluten, the key ingredient for bread structure and quality, is a big challenge. The consumers are very sensitive to the physical characteristics of the final product, which induces some limitations on the total content of microalgae incorporation.

In this context, the present work aimed to evaluate the effect of three green microalgae (*Chlorella vulgaris*, *Nannochloropsis gaditana*, *Chlamydomonas* sp.) produced in our laboratory, on dough and bread's texture, colour, volume, aW and water content. HPMC (hydroxypropylmethylcellulose) was used as a thickening agent, binding water and increasing doughs viscosity, for better volume and texture of the gluten-free breads. Microdough-Lab instrument was used to determine the water absorption of the gluten-free flours in addition with the three different microalgae.

Microalgae biomass addition can enhance the global aspect and nutraceutical potential of bread. This innovative product, daily base consumed, could give important benefits for some markets, such as celiac and sportsman.

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[1] Batista, A. P., Nicolai, A., Fradinho, P., Fragoso, S., Bursic, I., Rodolfi, L., & Raymundo, A. **2017**, 26, 161-171.

[2] Gouveia, L., Batista, A. P., Raymundo, A., & Bandarra, N. **2008**, 38(5), 492-501.

[3] Gouveia, L., Coutinho, C., Mendonça, E., Batista, A. P., Sousa, I., Bandarra, N. M., & Raymundo, A. **2008**, 88(5), 891-896.

[4] Batista, A.P., M.C. Nunes, P. Fradinho, L. Gouveia, I. Sousa, A. Raymundo, J.M. Franco. **2012**, 182–189

[5] Graça, C., Fradinho, P., Sousa, I., & Raymundo, A. **2017** 89, 466-474.

CP008

APLICAÇÃO EM WAFFLES DE UM CORANTE NATURAL OBTIDO DE FRUTOS DE *ARBUTUS UNEDO* L.

Cecilia Jiménez López¹, Cristina Caleja^{1,2}, Rúbia C. G. Corrêa¹, Maria Inês Dias¹, M.A. Prieto^{1,3}, Maria Filomena Barreiro^{1,2}, Lillian Barros¹, Isabel C.F.R. Ferreira^{1*}

¹*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal*

²*Laboratório de Processos de Separação e Reação - Laboratório de Catálise e Materiais (LSRE-LCM), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal*

³*Grupo de nutrição e bromatologia, Faculdade de Ciência e Tecnologia Alimentar, Universidade de Vigo, Ourense Campus, E32004 Ourense, Espanha*

**iferreira@ipb.pt*

Os corantes são um dos aditivos mais importantes em termos de marketing, uma vez que a cor pode influenciar diretamente as escolhas e preferências dos consumidores [1]. No entanto, têm sido descritos alguns efeitos indesejáveis de determinados corantes artificiais. Contrariamente, os corantes naturais (e.g. ricos em compostos antociânicos) são genericamente considerados inofensivos, para além de poderem proporcionar efeitos bioativos [2]. Neste estudo, um extrato rico em antocianinas, obtido a partir de frutos de *Arbutus unedo* L. (medronho), foi aplicado como corante natural num produto de pastelaria. Para a preparação do extrato, otimizou-se o processo de extração utilizando duas metodologias: extração assistida por calor e extração assistida por ultrassons, de forma a obter as condições que maximizam a concentração de antocianinas. Foi aplicada uma metodologia de superfície de resposta, seguindo um delineamento experimental de 5 níveis e as respostas foram obtidas através de HPLC-DAD-ESI/MS, onde foram identificados três compostos antociânicos; a cianidina-3-glucósido foi a molécula maioritária. A técnica de extração assistida por calor demonstrou ser o método mais eficaz para a extração de antocianinas, produzindo 51,2% de extrato, com um teor total de antocianinas de 382,4 µg/g fruto seco e 744,6 µg/g de extrato, nas condições ótimas de 5 minutos, 90°C, 80% de etanol e 15 g/L de razão sólido: líquido. Posteriormente, o extrato foi incorporado em *waffles*, tendo-se avaliado a sua composição em macronutrientes, bem como em açúcares livres e ácidos gordos, ao longo de 6 dias de armazenamento. Os resultados obtidos demonstraram que a incorporação do extrato não causou alterações nos componentes nutricionais. Validam também a possibilidade de utilizar frutos de *A. unedo* como fonte de compostos antociânicos muito interessantes para utilização como corantes alimentares naturais.

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[1] Caroch, M.; Barreiro, M. F.; Morales, P.; Ferreira, I. C. F. R. *Comprehensive Reviews in Food Science and Food Safety*, **2014**, 13, 377–399.

[2] Albuquerque, B.R.; Prieto, M.A.; Barreiro, M.F.; Rodrigues, A.; Curran, T.P.; Barros, L.; Ferreira, I.C.F.R. *Industrial Crops and Products*, **2016**, 95, 404–415.

CP009

DESENVOLVIMENTO DE NOVOS PRODUTOS ALIMENTARES COM CORANTES NATURAIS OBTIDOS A PARTIR DE FLORES COMESTÍVEIS

Tânia C.S.P. Pires^{1,2}, Maria Inês Dias¹, Lillian Barros¹, João C.M. Barreira¹, Celestino Santos-Buelga², Isabel C.F.R. Ferreira^{1,*}

¹*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal*

²*Grupo de Investigación en Polifenoles (GIP-USAL), Facultad de Farmacia, Universidad de Salamanca, Campus Miguel de Unamuno s/n, 37007 Salamanca, España.*

**iferreira@ipb.pt*

A substituição de corantes artificiais por homólogos naturais está entre as principais tendências dos consumidores atuais, justificando a prospeção de novas fontes desses compostos nomeadamente flores comestíveis ricas em antocianinas [1]. O objetivo do presente estudo foi desenvolver uma nova estratégia de coloração em produtos à base de iogurte utilizando extratos ricos em antocianinas obtidos das flores comestíveis de dália, rosa e centáurea, como potenciais substitutos do E163 (extrato de antocianinas). A caracterização antociânica dos extratos aquosos das flores foi realizada por HPLC-DAD-ESI/MS e estes foram, posteriormente, incorporados em iogurtes. Os produtos desenvolvidos foram submetidos a avaliação dos seus parâmetros nutricionais (métodos AOAC), composição em açúcares livres (HPLC-RI) e ácidos gordos (GC-FID), tendo sido também avaliada a estabilidade cromática dos mesmos (conteúdo de antocianinas e parâmetros de cor). Todos os ensaios descritos foram realizados no dia da preparação e após 7 dias de armazenamento e comparados com duas amostras controlo (sem adição de um agente corante e com a adição de um aditivo natural - E163). Foi realizada uma análise discriminante linear para perceber o efeito que as diferentes formulações de iogurtes teriam em cada um dos parâmetros estudados. Foram identificadas nove antocianinas nos extratos aquosos de dália, duas nos de rosa e oito nos de centáurea, sendo a cianidina, pelargonidina e a delphinidina as principais agliconas identificadas. O perfil nutricional foi muito semelhante entre todas as amostras testadas, sendo a humidade o principal componente, seguida de hidratos de carbono, proteínas, gordura e cinza. A lactose e o ácido oleico foram identificados como o açúcar e o ácido gordo maioritários em todas as amostras. Em geral, os iogurtes preparados com cada extrato de flor, apresentaram um valor nutricional e perfil em açúcares semelhantes aos preparados com E163 e à amostra controlo. No entanto, dois extratos naturais destacaram-se apresentando maior potencial como alternativa ao uso de E163, sendo eles o extrato de rosa, considerando a sua capacidade de coloração (amarelo-laranja), e o extrato de dália, particularmente na manutenção da proteção contra a oxidação dos ácidos gordos polinsaturados.

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[1] Pires, T.C.S.P.; Dias, M.I.; Barros L.; Barreira, J.C.M.; Santos-Buelga, C.; Ferreira, I.C.F.R. *LWT - Food Science and Technology*, **2018**, 97, 668–675

CP010

AVALIAÇÃO DO VALOR NUTRITIVO, ACEITAÇÃO E PERFIL SENSORIAL DE BARRAS DE CEREAIS COM INCORPORAÇÃO DE GRILOS COMESTÍVEIS DESENGORDURADOS

J.C. Ribeiro¹, R.C. Lima², M.R.G. Maia³, A.A. Almeida⁴, A.J.M. Fonseca³, A.R.J. Cabrita³, L. M. Cunha^{1,*}

¹GreenUPorto & LAQV/REQUIMTE, DGAOT, Faculdade de Ciências da Universidade do Porto, Campus Agrário de Vairão.

²Sense Test, Lda, Vila Nova de Gaia, Portugal.

³LAQV/REQUIMTE, ICBAS, Universidade do Porto.

⁴LAQV/REQUIMTE, Departamento de Ciências Químicas, Faculdade de Farmácia, Universidade do Porto.

*corresponding author: lmcunha@fc.up.pt

Os insetos comestíveis apresentam-se como uma nova fonte alimentar com elevado potencial de aplicação. No entanto, a sua aceitação por parte de consumidores ocidentais é bastante baixa [1], estando associados a propriedades sensoriais negativas. Duas espécies de grilos liofilizados (*Acheta domesticus*; *Gryllodes sigillatus*) foram utilizadas neste estudo. O valor nutricional e teor em minerais foram avaliados em amostras das duas espécies moídas. As amostras foram desengorduradas de acordo com o método de Soxhlet, tendo sido testados cinco solventes orgânicos diferentes. Foram elaboradas barras de cereais sem incorporação de grilo, com incorporação de 8% (m/m) de grilos inteiros moídos ou 6% (m/m) de grilos desengordurados. A análise sensorial das barras foi efetuada por 70 provadores (recrutados com base na sua disponibilidade para comer insetos [1]), que avaliaram a aceitação global e intenção de consumir a amostra [2] (em escalas de 9 pontos) e descreveram o perfil sensorial através de um boletim *Check-All-That-Apply*, identificando também o perfil ideal. A análise nutricional revelou que ambas as espécies são excelentes fontes de proteínas (ca. 65% da matéria seca) e de alguns minerais (P, Cu, Zn, Mn e Se). O etanol foi o solvente que apresentou os melhores resultados na extração lipídica, e o desengorduramento dos grilos levou a uma melhoria das propriedades sensoriais das barras de cereais, independentemente da espécie incorporada. As barras com incorporação de grilos desengordurados tiveram avaliações de aceitação global e intenção de consumo idênticas à barra controlo (sem incorporação de grilos), enquanto as barras com incorporação de grilos inteiros moídos tiveram piores avaliações. O perfil sensorial revelou que as únicas diferenças entre as barras com incorporação de grilos desengordurados e a barra controlo e barra com perfil ideal estavam relacionadas com aparência e textura, enquanto as barras com incorporação de grilos inteiros moídos foram associadas a vários descritores sensoriais negativos relacionados com odor e sabor. O trabalho desenvolvido permitiu confirmar o elevado valor nutricional das espécies de grilos estudadas e melhorar as suas propriedades sensoriais através do desengorduramento, o que sugere que o sabor desagradável associado aos grilos parece estar relacionado com a fração lipídica.

[1] Cunha, L. M., *et al.* Adoption of insects as a source for food and feed production: A cross-cultural study on determinants of acceptance."11thPangborn Sensory Science Symposium", Gothenburg, Sweden. (2015)

[2] Schutz H. G. Food Action Rating Scale for Measuring Food Acceptance. *Journal of Food Science*, 30 (2), 365-374. (1965)

CP011

EFFECT OF ION EXCHANGE RESINS ON WHITE AND RED WINE PH: IMPACT ON WINE SENSORY CHARACTERISTICS

Rita Borges^{1,3}, Conceição Fernandes¹, Celeste Marques², Carlos Matos³, Alice Vilela³, Filipe-Ribeiro, L. ³, Fernando M. Nunes³, Fernanda Cosme³

¹Mountain Research Centre (CIMO), ESA-Polytechnic Institute of Bragança, Portugal

²AEB Bioquímica Portuguesa SA, Zona Industrial de Coimbrões, Viseu, Portugal

³Chemical Research Centre (CQ-VR), Food and Wine Chemistry Lab, UTAD, Vila Real, Portugal.

Email: ritaborges_17@hotmail.com

The pH control during winemaking is a fundamental parameter by their influence on color, freshness and to achieve wine microbiological stability. The most common acidify correction performed in wineries is addition of natural tartaric acid; however, in some cases, this operation increases the risks of potassium bitartrate precipitations [1, 2]. The application of ion exchange resins for wine acidification is based on ability of exchanging ions fixed on functional groups, namely by exchanging cations, such as potassium, with hydrogen ions. Nevertheless, there is an important lack of knowledge on the impact of this operation on wine sensory characteristics. To adjust wine pH, a certain amount of treated wine by ion exchange resins is mixed with the untreated wine [3]. According to OIV [4], treatment must not lower the pH of wine below 3.0 and the decrease should not exceed 0.3 pH units. Anion exchangers are not allowed by the OIV [3] due to the negative effects on the wine sensory quality [5,6]. Therefore, the aim of this work was to evaluate the effect of cation exchange resins, authorized by the OIV, according to Resolution 43/2000 [3] on wine pH control and to evaluate their impact on wine sensory quality at industrial scale. In this study a white and a red wine from the Douro Valley region, 2015 vintage, was used. In this work ion exchange resin treated white wine was almost 20% from total white wine volume and red wine was almost 30% from total red wine volume. The present study indicated that there were no considerable changes in sensory attributes, although a slight improvement in the aroma and taste, as a result of the ion-exchange pH adjustment. These results show that the application of ion exchange resins process to wine could be an interesting tool for white and red wine pH adjustment, without interfering with wine sensorial quality.

Keywords: White wine, red wine, pH, acidity, ion exchange resins, sensory quality.

References:

- [1] Berg, H. W.; Keefer, R. M. American Journal of Enology and Viticulture, **1958**, 9,180–183.
- [2] Ratsimba, B.; Laguerie, C.; Biscans, B.; Gaillard, M. Bulletin de la Societé Chimique de France, **1989**, 3, 325–330
- [3] O.I.V. Resolution OENO 43/2000
- [4] O.I.V. Resolution OENO 443/2012
- [5] Mira, H.; Leite, P.; Ricardo-Da-Silva, J.M.; Curvelo-Garcia, A.S.. *International des Sciences de la Vigne et du Vin* **2006**, 40, 223–246.
- [6] Lasanta, C.; Caro, I.; Pérez, L. *Food Chemistry* **2013**, 138, 1072–1078.

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CP012

EFEITO DA COMPOSIÇÃO NUTRICIONAL DE *ARTHOSPIRA PLATENSIS* NA QUALIDADE DE MASSAS ISENTAS DE GLÚTEN

Patrícia Fradinho¹, Rita Soares¹, Alberto Niccolai², Liliana Rodolfi^{2,3}, Natascia Biondi², Mario R. Tredici², Isabel Sousa¹, [Anabela Raymundo](mailto:anabraymundo@isa.ulisboa.pt)¹

¹LEAF – Linking Landscape, Environment, Agriculture and Food, Instituto Superior de Agronomia, Universidade de Lisboa. Tapada da Ajuda, 1349-017 Lisboa, Portugal

²Department of Agrifood Production and Environmental Sciences (DISPAA), University of Florence, Piazzale delle Cascine 24, 50144 Florence, Italy

³Fotosintetica & Microbiologica S.r.l., Via dei Della Robbia 54, 50132 Florence, Italy

anabraymundo@isa.ulisboa.pt

Tradicionalmente elaborada com sêmola de trigo *durum*, a massa alimentícia é um produto largamente consumido. Em resposta à necessidade dos consumidores com algum tipo de intolerância ao trigo (ex. doença celíaca), têm surgido no mercado cada vez mais produtos isentos de glúten, nomeadamente massas alimentícias. No entanto, muitas vezes, esses produtos não satisfazem as carências nutricionais deste tipo de consumidores, em termos de vitaminas (B12, D) e minerais (ferro, cálcio, zinco) [1]. É amplamente reconhecido o impacto positivo das microalgas na saúde. Estudos desenvolvidos pelo nosso grupo de investigação demonstraram melhorias nas propriedades nutricionais e de estrutura de massas alimentícias de trigo [2] e de bolachas [3], principalmente com a incorporação de *Arthrospira platensis* (AP), uma cianobactéria, rica em proteínas, ácido γ -linolénico, vitamina B12 e ficocianina [4], vulgarmente conhecida por Spirulina. O desenvolvimento de massas isentas de glúten constitui um desafio, em termos de estruturação. Neste sentido, a incorporação de AP constitui uma mais valia para a criação de estrutura em matrizes sem glúten, resultante do seu elevado teor proteico, além dos benefícios nutricionais associados. Este estudo pretendeu avaliar o impacto da adição de AP de duas origens (F&M-C256 e SOx) na qualidade de massas alimentícias isentas de glúten e no seu valor nutricional. Pretendeu-se elaborar um produto final que satisfaça as necessidades nutricionais da população alvo, e simultaneamente alcançar características de textura semelhantes à massa tradicional com glúten. Com base numa formulação previamente otimizada, constituída por farinha de arroz e gel de psyllium (controlo), procedeu-se à incorporação da biomassa de AP (1-3%). As massas desenvolvidas foram comparadas com o controlo e com uma referência de sêmola de trigo *durum*, em termos de parâmetros da qualidade da cozedura, textura, composição nutricional, atividade antioxidante, compostos fenólicos e digestibilidade *in vitro*.

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[1] Theethira, T.G. et al. *Expert Reviews of Gastroenterology and Hepatology* **2014**, 8(2), 123–129.

[2] Fradique, M. et al. *Journal of Science of Food and Agriculture* **2010**, 90, 1656–1664.

[3] Batista, A.P. et al. *Algal Research* **2017**, 26, 161-171.

[4] Hongsthong, A.; Bunnag, B. In P.M. Gault, H.J. Marler (Eds.), *Handbook on Cyanobacteria: Biochemistry, Biotechnology and Applications* **2009**, Nova Science Publishers, pp. 51–103.

CP013

DETERMINANTES DA UTILIZAÇÃO DOS SERVIÇOS DE ALIMENTAÇÃO INSTITUCIONAIS PELOS COLABORADORES DE UNIVERSIDADE PORTUGUESA

João PM Lima^{1, 2, 3, 4}, Teresa RS Brandão⁵, Ada Rocha^{3, 4, 6}

1 - Escola Superior de Tecnologia da Saúde de Coimbra – Instituto Politécnico de Coimbra

2 – CiTechCare

3 – GreenUPORTO

4 – LAQV – Requimte

5 – CBQF – Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa/Porto

6 - Faculdade de Ciências da Nutrição e Alimentação da Universidade do Porto

INTRODUÇÃO: O consumo alimentar realizado no local de trabalho representa uma parte importante da ingestão alimentar global realizado pelo indivíduo. A caracterização dos determinantes da escolha do local de almoço, poderá contribuir para adequar a qualidade do serviço de alimentação universitária, melhorando a taxa de utilização do mesmo, e promovendo a alimentação saudável dos colaboradores através do seu local de trabalho.

Objetivo: Caracterizar os determinantes da escolha do local de almoço dos colaboradores de uma universidade portuguesa, bem como os fatores chave considerados como necessidades de mudança nos serviços de alimentação institucionais tendo em vista a sua utilização mais frequente.

Metodologia: Foi realizado um estudo observacional de corte transversal numa Universidade Portuguesa, sendo avaliados 513 indivíduos, a maioria mulheres (65,5%). A recolha de dados foi realizada durante o horário de trabalho. Os participantes foram selecionados aleatoriamente. O consentimento informado foi obtido e o objetivo do estudo foi explicado individualmente. A recolha de dados foi realizada através da administração de um inquérito desenvolvido para o efeito, sendo constituído por questões sociodemográficas, os determinantes do consumo alimentar considerados na literatura científica e utilizados noutros estudos com amostras representativas da população portuguesa e um conjunto de fatores determinantes para a utilização mais frequente do serviço de alimentação institucional, selecionados por metodologia de Delphi.

Resultados: Cerca de 97% dos entrevistados almoçam todos os dias. No entanto, 36,1% dos colaboradores utilizam o serviço de alimentação da universidade, o que é preocupante. A maioria dos entrevistados identifica o preço e a qualidade das refeições como determinantes da escolha do local para almoçar. Quando questionados acerca dos fatores a implementar no Serviço de Alimentação institucional que contribuiriam para uma utilização mais frequente dos mesmos, os três aspectos mais referidos foram: oferta alimentar, qualidade nutricional e sensorial e a rapidez de atendimento.

Conclusões: A qualidade das refeições, nomeadamente a qualidade nutricional e sensorial, a par com o custo e a rapidez do serviço são fortes determinantes da utilização dos serviços de alimentação, razão pela qual importa melhorar a qualidade nutricional dos alimentos disponibilizados, e melhorar a logística dos serviços, contribuindo para uma maior taxa de utilização e também para a promoção da alimentação saudável.

CP014
A WHOLE NEW WORLD OF TRADITIONAL FOODS:
vegetable alheira

Diana Filipe¹, Jéssica Quintas¹, Marisa Geraldés¹, Ana Lúcia Baltazar¹, João PM Lima^{1, 2, 3, 4}

1 – ESTeSC-Coimbra Health School, Dep. Dietética e Nutrição

2 – ciTechCare

3 – GreenUPORTO

4 – LAQV - Requimte

INTRODUCTION: Food Industry is constantly evolving and technology plays an important role in food sector. Vegetarianism is a vegetable-based food style, characterized by exclusion of meat, fish and not include animal products. Scientific-technical advances allow the food production to be better adapted to the consumer, with more sustainable and efficient processes, so more food options have arisen.

AIM: Understand the relevance of vegetarian products in the market; recognize the technological process of the vegetable alheira; gather the nutritional benefits of this product compared to “traditional” alheira.

METHODS: A questionnaire was elaborated and applied, to realize the importance of vegetarian options of traditional Portuguese foods, such as alheira. It was visited an alheira industry and were observed in loco the technological process and processing. Eight products (vegetable and meat) were compared at nutritional and monetary level.

RESULTS: 107 individuals answered the questionnaire, mostly vegetarians/vegans (83.2%); regarding the importance of vegetarian options, 61.7% considered it very important; comparing the nutritional level, 97.2% considered that the vegetarian option would be the healthiest. Regarding nutritional values, they're not very divergent. However, vegetarian options are better than the meat option, having a lower saturated fats content and a higher fiber content. The technological process was summarized in the following steps: Receiving raw materials; Storage; Preparation (wading, cooking, washing); Mixing; Filling; Smoking; Packaging; Storage of finished product; Distribution.

CONCLUSION: There is a growing interest in products of plant origin. The vegetable alheira is a more conscious option, than the traditional alheira, not only for vegetarians but for the general population, attending to them nutritional characteristics.

CP015

ANTIBACTERIAL ACTIVITY OF MARITIME PLANT EXTRACTS AGAINST FOOD BACTERIAL STRAINS: A PRELIMINARY STUDY

Nádia Osório^{1,2}, Aida Moreira da Silva^{2,3} M^a João M. C. Barroca^{2,3}

¹*Instituto Politécnico de Coimbra, ESTeSC, Portugal*

²*Molecular Physical-Chemistry, R&D Unit, Department of Chemistry, University of Coimbra, Portugal;* ³*Instituto Politécnico de Coimbra, ESAC, Portugal*

Taking into consideration the demand for natural and bioactive compounds, the delicate white crowberry and leaves of *Corema album* were used to assess their antibacterial effect. Firstly, methanolic extracts were obtained from vegetal matrices and lyophilized and secondly the dried extracts were resuspended in dimethylsulfoxide 0.2% to a final concentration of 50 mg/mL.

To assess the antibacterial effect we used the broth microdilution method for the determination of the minimum inhibitory concentration (MIC) and the bacterial growth was detected by optical density at 600nm and after by addition of an indicator solution named 2-(4-iodophenyl)-3-(4-nitrophenyl)-5-phenyltetrazolium chloride in alcoholic solution. Pathogenic bacteria were selected as *Staphylococcus aureus* and *Escherichia coli*.

In this study, the leaves extract showed bactericidal activity against *S. aureus*, MIC at 12.5 mg/mL, however any effect was observed against *E. coli*. The white crowberry extracts in the maximum concentration tested (12.5mg/mL) we didn't observe any bactericidal activity but we also observed a bacteriostatic effect, specifically 19% of growth reduction in *E. coli* and around 80% in *S. aureus*.

The *Corema album* extracts have antibacterial activity, especially against Gram positive coccus. As future work will be important increase the knowledge in this field and will be important to test the leaves extracts against other bacterial species (named *Enterococcus*, *Streptococcus*...).

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CP016

Increased accumulation of anthocyanins in vine stems upon chitosan application: alternate use of winery waste produce to extract natural colour additives for the food industry

Rupesh Kumar Singh^{a}, Fernanda Cosme^a, Ana L. Pinto e Sintra^b, António Inês^a, Virgílio Falco^a and Ana Alexandra Oliveira^b*

^a*Centro de Química de Vila Real (CQ-VR), UTAD, 5000-801, Vila Real, Portugal*

^b*Centro de Investigação e de Tecnologias Agro-Ambientais e Biológicas (CITAB), UTAD, 5000-801 Vila Real, Portugal*

[*rupeshbio702@gmail.com](mailto:rupeshbio702@gmail.com)

Chitosan is a biopolymer and has been used in agriculture for different objectives including improved resistance against fungal pathogens, yield, fruit weight, vegetative growth, quality and shelf-life [1]. In the present work, grapevines from Touriga Franca red grape variety were exposed to 0.01% chitosan aqueous solution during initiation of veraison, after complete veraison and at maturation stage. Vine stems were collected after harvesting of grapes and samples extracted in 50% aqueous ethyl alcohol (v/v) and monomeric anthocyanins were quantified by HPLC. As expected malvidin-3-glucoside was the major anthocyanin recorded with 19.91±0.70 mg/L in control grapevine stems and 43.57±7.70 mg/L (118.83% increased) in chitosan treated grapevine stems. Malvidin-3-coumaroylglucoside was the second major anthocyanin with 11.69±0.38 mg/L in control grapevine stems and 25.11±3.99 mg/L (114.79% increased) in treated grapevine stems followed by peonidin-3-glucoside (5.53±0.20 mg/L in control grapevine stems and 11.00±1.90 mg/L in treated grapevine stems) and malvidin-3-acetylglucoside (5.44±2.48 mg/L in control grapevine stems and 14.96±2.27 mg/L in treated grapevine stems). In addition to these major anthocyanins, 11 other anthocyanins were also detected and quantified, with significant increased accumulation in the treated grapevines.

Anthocyanins are natural colourants with health benefits in dietary context and gaining popularity as a replacement of synthetic colours in food and cosmetic industries with huge market growth forecast up to \$387.4 Million by 2021 [2]. Several synthetic colours are being prohibited and regulated by comprehensive sets of new regulation which is a major limitation for industrial sector; recently EU and USA alleviated the need of natural colours in a variety of products to meet new regulations [3]. The present study suggests application of chitosan to induce anthocyanin accumulation in grapevine stems and use of this winery waste produce to meet the requirement of natural colourants for the food industry.

[1] M Massimo, C Raffaella, *Int J Mol Sci*, 2016, 17(7), 996.

[2] A Ingo, KWV Anders, W Micael, KHPM Anne, R Julia, O Anne, M Stefan, PM Hans, M Cathie, M Andrea, *Metab Eng* 2018, 48, 218–232.

[3] L Sari, B Maria, K Alexandra, S Raphaela, B [Cato](#), U [Franz](#), *Food Addit Contam*, 2017, 34 (3), 335–355.

CP017

CITRUS BY-PRODUCTS AND THEIR BIOLOGICAL PROPERTIES APPLIED TO FOOD INDUSTRY

Mariana A. Andrade^{1,2,*}, Vasco Lima², Ana Sanches Silva^{3,4}, Fernanda Vilarinho^{1,5},
Maria Conceição Castilho², Khaoula Khwaldia⁶, Fernando Ramos^{2,7}

¹ *Department of Food and Nutrition, National Institute of Health Doctor Ricardo Jorge (INSA),
I.P., Av. Padre Cruz, 1649-016, Lisbon, Portugal*

² *Faculty of Pharmacy, University of Coimbra, Pólo III - Pólo das Ciências da Saúde,
Azinhaga de Santa Comba, 3000-354 Coimbra, Portugal*

³ *National Institute for Agricultural and Veterinary Research (INIAV), I.P., Rua dos Lagidos,
Lugar da Madalena, 4485-655, Vairão, Vila do Conde, Portugal*

⁴ *Center for Study in Animal Science (CECA), ICETA, University of Porto, Porto, Portugal;*

⁵ *IDMEC, Departamento de Engenharia Mecânica, Instituto Superior Técnico, University of
Lisbon, Lisbon, Portugal*

⁶ *Institut National de Recherche et d'Analyse Physico-chimique, INRAP, Pôle Technologique
de Sidi Thabet, 2020 Tunis*

⁷ *REQUIMTE/LAQV, Faculty of Pharmacy, University of Coimbra, Coimbra, Azinhaga de
Santa Comba, 3000-548 Coimbra, Portugal*

[*mariana.andrade@insa.min-saude.pt](mailto:mariana.andrade@insa.min-saude.pt); malvoco92@gmail.com

Every year, one-third of the world's food production, approximately 1.3 billion tons, is lost or wasted, resulting in a significant disposal of by-products [1]. In the case of fruits, they often reach to the consumer in form of juices or other formulations. These fruits by-products have a low economic value, and some possess high biological activities. In fact, their biological activities are sometimes higher than those of the edible portion. Thus, fruits by-products may be a valuable source of bioactive compounds for the food, pharmaceutical and cosmetic industries [2]. The most commonly found active compounds in fruits by-products are carotenoids, vitamins (mainly C and D), phenolic compounds and dietary fiber [3]. These active compounds are responsible for the biological activities of plants and fruits, such as protection against harmful organisms and radiation. One of the most produced and consumed crops in the world, citrus fruits (e.g. oranges, lemons, and limes) are known to be a rich source of citric acid, vitamin C, and flavonoids. Their by-products can have a higher carotenoid content than the edible portion of the fruit and, consequently, present a high antioxidant capacity. The main objective of this study is to summarize, through an exhaustive literature review, the main active compounds of citrus fruits by-products and their biological activities. Moreover, the possible application of citrus fruits extracts and oils into active food packaging is also addressed.

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[1] Gustavsson, J. et al. *SAVE FOOD An Initiative Food Loss Waste Reduct.* **2011**.

[2] Martínez, R. et al. *Food Chemistry* **2012**, 135, 1520–1526.

[3] Ayala-Zavala, J.F. et al. *Food Research International* **2011**, 44, 1866–1874.

CP018

GRAPE BY-PRODUCTS AS A SOURCE OF ACTIVE COMPOUNDS FOR FOOD PACKAGING APPLICATION

Mariana A. Andrade^{1,2,*}, Vasco Lima², Ana Sanches Silva^{3,4}, Fernanda Vilarinho^{1,5}, Maria Conceição Castilho², Khaoula Khwaldia⁶, Fernando Ramos^{2,7}

¹ *Department of Food and Nutrition, National Institute of Health Doutor Ricardo Jorge (INSA), I.P., Av. Padre Cruz, 1649-016, Lisbon, Portugal*

² *Faculty of Pharmacy, University of Coimbra, Pólo III - Pólo das Ciências da Saúde, Azinhaga de Santa Comba, 3000-354 Coimbra, Portugal;*

³ *National Institute for Agricultural and Veterinary Research (INIAV), I.P., Rua dos Lagidos, Lugar da Madalena, 4485-655, Vairão, Vila do Conde, Portugal*

⁴ *Center for Study in Animal Science (CECA), ICETA, University of Oporto, Oporto, Portugal;*

⁵ *IDMEC, Departamento de Engenharia Mecânica, Instituto Superior Técnico, University of Lisbon, Lisbon, Portugal*

⁶ *Institut National de Recherche et d'Analyse Physico-chimique, INRAP, Pôle Technologique de Sidi Thabet, 2020 Tunis*

⁷ *REQUIMTE/LAQV, Faculty of Pharmacy, University of Coimbra, Coimbra, Azinhaga de Santa Comba, 3000-548 Coimbra, Portugal*

[*mariana.andrade@insa.min-saude.pt](mailto:mariana.andrade@insa.min-saude.pt); malvoco92@gmail.com

Vitis spp. or simply grape is one of the most produced crops in the world. The main production of grapes is mainly directed to wine production. According to EUROSTAT, in the European Union alone, there were produced more than 25,000 tons of grapes in 2015 [1]. In the wine production, the grape is not used entirely, which results in a major quantity of grape by-products that can be used for the production of cognac, spirits or other alcoholic beverages. Along with grapes, these by-products are known to have a high quantity of phenolic compounds like epicatechin and gallic acid, which have powerful biological activities [2–4]. Phenolic compounds, as well as their amount, differ according to the part of the grape. Grape seeds are known to have the highest phenolic content (60-70 %), followed by skin (28-35 %) and pulp (10 %) [5]. Although these contents may vary according to the grape variety and the edaphoclimatic conditions to which the plant was exposed to, two of the main classes of phenolic compounds found in grapes and grape's by-products are tannins and anthocyanins. Tannins can be divided into two major groups, hydrolyzable tannins, and condensed tannins, and their application as food additives has been considered controversial. Tannins can act as antinutritional compounds by binding to proteins, starch, and enzymes in the gastrointestinal tract, preventing its absorption by the digestive system [6,7]. Anthocyanins are water-soluble pigments that are present in several fruits and plants, responsible for their red, blue and purple colors, with powerful antioxidant, anti-inflammatory and cardioprotective activities [8–10].

The goal of this extensive literature review is to address the main active compounds found in grape by-products extracts and oils and to evaluate their current application into active food packaging to prolong the shelf life of foods. Future trends in this field are also addressed.

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funded by the Foundation for Science and Technology (FCT). Vasco Lima is grateful for his research grant () in the frame of the VIPACFood project.

- [1] EUROSTAT [online]. Accessed July 24, 2018. Available at <http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=taq00121&language=en>.
- [2] Campos, L.M.A.S. et al. *Bioresource Technology* **2008**, 99, 8413–8420.
- [3] Maier, T. et al. *Food Chemistry* **2009**, 112, 551–559.
- [4] Özalp Özen, B. & Soyer, A. *Journal of Food Science and Technology* **2018**, 55, 120–127.
- [5] Ribeiro, L.F. et al. *Journal of Chromatography B* **2015**, 1007, 72–80.
- [6] Chung, K.-T. et al. *Trends in Food Science and Technology* **1998**, 9, 168–175.
- [7] Mingshu, L. et al. *Journal of Basic Microbiology* **2006**, 46, 68–84.
- [8] Pergola, C. et al. *Nitric Oxide* **2006**, 15, 30–39.
- [9] Reis, J.F. et al. *Journal of Translational Medicine* **2016**, 14, 315.
- [10] Wu, S. & Tian, L. *Molecules* **2017**, 22, 1606.

CP019

INNOVATION TRACK: PROMOTING THE DEVELOPMENT OF NEW PRODUCTS AND SERVICES FOR THE AGRO-FOOD AND AGRO-ENVIRONMENTAL SYSTEMS

Leandro Oliveira, Graça Teixeira, Eduardo Luís Cardoso *

Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina
– Laboratório Associado, Escola Superior de Biotecnologia, Porto, Portugal
*ecardoso@porto.ucp.pt

Keywords: innovation; entrepreneurship; agrofood; university contest; new products.

The promotion of academic entrepreneurship associated with the economic valorization of knowledge produced in universities is included in the objectives of bridging the gap between research and innovation in Europe. In this way, the Innovation Track Contest and Program aims to create the basis for a culture and dynamic of innovation in which working groups of students at MSc level are focused on an innovation program towards the development of new products and services for the agro-food and agro-environmental systems. The program includes the support of the research and innovation facilities of the Escola Superior de Biotecnologia da Universidade Católica Portuguesa, and each group can have the support of a scientific and a business mentor across the innovation process and the outcomes will be presented to the innovation ecosystem including companies and investors. The working groups follow a design and development methodology in which each team will have the possibility to be involved in the following tasks: technical-scientific feasibility studies; proof of concepts; prototyping; and a business project. The outcomes that will be assessed could include a prototype, a specification file and a business project. The results will be presented to the market through different forms of communication, with the award of monetary prizes in different categories. The Innovation Track has motivated 18 teams of students from three different Universities, 15 targeting the agro-food sector and 3 teams with projects looking for products or services with more relevance on environmental systems. Teams were also being challenged to submit their projects to other initiatives like the EcoTrophelia contest to reach wider impact. In 2018, 5 teams submitted their projects, 3 of them were present in the portuguese final fase and 1 team won the first prize and represented Portugal in the EcoTrophelia European final in Paris. The Innovation Track Contest and Program, in it's first edition, is already showing results in the involvement of the university students in the innovation processes.

CP020

APLICAÇÃO DE UREIA-PAGE E ELETROFORESE BIDIMENSIONAL COMO TÉCNICAS DE MONITORIZAÇÃO DA PROTEÓLISE DO “QUEIJO DE ÉVORA” FABRICADO COM DIFERENTES ECÓTIPOS DE *CYNARA CARDUNCULUS* L.

Sofia Freitas¹, Ana Lúcia Garrido¹, Cristina Pinheiro^{1,2}, Elsa Lamy², Nuno Alvarenga^{3,4,5}, António Martins^{3,5} e Maria F. Duarte^{2,6}

¹Departamento de Zootecnia, ECT - U. Évora, Ap. 94, 7006-554, Portugal

²ICAAM, U. Evora, Ap. 94, 7006-554 Evora

³UTI-INIAV, Quinta do Marquês, Oeiras, Portugal

⁴ESA-Instituto Politécnico de Beja, Rua Pedro Soares, 7800-295 Beja, Portugal

⁵LEAF-ISA, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisbon, Portugal

⁶CEBAL/IPBeja, Rua Pedro Soares, s.n, Campus IPBeja, 7801-908 Beja, Portugal

O fabrico do queijo em Portugal provém da época das invasões romanas. Com o passar do tempo, e de acordo com hábitos e culturas das diversas populações, os queijos produzidos terão adquirido uma tipicidade e especificidade de acordo com o tipo e zona de produção [1].

Em Portugal, encontra-se uma vasta diversidade de queijos de ovelha, com Denominação de Origem Protegida como o Queijo de Évora (DOP), o Queijo de Azeitão, o Queijo de Serpa, o Queijo Serra da Estrela e o Queijo de Nisa [1,2], sendo estes fabricados com o extrato de *Cynara cardunculus* L. Este agente coagulante confere características singulares aos queijos, a nível de textura e atributos olfatoriais, o que tem vindo cada vez mais a despertar o estudo do seu efeito nos queijos, particularmente nos queijos com denominação de origem protegida.

Neste trabalho procurou-se otimizar técnicas de extração e separação das caseínas e avaliar o efeito da utilização do extrato de três ecótipos de *Cynara cardunculus* L. (Cynara 1, Cynara 2, Cynara 3), na degradação das frações proteicas solúveis e insolúveis do Queijo de Évora, tendo como referência um agente coagulante de origem animal. Estudou-se os perfis de ambas as frações proteicas, por técnicas de eletroforese unidimensional (ureia-PAGE) para a fração de caseínas, e bidimensional para a fração proteica solúvel em água.

Conclui-se que ambas as técnicas complementam-se no estudo da proteólise do Queijo de Évora. O uso de *Cynara cardunculus* L., como agente coagulante no fabrico deste queijo, promove uma proteólise mais extensa, comparativamente à utilização do agente coagulante animal, no entanto não se verificaram diferenças significativas entre os ecótipos de *Cynara cardunculus* L.

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[1] Rosa, I. de F., Lidon, F. C., & Oliveira, J. F. S. (2005). Qualidade do Queijo de Évora, produzido com coagulante de origem microbiológica (*Mucor miehei*) e vegetal (*Cynara cardunculus* L.). [2] Macedo, I. Q., Faro, C. J., & Pires, E. M. (1993). Specificity and Kinetics of the Milk-Clotting Enzyme from Cardoon (*Cynara cardunculus* L.) toward Bovine κ -Casein. *Journal of Agricultural and Food Chemistry*

CP021

QUALITY AND SAFETY ASSESSMENT OF FISHERY PRODUCTS: AN ENZYMATIC AMPEROMETRIC SENSOR FOR HISTAMINE ANALYSIS

Ricarda Torre, Estefânia Costa-Rama, Henri P.A. Nouws, Cristina Delerue-Matos

REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto,
Rua Dr. António Bernardino de Almeida 431, 4200-072 Porto, Portugal. rdvdt@isep.ipp.pt

Histamine is a biogenic amine produced by the decarboxylation of histidine. It is considered the most relevant fish freshness indicator due to its biological toxicity that, when consumed in high dosage, leads to scombroid poisoning [1]. However, histamine does not appear only in fish; other foods or beverages such as wine, cheese and meat may also contain histamine [2]. The increase of its concentration in foods is related with inappropriate refrigerated handling and preservation conditions. Maximum histamine levels are legally established; for example, according to European Regulation (EC) histamine concentration in fish cannot exceed 200 mg·kg⁻¹ [3].

There are many methods for the analysis of histamine such as gas and liquid chromatography and ELISA kits [2]. However, these methods are time consuming and require expensive and complex (non-portable) instrumentation.

The portability of the instrumentation is an interesting characteristic that would allow histamine analysis along the entire production chain. Therefore, an enzymatic sensor based on a miniaturized electrode (screen-printed carbon electrode) was developed and could be an alternative to conventional methods because it is inexpensive and portable, provides fast analysis and is environmentally friendly (since low reagent and sample volumes are needed and the sensor is reusable, decreasing waste generation). This sensor is based on the oxidation of histamine to imidazoleacetaldehyde, catalyzed by (commercially available) diamine oxidase. The use of ferricyanide as redox mediator allows the determination of histamine by chronoamperometry. The developed sensor provides precise results, a high sensitivity and a wide linear range (5 - 75 mg·L⁻¹).

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- [1] Feng, C.; Teuber, S.; Gershwi, M.E. *Clinic. Rev. Allerg. Immunol.* **2016**, 50, 64-69.
- [2] Papageorgiou, M.; Lambropoulou, D.; Morrison, C.; Klenska, E.; Namiesnik, J.; Plotka-Wasyłka, J. *TrAC – Trends Anal. Chem.* **2018**, 98, 128-142.
- [3] Duflos, G.; Inglebert, G.; Himber, C.; Degremont, S.; Lombard, B.; Brisabois, A. *Int. J. Food Microbiol.* **2018**.

CP022
**VERIFICATION STUDY OF A COMMERCIAL ELISA KIT FOR
AFLATOXIN B₁ DETECTION IN CORN**

Carolina S. Pereira^{1,2}, Sara C. Cunha², José Fernandes², Filipa D. Fernandes¹

¹CALSEG – Consultoria e Serviços, Unipessoal Lda, Rua Gonçalves Zarco 1129B, S/110 e 112, 4450-685 Leça da Palmeira, Portugal

²LAQV-Requimte, Laboratório de Bromatologia e Hidrologia, Departamento de Ciências Químicas, Faculdade de Farmácia, Universidade do Porto, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal. pereiracarolina03@gmail.com

Animal feed is a potential route for contaminants like mycotoxins to enter into the human food chain. Hence, a close monitoring is fundamental and should be performed with adequate analytical methods.

In this study, a commercial ELISA kit for aflatoxin B₁ detection in corn samples, RIDASCREEN® Aflatoxin B₁ 30/15, was assessed by the evaluation of some performance parameters. Plus, specific requirements for the appliance of this kit as a screening method at the concentration of 20 µg/kg were also determined. Lastly, corn samples were analysed with the kit and with an LC-MS/MS method, and the results were compared testing also the applicability of the kit in a real scenario. Plus, the analysis with LC-MS/MS method allowed to evaluate the samples contamination with other prevalent mycotoxins.

Basically, the following results were achieved: limit of detection of 1.1 µg/kg and limit of quantification of 2.5 µg/kg; repeatability of 9.3 %; 18.0 % of intermediate precision; trueness of 101.8 %; relative expanded uncertainty of ± 0.46 µg/kg; cut-off value of 14 µg/kg and a very low rate of false suspect results, for screening. Finally, the results obtained with the ELISA kit about AFB₁ were generally confirmed by LC-MS/MS which ends up increasing the confidence in the kit under study. Furthermore, LC-MS/MS experiments revealed that corn samples were not contaminated with any targeted mycotoxins in quantifiable levels, although co-occurrence was detected ubiquitously, even at trace levels. These findings highlight the need to focus on the development of simultaneously quick and multi-mycotoxins methods.

Overall, RIDASCREEN® Aflatoxin B₁ 30/15 applied to corn revealed to be an effective tool for the quantification of this mycotoxin between 2.5 and 50 µg/kg or just for its screening at 20 µg/kg.

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CP023

VARIABILITY OF CATECHINS AND XANTHINES CONTENTS ON TEA FROM DIFFERENT PARTS OF AZOREAN *CAMELLIA SINENSIS*

Lisete Paiva^{1,2}, Elisabete Lima^{2,3}, José Baptista^{2,3}

¹*Plantações de Chá Gorreana, Gorreana, 9625-304 Maia, S. Miguel, Azores, Portugal*

²*Biotechnology Centre of Azores (CBA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal*

³*Institute of Agricultural and Environmental Research and Technology (IITAA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal. jose.ab.baptista@uac.pt*

Polyphenols, the major antioxidant constituents of tea from *Camellia sinensis*, are considered responsible not only for their flavor characteristics, but also for their wide variety of health benefits [1-3]. The objective of the present study was to investigate the variability of catechins (flavan-3-ols) and xanthines (purine alkaloids) contents in different parts of the Azorean *C. sinensis*, to find the best parts combination in order to make a tea blend with maximum impact on the human health. The high-performance liquid chromatography/diode array detection (HPLC/DAD) was used for the simultaneous determination of major tea catechins, namely: (-)-epicatechin (EC), (-)-epigallocatechin-gallate (EGCG), gallocatechin-gallate (GCG) and (-)-epicatechin-gallate (ECG), and alkaloids, namely caffeine (CAF), in tea from different parts of *C. sinensis* following the methodology of Baptista et al. [4]. The results clearly show differences in the catechins and xanthines contents. Flowers presented the highest level of EGCG with a value of 41.23% of the total green tea polyphenols (tGTP) and the internodes presented the lowest value (6.31% of tGTP). The internodes presented the highest value of CAF (61.5%) followed by the combination of bud, 1st and 2nd leaves (57.61%) and the flowers the lowest value (12.83%) of the tGTP. The 2nd leaf presented the maximum values of EC and GCG with 4.58% and 2.38%, respectively, and the bud presented the lowest values of 1.06% and 0.37% of the tGTP, respectively. The flowers also presented the maximum value of ECG (34.88%) and the internodes the minimum value (13.23%) of the tGTP. In conclusion the combination of the flowers, internodes plus the 1st and 2nd leaves presented the highest concentration in EGCG, ECG, EC, GCG and CAF or alternatively the same combination with reduced internode material will be a good mixture for people very sensitive to caffeine.

[1] Chu, D. C.; Juneja, L. R. General chemical composition of green tea and its infusion. In: Yamamoto, T., Juneja, L. R., Chu, D. C., Kim, M. (Eds.), *Chemistry and Applications of Green Tea*. CRC Press, Boca Raton **1997**, 13–22.

[2] Camfield, D. A. et al. *Nutrition Reviews* **2014**, 72, 507–522.

[3] Jankun, J.; Selman, S. H.; Swiercz, R. *Nature* **1997**, 387, 561.

[4] Baptista, J.; Lima, E.; Paiva, L.; Castro, A. R. *Food Science and Technology* **2014**, 59, 1152–1158.

CP024
EFFECT OF SHOOT MATURITY AND DIFFERENT WITHERING DURATION ON THE CATECHINS AND XANTHINES CONTENTS OF TEA FROM AZOREAN *CAMELLIA SINENSIS*

Lisete Paiva^{1,2}, Elisabete Lima^{2,3}, Madalena Motta¹, José Baptista^{2,3}

¹*Plantações de Chá Gorreana, Gorreana, 9625-304 Maia, S. Miguel, Azores, Portugal*

²*Biotechnology Centre of Azores (CBA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal*

³*Institute of Agricultural and Environmental Research and Technology (IITAA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal. lisete.s.paiva@uac.pt*

Various kinds of tea consumed in the world are produced from the same plant species, *Camellia sinensis* L. Originated from China, tea has gained the world's taste in the past 2000 years due to unique aroma, characteristic flavor and health benefits [1, 2]. The current study explored the effects of shoot maturity and withering duration on the *C. sinensis* tea composition, taking into the consideration to find the best processing conditions in order to produce tea with maximum impact on the human health. The determination of major phenolic antioxidants flavan-3-ols (catechins) and purine alkaloids (xanthines), namely: (-)-epicatechin (EC), (-)-epigallocatechin-gallate (EGCG), gallic catechin-gallate (GCG), (-)-epicatechin-gallate (ECG) and caffeine (CAF), were made using high performance liquid chromatography (HPLC) following the Baptista et al. methodology [3]. The samples composed by bud, 1st, 2nd and 3rd leaves plus internodes and dried at 40 °C, in order to preserve the biochemical composition of tea, presented the following results in percentage of the total green tea polyphenols (GTP). Concerning the effect of shoot maturity, young leaves presented higher average values for EGCG (25.38%) and CAF (43.04%) as compared to 22.42% and 39.29% for old leaves, respectively. Oppositely, young leaves showed lower average values of EC (2.84%) and ECG (18.94%) as compared to 4.07% and 25.76% for old leaves, respectively. Relatively to the withering effect, the usual duration (12 hours), used for *C. sinensis* processing, revealed higher values for EGCG (29.18%) and ECG (34.40%), as compared to long withering duration (48 hours) that presented the lower average values of 12.77% and 17.50%, respectively. However, higher average values were found in CAF for long withering (55.16%) as compared to the usual withering process (22.06%). The EC values were not affected by the withering duration showing similar results of 4.19% and 4.77% for long and usual duration, respectively. In conclusion, the results clearly show differences in the catechins and caffeine contents, accordingly to the effects of shoot maturity and different withering duration and consequently differences in the tea human health benefits.

[1] Yang, C. S.; Hong, J. *Annual Review of Nutrition* **2013**, 33,161–181.

[2] Namita, P.; Mukesh, R.; Vijay, K. J. *Global Journal of Pharmacology* **2012**, 6, 52–59.

[3] Baptista, J.; Lima, E.; Paiva, L.; Castro, A. R. *Food Science and Technology* **2014**, 59, 1152–1158.

CP025

Maximização da extração de antocianinas de *Hibiscus sabdariffa* por diferentes métodos para obtenção de corantes alimentares

José Pinela¹, M.A. Prieto^{1,2}, Eliana Pereira¹, Bernardo Lopes¹, Inès Jabeur¹, Maria Filomena Barreiro^{1,3}, Lillian Barros¹, Isabel C.F.R. Ferreira¹

¹*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal* ²*Nutrition and Bromatology Group, Faculty of Food Science and Technology, University of Vigo, Ourense, Spain* ³*Laboratório de Processos de Separação e Reação - Laboratório de Catálise e Materiais (LSRE-LCM), Instituto Politécnico de Bragança, Bragança, Portugal* *iferreira@ipb.pt

A consciencialização do consumidor atual sobre a existência de alternativas naturais aos aditivos artificiais, hoje em dia massivamente utilizados na indústria alimentar, mas com potenciais efeitos tóxicos e alergénicos, tem promovido a procura por alimentos formulados com ingredientes de base natural [1,2]. A investigação científica nesta área tem ganho destaque [3,4], mas ainda é necessário alargar o leque de opções disponíveis, encontrar novas fontes e desenvolver processos de extração e estabilização eficientes e sustentáveis. Neste sentido, este estudo foi realizado com o objetivo de maximizar a extração de antocianinas a partir de cálices de *H. sabdariffa* para obtenção de corantes na gama do vermelho. Os cálices secos e pulverizados foram sujeitos a extrações assistidas por calor e por ultrassons. As variáveis inerentes a cada processo (i.e. tempo, percentagem de etanol e temperatura ou potência) foram combinadas em desenhos fatoriais de 5 níveis e, posteriormente, analisadas pela metodologia de superfície de resposta. Os teores de delphinidina-3-O-sambubiósido e de cianidina-3-O-sambubiósido, determinados por LC-DAD-ESI/MSⁿ, foram utilizados como variáveis dependentes. Os modelos teóricos desenvolvidos foram ajustados com sucesso aos dados experimentais, validados estatisticamente e usados na determinação das condições que maximizam a extração destes pigmentos. O método de extração assistido por ultrassons foi o mais eficiente, originando teores de antocianinas superiores a 50 mg/g de extrato. Posteriormente, determinaram-se os efeitos dose-resposta da razão sólido/líquido nas condições anteriormente otimizadas para as 3 variáveis, tendo-se verificado uma melhoria na capacidade de extração com o aumento deste fator. Os resultados obtidos sustentam o uso de *H. sabdariffa* como uma fonte sustentável de corantes naturais com aplicações em diferentes setores industriais, sendo uma das fontes mais ricas em antocianinas descritas na literatura.

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- [1] Carochó, M.; Morales, P.; Ferreira, I.C.F.R. *Trends Food Sci. Technol.* **2015**, *45*, 284-295.
- [2] Martins, N.; Roriz, C.L.; Morales, P.; *et al.* *Trends Food Sci. Technol.* **2016**, *52*, 1-15.
- [3] Almeida, H.H.S.; Barros, L.; Barreira, J.C.M.; *et al.* *Food Chem.* **2018**, *261*, 224-232.
- [4] Carochó, M.; Barros, L.; Barreira, J.C.M.; *et al.* *Food Chem.* **2016**, *207*, 51-59.

CP026

DESENVOLVIMENTO DE UM NOVO ADITIVO PARA CARNE DE BOVINO RICO EM EXTRATOS NATURAIS

Ricardo Gomes^{1,2}, João Pires¹, Carolina Rodrigues¹, Victor Gomes Lauriano Souza¹, Ana Luísa Fernando¹

¹MEtRICs, Departamento de Ciências e Tecnologia da Biomassa (DCTB), Faculdade de Ciências e Tecnologia, Universidade NOVA de Lisboa, Caparica, Portugal (Pires: jr.pires@campus.fct.unl.pt; Rodrigues: cpe.rodrigues@campus.fct.unl.pt; Souza: v.souza@campus.fct.unl.pt; Fernando: ala@fct.unl.pt)²LAQV-REQUIMTE, Departamento de Química (DQ), Faculdade de Ciências e Tecnologia, Universidade NOVA de Lisboa, Caparica, Portugal (Gomes: rg.gomes@campus.fct.unl.pt)

Atualmente, um dos desafios da indústria alimentar é a implementação de aditivos de origem natural, substituindo produtos sintéticos como os sulfitos, associados a doenças e alergias. Assim, este trabalho tem como objetivo a elaboração de um novo aditivo alimentar para hambúrgueres de bovino, rico em extratos naturais. Para obter a formulação otimizada, vários ingredientes em diferentes proporções foram testados e, através da metodologia de superfície de resposta (RSM), foi realizada a sequência de experiências desenhadas.

Os cinco ingredientes testados são compostos naturais ricos em bactérias do ácido láctico, betalaínas, carotenóides, hidratos de carbono e vitamina C. As experiências foram divididas em 5 blocos, num total de 45 misturas diferentes. Paralelamente, avaliaram-se os hambúrgueres sem aditivos enquanto controlo e ainda com sulfitos. A carne picada utilizada como matriz alimentar foi fornecida por uma empresa do sector, sendo depois de misturada com cada fórmula de aditivos a testar, armazenada em coletores plásticos estéreis de tampa roscada, sob refrigeração ($3\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$) por 8 dias. Cada conjunto foi caracterizado relativamente às suas propriedades físico-químicas para os dias 1, 2, 5, 6 e 8. Entre as características estudadas estão as substâncias reativas ao ácido tiobarbitúrico (TBARS), pH, acidez, cor, humidade e azoto básico volátil.

Como resultado, obtiveram-se as superfícies de resposta e as respetivas equações. Considerando-se todos os sistemas em simultâneo, estabeleceu-se uma formulação ótima para um armazenamento de 5 dias em refrigeração. A mistura ideal contém de forma decrescente fermentos lácteos > carotenóides > vitamina C > betalaínas > hidratos de carbono. Após as experiências confirmatórias, o novo aditivo demonstrou uma performance antioxidante 32% superior ao agente sintético que contém sulfitos. A estabilidade oxidativa é potencialmente mantida pela ação da vitamina C, que inibe a formação de radicais ao reagir com O_2 e contribui para a manutenção de um pH reduzido.

CP027

DEVELOPMENT OF SPAGHETTIS WITH INCORPORATION OF ALTERNATIVE FLOURS

¹M.J.Barata de Carvalho, ¹A. Mira, ¹A. Banza, ¹F. Fragoso,
¹C. Lampeira, ¹J. Dias, ¹P. Lage, ¹A. Floro, ¹M. Brito Costa

¹DTCA, Escola Superior Agrária, Instituto Politécnico de Beja, Portugal;

Food industry concern is the development of new foods with an impact on human health (functional foods), essentially due to the increase in diseases associated with food consumption, such as obesity, diabetes, celiac disease, cancer and malnutrition [1]. Pasta is a traditional food generally made from durum wheat semolina, and it has a primary role in human nutrition. In the last few years, flours from different products have been used to substitute durum wheat semolina, either totally or partially, to satisfy some nutritional specific need. Spaghetti is the pasta type most consumed, being considered as a good product for the addition of highly nutritious raw materials [2], thus the addition of ingredients with nutraceutical potential is feasible in the production of a paste with acceptable nutritional properties [3]. Alternative ingredients such as cassava, unripe plantain, silver plantain, *Colocasia esculenta*, breadfruit, maize and chickpea flour were used in this study to prepare spaghetti with functional characteristics, namely the potential unripe plantain fruit can be used as a source of antioxidants of interest for the development of gluten-free spaghetti [4]. Hence, the aim of this work was to evaluate the chemical composition, physical properties, texture and sensory of gluten-free spaghettis manufactured with gluten-free flours and different levels of the above-mentioned fruits. Sensory evaluation was carried out by 50 untrained panellists of students and academic staff, using a hedonic test with a five-point rating scale. Each category was rated from 1 (dislike very much) to 5 (like very much), the spaghettis were cooked at the optimal cooking time before served to the panellists at 40-45°C. Commercial brands were used as reference products. In rheological features, the samples presented some significant differences ($p < 0,05$) between the formulations, and in all gluten-free dough formulations, the viscous modulus (G'') showed a similar tendency to G' which was greater than G'' , which suggests a solid elastic-like behaviour of all the gluten-free formulas. In terms of sensory acceptability this study presented data very satisfactory with high scores, mainly in texture acceptability, which was not significantly different from a commercial spaghetti product tested, mostly with maize, cassava and silver plantain flours. It was possible to develop gluten-free spaghetti with quality characteristics using alternative flours rather than wheat flours, and due do this effort it might be useful to think in the countries where this alternative fruits flours are native, to motivate those flours production in order to enrich the population sustainability and nutritional needs.

References:

- [1] - Patiño-Rodríguez, O.; Bello-Pérez, L.A.; Flores-Silva, P.C.; Sánchez-Rivera, M.M.; Romero-Bastida, C.A. (2018). Physicochemical properties and metabolomic profile of gluten-free spaghetti prepared with unripe plantain flours. *LWT*, **90**, April 2018, Pag: 297-302. <https://doi.org/10.1016/j.lwt.2017.12.025>.
- [2] - Chillo, S. Laverse, J. Falcone, P.M. Del Nobile M.A. (2008). Quality of spaghetti in base amaranthus wholemeal flour added with quinoa, broad bean and chick pea. *Journal of Food Engineering*, 84 pp. 101-107.
- [3] - Giménez, M.A.; González, R.J.; Wagner, J.; Torres, R.; Lobo M.O.; Samman, N.C. (2013). Effect of extrusion conditions on physicochemical and sensorial properties of corn-broad beans (*Vicia faba*) spaghetti type pasta. *Food Chemistry*, 136, pp. 538-545.
- [4] - Hoyos-Leyva, J.D.; Bello-Pérez, L.A.; Agama-Acevedo, E.; Alvarez-Ramirez, J. (2015). Optimising the heat moisture treatment of Morado banana starch by response surface analysis. *Starch/Stärke*, 67, pp. 1026-1034.

CP028

Arrabidaea chica Verlot: extrato rico em antioxidantes e potencial corante natural para alimentos

Ilza Maria de Oliveira Sousa¹, Diana Pinto², Julia Teixeira Paula³, Fernando Antônio Cabral³, Nubia de Cássia Almeida Queiroz⁴, Maria Beatriz P.P. Oliveira², Mary Ann Foglio⁴.

¹ Programa de Pós-Graduação em Ciências Médicas - Faculdade de Ciências Médicas - FCM / Universidade de Campinas - UNICAMP, Campinas, SP, Brasil.

² LAQV / REQUIMTE, Faculdade de Farmácia, Universidade do Porto, Rua Jorge Viterbo Ferreira, 280, 4050-313 Porto, Portugal.

³ Department de Engenharia de Alimentos, Universidade Estadual de Campinas - UNICAMP, 13083-862 Campinas, SP, Brasil

⁴ Faculdade de Ciências Farmacêuticas, UNICAMP 13083-859 Campinas, SP, Brasil.
ilzamo.sousa@gmail.com

Palavra-chave: Corantes naturais, antocianinas e atividade antioxidante.

A espécie *A. Chica* Verlot, da família Bignoniaceae, contém na sua composição vários pigmentos (bixina, genipina e cajarina/antocianina) que lhe conferem cor vermelho-escuro. Estão descritas várias aplicações, nomeadamente para tingir fibras artesanais [1]; as folhas de *A. chica* são utilizadas popularmente na forma de chás para o tratamento de cólicas intestinais, diarreia, anemia e inflamações uterinas, além do tratamento de micoses e desinfeção de ferimentos na pele [1,2]. Neste trabalho foi avaliado o teor total de compostos fenólicos e flavonoides do extrato *A. chica* produzido por *spray drying*, por métodos espectrofotométricos, bem como a atividade antioxidante (através de ensaios de DPPH e FRAP), de acordo com Costa *et. al.*, 2018 [3]. O teor de carajurina foi determinado por HPLC-DAD [4]. Os resultados obtidos estão resumidos na tabela 1. O extrato estudado parece promissor como corante natural. Além de dar cor aos alimentos, possui compostos bioativos que conferem propriedades benéficas aos produtos onde é adicionado.

Tabela 1: Teor de fenólicos e flavonoides totais, atividade antioxidante e teor de luteolina e carajurina do Extrato bruto de *A. chica* (média e desvio padrão expresso em matéria seca)

Ensaio	Extrato bruto seco por <i>Spray drying</i>
Fenólicos totais (mg GAE/g)	137,87±14,71
Flavonoides totais (mg CAE/g)	55,70 ± 5,61
IC ₅₀ DPPH (µg/mL)	466,99 ± 46,11
FRAP (µmol of Fe ₂ /g)	1,45 ± 0,06
Teor de carajurina (mg/g)	2,24 ± 0,07
Teor de luteolina (mg/g)	0,17 ± 0,02

Referência:

- [1] Corrêa MP 1984. Dicionário das plantas úteis do Brasil e das exóticas cultivadas. Rio de Janeiro: Ministério da Agricultura.
- [2] Jorge, M.P. *et al.*, 2008. Evaluation of wound healing properties of *Arrabidaea chica* Verlot extract. Journal of Ethnopharmacology, 118(3), pp.361–366.
- [3] Costa, A.S.G. 2018. Nutritional, chemical and antioxidant/pro-oxidant profiles of silverskin, a coffee roasting by-product. Food Chemistry 267, 28–35.
- [4] Paula, J.T. *et al.*, 2014. Extraction of anthocyanins and luteolin from *Arrabidaea chica* by sequential extraction in fixed bed using supercritical CO₂, ethanol and water as solvents. J. of Supercritical Fluids 86 pp. 100–107.

CP029
**CHEMICAL FEATURES OF GREEN FIG PULP AND PEEL:
PHENOLIC, ORGANIC ACIDS, AND TOCOPHEROLS PROFILE**

Luís Palmeira, Carla Pereira, Maria Inês Dias, Lillian Barros, Isabel C.F.R. Ferreira

Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal.

**lillian@ipb.pt*

Ficus carica L. is one of the first domesticated trees of the Neolithic Revolution; it is native to western Asia and was later spread to the Mediterranean region. Its fruits, figs, are widely consumed in fresh or dried form, or used for spirit beverage and jam due to their sweet taste and well-known nutritional properties [1, 2]. Nevertheless, the fruit peel is often discarded in the preparation of food products that only require the pulp, and this part of the fruit is reported as a good source of phenolic compounds with several beneficial properties for human health [3], thus the importance of studying the different parts separately is justified. Therefore, the aim of this study was to explore and compare the chemical composition of green fig pulp and peel. For that purpose, the phenolic composition was assessed by HPLC-DAD-ESI/MS, organic acids by HPLC-PDA, and tocopherols by HPLC-fluorescence.

Regarding phenolic compounds, the highest concentration was found in the peel, which revealed the presence of flavonoids and phenolic acids in similar concentrations, with quercetin-3-*O*-rutinoside, 5-*O*-caffeoylquinic acid, and vanilic acid malonyl-di-deoxyhexoside as the major compounds detected. On the other hand, the pulp presented a prevalence of phenolic acids, among which caffeic acid hexoside was the most abundant one.

In terms of organic acids, despite the higher amounts of oxalic and succinic acids found in the pulp, the peel showed higher concentrations of quinic, malic, citric, and total organic acids. The tocopherols profile was similar for both samples, with the four isoforms being detected; α -, β -, and total tocopherols were mostly found in the peels, whereas γ - and δ -tocopherol were prevalent in the pulp.

The results presented highlight the importance of this fruit in human diet, given its richness in nutritional and bioactive compounds that contribute for a balanced and functional diet. Additionally, the chemical composition of fig peel justifies the recovery of this part of the fruit for further application in food industry, in the cases where it is discarded for the preparation of fig-based products.

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[1] Kislev, M.E., Hartmann, A., Bar-Yosef, O. *Science* **2006**, 312, 1372–1374.

[2] Sedaghat, S., Rahemi, M. *Scientia Horticulturae* **2018**, 237, 44–50.

[3] Backes, E., Pereira, C., Barros, L., Prieto, M.A., Genena, A.K., Barreiro, M.F., Ferreira, I.C.F.R. *Food Research International* **2018**, 113, 197–209.

CP030
Impact of sterilization on phytosterols in canned tuna-based products.

Manuela Machado¹, Lígia L. Pimentel¹, Luís M. Rodríguez-Alcalá¹, Ana Pisco², Margarida Lopes², Ana M Gomes¹; Manuela Pintado¹

¹CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Arquiteto Lobão Vital, 4200-374 Porto, Portugal

²Ramirez & C^a (Filhos) SA, Rua do Passadouro, 135, 4455-180 Matosinhos, Portugal

mmachado@porto.ucp.pt

Phytosterols (PS) are characterized by a tetracyclic ring and a side chain linked to carbon 17. They can be classified according to the presence or absence of a double bond at $\Delta 5$ position (sterols or stanols respectively)(1,2). These compounds occur naturally in all foods of plant origin, such as vegetable oils, nuts, seeds, grain products, fruits and vegetables. Normal daily intake from natural sources is 200–400 mg/day (3). PS enriched foods are considered a valuable option as part of a healthy diet (1). The beneficial effects of these compounds have been demonstrated by several studies and consequently the European Food Safety Authority (EFSA) and the Food and Drug Administration (FDA) approved their use in functional foods. EFSA recommends a continuous daily intake of 3 g of PS during two to three weeks to obtain their claimed effects. In this context, the main objectives of this study were the characterization of the sterols profile of a commercial functional PS-rich ingredient as well as the evaluation of its stability after sterilization (119°C; 45min) of a canned tuna-based product enriched in this ingredient. Accordingly, the sterol profile was assayed by GC-FID (4). The results showed that the sterilization process did not affect the sterol profile, with β -sitosterol being the predominant sterol in all the tested samples. PS content in the novel tuna-based product complies with EFSA recommendations regarding cardiovascular health.

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1. Gylling H, Plat J, Turley S, Ginsberg HN, Ellegård L, Jessup W, et al.. Atherosclerosis. **2014**;232(2):346–60.
2. Marangoni F, Poli A. Pharmacol Res;. **2010**;61(3):193–9. Available from: <http://dx.doi.org/10.1016/j.phrs.2010.01.001>
3. Jiménez-Escrig A, Santos-Hidalgo AB, Saura-Calixto F. J Agric Food Chem. **2006**;54(9):3462–71.
4. Karavanou N, Andrikopoulos AENK. **2008**;391–400.

CP031

ADANSONIA DIGITATA FRUIT: BIOACTIVE COMPOUNDS AND ANTIOXIDANT ACTIVITY AGAINST REACTIVE SPECIES

Diana Pinto¹, Ana F. Vinha^{1,2}, Marisa Freitas¹, M. Beatriz P.P. Oliveira¹

¹LAQV, REQUIMTE, Faculty of Pharmacy, University of Porto, Rua Jorge Viterbo Ferreira n.º228, 4050-313 Porto, Portugal.

²FP-ENAS (UFP Energy, Environment and Health Research Unit), CEBIMED (Biomedical Research Center), University Fernando Pessoa, Praça 9 de Abril, 349, Porto, Portugal. anafvinha@gmail.com.

Baobab (*Adansonia digitata*) is an African native fruit, of which both chemical composition and antioxidant activity against physiologically relevant reactive oxygen species (ROS) and reactive nitrogen species (RNS) were not yet investigated. It is generally accepted that the antioxidant activity of natural resources could be related with the prevention of several diseases [1,2]. Baobab leaves, fruit pulp, root, stem, seeds and bark have shown medicinal properties, including diuretic, anti-inflammatory, antioxidant, hepato-protective, analgesic, anti-diarrhea, anti-dysentery, anti-rheumatoid and antiviral activities [3,4] mainly related to their phenolic composition. In this study, aqueous, ethanolic and hydroalcoholic (1:1) extracts of baobab were submitted to the analysis of total phenolic and flavonoid compounds (TPC and TFC, respectively) [5,6]. The antioxidant activity was also determined by *in vitro* assays, namely FRAP, DPPH (1,1-diphenyl-2-picrylhydrazyl) and the scavenging effect against ROS and RNS. The baobab pulp extracts presented a TPC ranging between 138 and 1573 mg GAE/100 g dw, for the alcoholic and aqueous extract, respectively. The hydroalcoholic extract presented the highest TFC content and antioxidant capacity. Moreover, the maximum scavenging activity against ROS and RNS were also obtained with the hydroalcoholic extract. In general, the high content of phenolic compounds of these extracts might explain its high scavenging capacity against all the ROS/RNS evaluated [superoxide anion radical ($O_2^{\cdot-}$), hydrogen peroxide (H_2O_2), hypochlorous acid (HOCl), nitric oxide ($\cdot NO$) and peroxy radical (ROO^{\cdot})]. Therefore, baobab fruit seems to be a promising source of bioactive compounds that should be explored due to its phytopharmaceutical potential.

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- [1] Barizão, E.O.; Visentainer, J.V.; Almeida, V.C.; Ribeiro, D.; Chisté, R.C.; Fernandes, E. *Food Research International* **2016**, *86*, 24-33.
- [2] Almeida, D.; Pinto, D.; Santos, J.; Vinha, A.F.; Palmeira, J.; Ferreira, H.N.; Rodrigues, F.; Oliveira, M.B.P.P. *Food Chemistry* **2018**, *259*, 113-121.
- [3] Owoyele, B.V.; Bakare, A.O. *Biomedicine & Pharmacotherapy* **2018** *97*, 209-212.
- [4] Adeoye, A.O.; Bewaji, C.O. *Journal of Ethnopharmacology* **2018**, *210*, 31-38.
- [5] Costa, A.S.G.; Alves, R.C.; Vinha, A.F.; Barreira, S.V.P.; Nunes, M.A.; Cunha, L.M.; Oliveira, M.B.P.P. *Industrial Crops and Products* **2014**, *53*, 350-357.
- [6] Costa, A.S.G.; Alves, R.C.; Vinha, A.F.; Costa, E.; Nunes, M.A.; Almeida, A.A.; Santos-Silva, A.; Oliveira, M.B.P.P. *Food Chemistry* **2018**, *267*, 28-35.

CP032

SEASONAL VARIATION IN THE BIOCHEMICAL COMPOSITION OF AZOREAN *FUCUS SPIRALIS*

Lisete Paiva¹, Elisabete Lima^{1,2}, Ana Isabel Neto³, José Baptista^{1,2}

¹*Biotechnology Centre of Azores (CBA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal*

²*Institute of Agricultural and Environmental Research and Technology (IITAA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal*

³*Azorean Biodiversity Group (ABG), Centre for Ecology, Evolution and Environmental Changes (cE3c), Department of Biology, University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal. lisete.s.paiva@uac.pt*

Macroalgae are abundant and structuring organisms on the coastal areas of the Azores islands (Portugal) [1] that are a very promising location for marine natural resources that may produce new compounds with health promoting effects [2]. The aim of the present study was to determine the seasonal (summer and winter) variability of the biochemical composition (protein, soluble carbohydrates, lipids, fatty acids groups, energy value, and total, soluble and insoluble dietary fiber) of the *Fucus spiralis* from São Miguel Island. The protein content shows the values of 8.25 and 9.71%, the carbohydrates the values of 13.45 and 17.59% and the total of lipids the values of 5.33 and 5.23% of dry weight (DW) for summer and winter, respectively. The saturated fatty acids (SFA) was 31.01 and 32.51% of total fatty acid methyl esters (tFAME), the monounsaturated fatty acids (MUFA) was 40.82 and 26.89% and the polyunsaturated fatty acids (PUFA) was 28.17 and 40.59% of tFAME for summer and winter, respectively. The ratios of $n6/n3$ were 2.94 and 1.99 and the ratios of hypocholesterolemic (h)/hypercholesterolemic (H) fatty acids were 2.37 and 2.14 for summer and winter, respectively. For total dietary fiber the values were similar for both seasons (40.47% and 40.44% of DW for summer and winter respectively), and a better result of soluble dietary fiber/insoluble dietary fiber ratio was found in winter (0.86) as compared to summer (0.78). The energy value presented higher values in winter (7.24 kJ/g DW) as compared to summer season (6.22 kJ/g DW). Overall, results revealed that protein, carbohydrates and energy value presented higher values in winter as compared to summer season. Lipids and total dietary fiber were similar in both seasons and soluble dietary fiber/insoluble dietary fiber ratio was higher in winter. The fatty acids (FA) profiles showed a slightly lower SFA in summer, whereas MUFA and PUFA presented higher values in summer and winter, respectively. Excellent $n6/n3$ and h/H FA ratios were obtained, with lower values in winter and slightly higher in summer, respectively. Generally, results revealed that *F. spiralis* nutritional value has seasonal variations and that its regular consumption will improve human health conditions. In addition, this alga has potential for use in the development of new foods for human consumption.

[1] Neto, A. I.; Brotas, V.; Azevedo, J. M. N.; Patarra, R. F.; Álvaro, N. M. V.; Gameiro, C.; Prestes, A. C. L.; Nogueira, E. M. Qualidade de Águas Costeiras do Grupo Oriental do Arquipélago dos Açores e Proposta de Monitorização, Universidade dos Açores, **2009**

[2] Paiva, L.; Lima, E.; Neto, A. I.; Baptista, J. *Marine Drugs* **2018**, *16*, 248.

CP033
**FUNCTIONAL BIOACTIVITY VALUE OF *FUCUS SPIRALIS* FROM
 TWO DIFFERENT AZOREAN ISLANDS**

Lisete Paiva¹, Elisabete Lima^{1,2}, Ana Isabel Neto³, José Baptista^{1,2}

¹*Biotechnology Centre of Azores (CBA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal*

²*Institute of Agricultural and Environmental Research and Technology (IITAA), University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal*

³*Azorean Biodiversity Group (ABG), Centre for Ecology, Evolution and Environmental Changes (cE3c), Department of Biology, University of Azores, 9501-801 Ponta Delgada, S. Miguel, Azores, Portugal. lisete.s.paiva@uac.pt*

The marine ecosystems, particularly the macroalgae organisms (commonly referred to as “seaweeds”), are an excellent natural resource of health-promoting metabolites due to their living mode in highly competitive and aggressive environments, a situation that demands the production of quite specific and potent bioactive molecules [1]. On the other hand, the Azores Islands (Portugal), being isolated in the middle of Atlantic Ocean (37°40' N and 25°31' W) and surrounded by seawater with low pollution levels [2], are a very promising location to look for new marine metabolites with health promoting effects in treating/preventing chronic diseases and/or for use in food industries. The objective of this study was to evaluate the geographical (São Miguel–SMG and Santa Maria–SMA Islands) variability of the brown seaweed *Fucus spiralis* (*Fs*) collected during winter and summer in terms of total phenolic and total flavonoid contents of the methanol and acetone:water (7:3) extracts, and to compare the *F. spiralis* antioxidant properties of the extracts using different and significant assays, such as: free radical-scavenging activity (FRSA), ferrous ion-chelating (FIC) activity and ferric-reducing antioxidant power (FRAP), in order to accurately reflect the *in vivo* complexity of interactions between antioxidants of the algal extracts. The total phenolics was higher in acetone:water than methanol extracts with best values in *Fs*-SMA (245.67 and 243.33 mg of phloroglucinol equivalents/g of dry extract for summer and winter, respectively). Oppositely, the total flavonoids was higher in methanol extracts with the best values in *Fs*-SMG (68.17 and 62.0 mg of rutin equivalents/g of dry extract for winter and summer, respectively). The highest FRSA was observed in the *Fs*-SMA methanol (EC₅₀=0.045 mg/mL) and acetone:water (EC₅₀=0.059 mg/mL) extracts from winter, showing even better values than the BHT (EC₅₀=0.062 mg/mL) used as reference. The FRAP showed the best results in *Fs*-SMA methanol extract (EC₅₀=0.016 mg/mL) from winter and *Fs*-SMA acetone:water extract (EC₅₀=0.017 mg/mL) from summer. The best FIC activity was found in *Fs*-SMG acetone:water extract (71.50%) from winter. Overall, results revealed that *F. spiralis* functional bioactivity value has geographical variations and that its regular consumption may add benefits to human health.

[1] Lordan, S.; Ross, R. P.; Stanton, C. *Marine Drugs* **2011**, 9, 1056–1100. [2] Neto, A. I.; Brotas, V.; Azevedo, J. M. N.; Patarra, R. F.; Álvaro, N. M. V.; Gameiro, C.; Prestes, A. C. L.; Nogueira, E. M. *Qualidade de Águas Costeiras do Grupo Oriental do Arquipélago dos Açores e Proposta de Monitorização*, Universidade dos Açores, **2009**.

CP034

ESTABILIDADE DA COR EM SUMOS DE ANANÁS: ESTUDO DA ADIÇÃO DE BIOFILMES COM INCORPORAÇÃO DE ANTIOXIDANTE

Carolina Rodrigues¹, Victor Gomes Lauriano Souza¹, Ana Luísa Fernando¹

¹MEtRICs, Departamento de Ciências e Tecnologia da Biomassa (DCTB), Faculdade de Ciências e Tecnologia, Universidade NOVA de Lisboa, Caparica, Portugal
(Rodrigues: cpe.rodriques@campus.fct.unl.pt; Souza: v.souza@campus.fct.unl.pt; Fernando: ala@fct.unl.pt)

A tendência pela procura de produtos de elevado valor nutricional e com o menor grau de processamento possível, fornecendo compostos bioativos, com propriedades organolépticas próximas do natural, torna-se um desafio constante para a indústria alimentar. Juntamente com esta procura, a indústria de sumos e refrigerantes enfrenta tantos outros desafios no sentido de melhoramento dos seus produtos, garantindo a estabilidade do produto final, do ponto de vista nutricional, sensorial e microbiológico permitindo prolongar o tempo de vida útil do produto. A qualidade de sumos, néctares e refrigerantes à base de fruta é altamente influenciada por diversos fatores como o tipo de processamento, adição de aditivos e o modo de armazenamento. O recurso a aditivos, nomeadamente antioxidantes, constitui uma alternativa para a tentativa de manutenção da estabilidade dos sumos. O sumo de ananás não é exceção e processos de degradação associados ao processamento e armazenamento podem contribuir para a sua deterioração, sendo necessária a procura por alternativas de melhoramento do produto.

Neste sentido, este trabalho visa fornecer um contributo para o estudo da estabilidade da cor em sumos de ananás, através da avaliação da possibilidade de adição de biofilmes de quitosano incorporados com ácido ascórbico. Neste estudo, sumos de ananás foram elaborados a partir de concentrado e sujeitos a tratamento térmico de 75°C/5 minutos. A estes sumos foram adicionados biofilmes de quitosano, com duas concentrações distintas de ácido ascórbico (1,5% e 3%). O estudo decorreu ao longo de 28 dias, em condições de armazenamento que mimetizam uma degradação mais acelerada (37°C). De forma a avaliar a evolução dos sumos nas condições acima referidas, efetuaram-se diversas análises (pH, acidez titulável, teor de ácido ascórbico, cor, teor de sólidos solúveis totais, teor de compostos fenólicos totais, atividade antioxidante).

Os sumos aos quais foi adicionado filme de quitosano com 3% de ácido ascórbico, demonstraram um escurecimento mais acentuado que os restantes sumos em estudo, independentemente de ter sido aplicado tratamento térmico ou não. A adição de ácido ascórbico verifica-se mais determinante para a variação das características do sumo ao longo do tempo de armazenamento do que o tratamento térmico. O elevado escurecimento verificado é correlacionável com o decréscimo da atividade antioxidante bem como dos teores em ácido ascórbico e compostos fenólicos.

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CP035

INCORPORATION OF *SPIRULINA* AND *HIMANTHALIA ELONGATA* ALGAE IN INTEGRAL PASTA: A REAL PROTEIN MEAL

Bárbara C.C. Oliveira^{1,2}, Sílvia M.F. Bessada¹, S. Machado¹, Rita C. Alves¹,
M. Beatriz P.P. Oliveira¹

¹REQUIMTE/Chemical Sciences Department, Faculty of Pharmacy, University of Porto,
Rua Jorge Viterbo Ferreira, 228, 4050-313, Porto, Portugal.

² Faculty of Sciences, University of Porto, Rua do Campo Alegre, s/n, 4169-007 Porto,
Portugal

Pasta products are worldwide consumed and well-accepted by all age groups (including children) due to their sensory and nutritive values, low cost and easy preparation. Pasta is traditionally manufactured with flour of bleached, semi-whole or whole durum wheat, being a good source of energy due to its carbohydrate content. In recent years, different healthy ingredients as algae and others have been used in pasta production to enhance its nutritional and/or functional properties. Producers and food industry have been fortified pasta products to answer to the growing interest in functional foods that can provide health benefits (high-protein sources and antioxidants, anti-inflammatory, anti-hypertensive effects, etc.) [1]. *Spirulina* is a filamentous blue-green microalga, well known as a good source of protein (50-70g/100g) [2]. *Himantalia elongata* (sea spaghetti) have high fiber content and antioxidant potential [2]. Recently, many studies report the incorporation of *Spirulina* and different seaweed on pasta to enhance their nutritional content and also improve benefits on human health [2]. Attending to FAO/WHO recommendations, for healthy adults the protein requirements is around 0.66g/kg/day, so new sources of dietary protein as algae are needed not only as a way to feed the world's population but also to reduce the negative environment impact of animal protein production. *Spirulina* is an easier, cheaper and environmentally friendly source of high quality protein also suitable for vegetarians and vegan diets.

In the present study, the nutritional composition of an integral pasta with algae (whole durum wheat and sea spaghetti 2% and *Spirulina* 1.5%) was evaluated and the results (n=3) compared with the same pasta without added algae. Both samples were analysed before and after cooking, in order to understand the changes in the nutritional value resulting from the food processing. The same experiments were performed in dried *Spirulina* and *Himantalia elongata* samples. The results showed an increase in the protein content (~15%) with the addition of algae, remaining unchanged with cooking process.

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[1] Ailton Cesar Lemes, Brazilian Archives of Biology and Technology, 2012, 55, 741-750.

[2] Gülsün Özyurt, Journal of Food Quality, 2015, 38, 268-272.

CP036

DETECTION OF Y-GLUTAMYL-S-ETHENYL CYSTEINE IN *VICIA NARBONENSIS* L: IMPROVEMENT OF THE EXTRACTION PROCESS

S. Machado¹, Michele F. da Cunha¹, Sílvia M.F. Bessada¹, Rita C. Alves¹, Eugénia Nunes², M. Beatriz P.P. Oliveira¹

¹REQUIMTE/Chemical Sciences Department, Faculty of Pharmacy, University of Porto, Rua Jorge Viterbo Ferreira, 228, 4050-313, Porto, Portugal.

²CIBIO/Faculty of Sciences, University of Porto, Rua do Campo Alegre, s/n, 4169-007 Porto, Portugal

The worldwide growing population, climate changes and hunger related issues have been focus of attention on food alternative supply systems. Taking into account the real situation, more resilient supply systems are advisable for food security.

Leguminous crops have been part of human diet due to their nutritional value, large storage time/lifetime and their role in sustainable agricultural systems. *Vicia narbonensis* L., commonly known as *narbon* vetch, is a low input crop, capable of high yield production under harsh environmental conditions, namely drought. The high protein content of seeds makes it an interesting alternative for food and feed. However, the presence of an antinutritional factor - the dipeptide Y-glutamyl-S-ethenyl cysteine (GEC) - already reported in the seeds, can limit the nutritional use of this crop [1,2]. Several methodologies have been reported for detection and quantification of GEC in *V. narbonensis* seeds, such as: spectrophotometry [1], high performance liquid chromatography with diode array detection (HPLC-DAD) [3], capillary electrophoresis with ultraviolet detection (CE-UV) [4], and capillary electrophoresis coupled to mass spectrometry (CE-MS) [4].

The aim of this work was to optimize the extraction and detection of GEC by reversed-phase HPLC, monitoring the dipeptide elution at 215 nm, for the selection of accessions with low/zero levels of GEC. Since a commercial GEC standard is not available, *V. narbonensis* L. seeds with high levels of GEC were used as positive control. Several extraction conditions were tested for GEC recovery using ethanol/water (70:30 v/v) as extraction solvent, according to Arias et al. [4]. A GEC recovery of 90% was obtained with 0.25 g of sample and 1h of extraction. An improvement of the time used for the extraction was attained with environmental and economic advantage.

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[1] Sánchez-Vioque, R. S. et al., *Anal. Biochem*, **2011**, 418, 180-183.

[2] Enneking, Dirk, *The toxicity of Vicia species and their utilisation as grain legumes*, Department of Plant Science ,University of Adelaide, **1994**, 121-124.

[3] R. Sánchez-Vioque, et al. ,*Anim. FeedSci. Technol.*, **2011**, 165, 125-130.

[4] M. Arias, et al. *Electrophoresis*, **2005**, 26, 2351-2359.

CP037
**QUANTIFICATION OF L-THEANINE IN AZOREAN GREEN AND
BLACK TEA: PSYCHOACTIVE AMINO ACID WITH BENEFICIAL
IMPACT ON COGNITIVE FUNCTIONS**

Miguel Rato^{1,2}, Lisete Paiva³, José Baptista¹

¹*Faculdade de Ciências e Tecnologia, Universidade dos Açores, 9501-801 Ponta Delgada,
S. Miguel, Açores, Portugal*

²*Faculdade de Medicina, Universidade de Coimbra, 3004-504 Coimbra, Portugal*

³*Pantações de Chá Gorreana, Gorreana, 9625-304 Maia, S. Miguel, Açores, Portugal.
jose.ab.baptista@uac.pt*

Many studies have been published showing the numerous health benefits of tea (e.g., anticancer, antioxidant, hypotensive effects, among others). Tea is the most consumed beverage after water for its pleasant taste, cultural significance, low retail price and relaxation effect. Most of these qualities can be attributed to a unique, neurologically-active amino acid called L-theanine (L-The). L-The, a free amino acid found almost exclusively in *Camellia sinensis*, cross the hematoencephalic barrier, without metabolic alterations, reaching the brain in less than 30 min after ingestion. The calming effect of green tea may seem contradictory to the stimulant property of tea' xanthines (caffeine, etc.) content that can be explained by the L-The action. It acts antagonistically against the xanthines on the nervous system via two different mechanisms. First, L-The directly stimulates the production of alpha brain' waves, creating a state of deep relaxation and mental alertness. Second, L-The is involved in the formation of the inhibitory neurotransmitter, γ -aminobutyric acid that influences the release of the two other neurotransmitters, serotonin and dopamine, producing the key relaxation effect [1-4]. The objective of this study was to compare the L-The levels in commercial green and black tea from S. Miguel, Azores, "unique" local in Europe where tea is produced. L-The content was determined by reverse-phase high-performance liquid chromatography using a diode array detector (at 338 nm) after o-phthalaldehyde derivatization as previously described [5]. The results showed the L-The average level of 2.96 g/100 g dry weight (DW) for green tea and 1.76 g/100 g DW for black tea. These results revealed that different types of Azorean tea (green and black) present different amounts of L-The. In fact, the concentration of L-The is influenced by the different processing conditions (fermentation, drying temperature and drying time), shoot maturity and samples origin, being the Azorean green tea average contents higher than green tea samples from China, Japan, Korea and Taiwan [5]. In conclusion, since L-The presented effects in reducing the stress, anxiety and the brain vascular disorders, the production of a new type of Azorean L-The-rich tea will be a natural alternative to synthetic pharmacologic drugs and possibly with less secondary effects.

[1] Camfield, D. A. et al. *Nutrition Reviews* **2014**, *72*, 507–522.

[2] Higashiyama, A. et al. *Journal of Functional Foods* **2011**, *3*, 171–178.

[3] Kimura, K. et al. *Biological Psychology* **2007**, *74*, 39–45.

[4] Rao, T. P. et al. *Journal of the American College of Nutrition* **2015**, *34*, 436–447.

[5] Baptista, J.; Lima, E.; Paiva, L.; Andrade, A. L.; Alves, M. G. *Food Chemistry* **2012**, *132*, 2181–2187.

CP040

GOMPHRENA GLOBOSA L.: OTIMIZAÇÃO DO PROCESSO DE EXTRAÇÃO DE CORANTES, AVALIAÇÃO DA SUA ATIVIDADE ANTIMICROBIANA E INCORPORAÇÃO NUMA MATRIZ ALIMENTAR

Custódio Lobo Roriz^{1,2}, Lillian Barros¹, M.A. Prieto^{1,3}, Patricia Morales², Filipa S. Reis¹, Maria Filomena Barreiro^{1,4}, Isabel C.F.R. Ferreira^{1,*}

¹Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal; ²Dpto. Nutrición y Bromatología II. Facultad de Farmacia. Universidad Complutense de Madrid (UCM), Madrid, Spain; ³Nutrition and Bromatology Group, Faculty of Food Science and Technology, University of Vigo, Ourense, Spain; ⁴Laboratory of Separation and Reaction Engineering—Laboratory of Catalysis and Materials (LSRE-LCM), Universidade do Porto, Porto. *ferreira@ipb.pt

Devido à grande preocupação por parte dos consumidores em relação aos aditivos artificiais presentes nos alimentos, a procura de alternativas de origem natural tem vindo a ganhar uma grande importância. Este trabalho, focou-se na otimização de três técnicas de extração, extração assistida por calor (EAC), por micro-ondas (EAM) e por ultrassons (EAU) de flores de *Gomphrena globosa* L., aplicando uma metodologia de superfície de resposta (MSR), tendo-se estudado os efeitos das variáveis, tempo de processamento (t), temperatura (T) ou potência (P), concentração de etanol ($\%Et$) e razão sólido/líquido (S/L). Como respostas foram utilizados o rendimento de extração e a concentração total de betacianinas determinadas por LC-DAD-ESI/MS. A técnica de extração que apresentou melhores resultados foi a EAU: $t = 22$ min, $P = 500$ W; $\%Et = 0\%$, e $S/L = 5$ g/L, conduzindo a um valor de betacianinas totais de $46,9 \pm 4,8$ mg/g [1,2]. Após ter sido determinada a melhor técnica de extração foi aplicada novamente a MSR no sentido de obter um extrato rico em betacianinas com elevada atividade antimicrobiana. As respostas foram avaliadas em termos das concentrações de extrato necessárias para obter os melhores valores de MIC (concentração mínima inibitória do crescimento) e MBC (concentração mínima bactericida). Os resultados indicaram as seguintes condições ótimas: $t = 10,8$ min, $P = 410,5$ W; $\%Et = 57,8\%$, e razão $S/L = 5$ g/L, fornecendo as seguintes respostas de MIC $\sim 0,15$ a $0,35$ g/L e MBC $\sim 0,30$ a $0,65$ g/L [3]. Este extrato rico em betacianinas e com elevada atividade antimicrobiana, foi incorporado num gelado, tendo-se verificado ao longo do tempo de prateleira (60 dias) a coloração desejada e sem alteração do seu perfil nutricional. Desta forma, foi possível com o extrato aquoso de flores de *G. globosa* atribuir a cor pretendida ao gelado e, simultaneamente, conferi-lhe capacidade antimicrobiana.

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[1] Roriz, C.L.; Barros, L.; Prieto, M.A.; Barreiro, M.F.; Morales, P.; and Ferreira, I.C.F.R. *Ind. Crop. Prod.*, **2017**, 105, 29–40,

[2] Roriz, C.L.; Barros, L.; Prieto, M.A.; Morales, P.; Ferreira, I.C.F.R. *Food Chem.*, **2017**, 229, 223–234.

[3] Roriz, C.L.; Barreira, J.C.M.; Morales, P.; Barros, L.; Ferreira, I.C.F.R. *LWT*, **2018**, 92, 101–107.

CP041

PROPRIEDADES NUTRICIONAIS E BIOATIVAS DA PLANTA SILVESTRE *RAPHANUS RAPHANISTRUM* L.

Júlia Harumi Iyda^{1,2}, Ângela Fernandes¹, Flávio Dias Ferreira², Maria José Alves¹,
Tânia C.S.P. Pires¹, Lillian Barros¹, Joana S. Amaral^{1,3}, Isabel C.F.R. Ferreira¹

¹*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal*

²*Departamento Acadêmico de Alimentos (DAALM), Universidade Tecnológica Federal do Paraná, Campus Medianeira, 85884-000, Paraná, Brasil*

³*REQUIMTE-LAQV, Faculdade de Farmácia, Universidade do Porto, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal*
Email of author for contact: jamaral@ipb.pt

Desde a antiguidade, diferentes plantas silvestres comestíveis têm sido usadas na alimentação humana, desempenhando um papel particularmente relevante em tempos de escassez de alimentos. Recentemente, tem-se assistido a um aumento do interesse por este tipo de alimentos, devido não só à crescente promoção por parte de *chefs* conceituados, mas também aos benefícios para a saúde associados ao seu consumo. Contudo, a informação disponível para algumas espécies silvestres continua a ser escassa. Desta forma, este trabalho visou o estudo das folhas de *Raphanus raphanistrum* L., conhecida vulgarmente como “labrestos” ou “saramagos”, com o objetivo de caracterizar a sua composição química e avaliar o seu potencial bioativo. A caracterização química incluiu a determinação de macronutrientes, composição em ácidos orgânicos, açúcares livres, ácidos gordos, tocoferóis e compostos fenólicos. Procedeu-se ainda à avaliação da atividade antioxidante por diferentes métodos (captação do radical DPPH, poder redutor, inibição da descoloração do β -caroteno e inibição da formação de espécies reativas do ácido tiobarbitúrico), da atividade antimicrobiana e da hepatotoxicidade.

Os resultados obtidos mostraram que *R. raphanistrum* é uma fonte de compostos benéficos incluindo α -tocoferol, ácidos gordos polinsaturados (principalmente ácido α -linolénico) e diferentes compostos fenólicos. No total, foram identificados 14 compostos, muitos dos quais descritos pela primeira vez nesta planta, incluindo 12 flavonóis derivados do canferol e da quercetina, e dois ácidos hidroxicinamoilquínicos (derivados dos ácidos ferúlico e *p*-cumárico). Adicionalmente, as folhas de *R. raphanistrum* apresentam um baixo valor calórico, tendo um conteúdo proteico superior e lipídico inferior comparativamente a outros vegetais de folha verde da família Brassicaceae, tais como rabanete e couve-galega. Na avaliação do potencial bioativo utilizou-se o extrato hidroetanólico e a decocção, demonstrando ambos propriedades antioxidantes, capacidade de inibir o crescimento de diversas bactérias Gram-positivo e Gram-negativo, sem contudo revelar hepatotoxicidade. Em geral, os resultados evidenciam o interesse em recuperar o uso desta planta silvestre como parte de uma dieta variada e saudável.

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CP042

NONENZYMATIC TRANSGLYCOSYLATION REACTIONS IN HONEY – AN INSIGHT INTO THE OLIGOSACCHARIDES FORMATION

Soraia P. Silva¹, Ana S. P. Moreira^{1,2}, M. Rosário M. Domingues^{1,2}, Dmitry V. Evtuygin³, Elisabete Coelho¹, Manuel A. Coimbra¹

¹QOPNA, Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, 3810-193, Aveiro, Portugal

²CESAM, Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, 3810-193, Aveiro, Portugal

³CICECO, Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, 3810-193, Aveiro, Portugal

soraiapiressilva@ua.pt

Honey is essentially a very concentrated aqueous solution of fructose and glucose containing a complex mixture of other carbohydrates and substances [1]. Some of the carbohydrates present in honey are attributed to invertase activity, which transfers α -glucosyl residues to other carbohydrates moieties, producing those with α -glucose residues [2]. Nonetheless, there is still no explanation for the origin of honey oligosaccharides holding different combinations of glycosidic linkage types and anomeric (α or β) configurations. The present work hypothesizes that nonenzymatic reactions can occur in honey under the honey maturation conditions (high sugar concentrations in acidic media), inducing carbohydrates condensation [3]. In order to validate this hypothesis, six aqueous model solutions (moisture content of 20%) containing sucrose + glucose, and sucrose + fructose were prepared using water and diluted citric acid at pH 4.0 and at pH 2.0. The model solutions were kept at 35 °C, the average temperature inside the beehive. The occurrence of nonenzymatic oligosaccharide synthesis, with a degree of polymerization up to 6, was observed after 5 months using electrospray ionization mass spectrometry analysis. These solutions were fractionated by ligand-exchange/size-exclusion (LEX-SEC) chromatography. Methylation analysis on the oligosaccharides fractions showed the presence of terminally-linked glucose and fructose residues in the highest amount, along with lower amounts of (1 \rightarrow 2)-, (1 \rightarrow 3)-, (1 \rightarrow 4)- and (1 \rightarrow 6)-linked glucose and (2 \rightarrow 1)- and (2 \rightarrow 6)-linked fructose residues. The identification of the oligosaccharides was further elucidated after oligosaccharide derivatization to alditol acetates. The honey oligosaccharides maltose, isomaltose, inulobiose, blastose, sophorose, gentiobiose, cellobiose, panose, 1-kestose, and inulotriose were also identified in model solutions. In conclusion, as model solutions showed the occurrence of oligosaccharide synthesis without the intervention of enzymes, honey oligosaccharides may be resulting from nonenzymatic reactions.

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[1] Directive of the European Parliament 2001/110/EC, *J. Offic.* **2002**, L 010, 47-52.

[2] White, J.W.; Maher, J., *Arch. Biochem. Biophys.* **1953**, 42, 360–367.

[3] Silberman, H.C., *J. Org. Chem.* **1961**, 26, 1967–1969.

CP043

Corn silk and Urinary tract infections: a review

Ana C. E. P. C. Amaral, Rita C. Alves, M. Beatriz P.P. Oliveira*

REQUIMTE, LAQV/ Faculdade de Farmácia da Universidade do Porto, Porto, Portugal.

*beatoliv@ff.up.pt

Urinary tract infections (UTI) are one of the most frequent bacterial infections observed in the outpatient setting [1]. Antibiotics are primary tools for the treatment and prophylaxis of recurrent UTI. However, their indiscriminate use for prophylaxis or errors in the therapy can lead to the emergence of drug-resistant pathogens, causing a problem of global public health. Thus, the search for alternative therapies in the management of UTI is urgent.

In traditional European phytomedicine, infusions, decoctions or even ethanol–water extracts from different plants and herbs are frequently used for UTI prevention [3]. The aim of this review was to compile information on the bioactive compounds of *Zea mays* L. dried stigmata (or corn silk, CS), as well as the roles in prophylaxis and adjuvant treatment of UTI.

To evaluate the effects and safety of CS in the UTI prophylaxis, several *in vitro* and *in vivo* assays, as well as clinical trials have been performed. The main conclusions revealed that CS extracts have no antibacterial activity against *E. coli*, *P. aeruginosa*, *K. pneumonia*, *S. aureus*, *S. pneumonia* and *S. pyogenes* [8]. However, aqueous extracts of CS significantly reduced the UTI symptoms and the values of pus cells, red blood cells, and crystals [7]. This could probably be explained by the phytochemical composition of CS, which contains C-glycosyl-flavones such as 3'-deoxyderhamnosylmaysin responsible for antiadhesive activity against bacteria [3]. Moreover, chlorogenic acids (in particular 3-caffeoylquinic acid) and maysin are responsible for the antioxidant activity [4] and the high levels of potassium in aqueous CS extracts may induce diuresis [6]. No adverse effects were observed in animal studies (rats), which supported the safety of CS consumption by humans [9].

In conclusion, CS is considered a safe maize by-product, able to be used in the UTI prophylaxis and adjuvant therapy. Besides, the availability of CS in a large scale justifies the potential industrial value as a functional food product for UIT prophylaxis.

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- [1] Barber, A.E., *et al.*, *Clin. Inf. Dis.*, **2013**, 57, 719-724.
- [2] Hasanudin, K., Hashim, P., & Mustafa, S., *Molecules*, **2012**, 17(8), 9697.
- [3] Rafsanjany, N., *et al.*, *Fitoterapia*, **2015**, 105, 246-253.
- [4] Žilić, S., *et al.*, *J. of Cereal Science*, **2016**, 69, 363-37.
- [5] Liu, J., *et al.*, *Food Chemistry*, **2011**, 126(1), 261-269.
- [6] Velazquez, D.V.O., *et al.*, *Phytomedicine*, **2005**, 12(5), 363-369.
- [7] Sahib, A. S., Mohammed, I. H., & Hamdan, S. J., *J. of Interc. Ethnopharmac.*, **2012**, 1(2), 93-96.
- [8] Eman, A.A., *J of American Science*, **2011**, 7(4), 726-729.
- [9] Wang, C., *et al.*, *J Ethnopharmacol.*, **2011**, 137(1), 36-43.

CP044

AVALIAÇÃO DA COMPOSIÇÃO QUÍMICA E ATIVIDADE ANTIMICROBIANA DO ÓLEO ESSENCIAL DE BAGAS DE ZIMBRO (*JUNIPERUS COMMUNIS* L.)

Soraia Falcão¹, Isabel Bacém², Getúlio Igrejas², Pedro J. Rodrigues³, Miguel Vilas-Boas¹, Joana S. Amaral^{1,4}

¹*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal*

²*ESTiG, Instituto Politécnico de Bragança, Portugal*

³*Research Centre in Digitalization and Intelligent Robotics (CeDRI), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal*

⁴*REQUIMTE-LAQV, Faculdade de Farmácia, Universidade do Porto, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal*
Email of author for contact: jamaral@ipb.pt

As bagas do zimbro (*Juniperus communis* L.) são usadas na gastronomia de diferentes países Europeus, sendo consideradas a única especiaria obtida de plantas da família Cupressaceae e um dos poucos exemplos de especiarias produzidas em regiões de clima temperado [1]. Em Trás-os-Montes, são tradicionalmente utilizadas como condimento em pratos de carne de caça, com o objetivo de lhes conferir um aroma e sabor particulares. A nível mundial, são ainda frequentemente utilizadas na aromatização de bebidas, tais como o gin e bebidas tradicionais. As bagas de zimbro estão também descritas como tendo atividade diurética, estomáquica e antisséptica, estando o óleo essencial de bagas de zimbro inscrito em diferentes farmacopeias.

Neste trabalho, foram avaliadas 3 amostras de óleo essencial de bagas de zimbro, sendo uma obtida por extração em sistema de Clevenger a partir de bagas colhidas em Portugal (OE1) e duas amostras comerciais (OE2 e OE3). A análise foi realizada por cromatografia gasosa com deteção por espetrometria de massa (GC-MS), permitindo a identificação de um total de 97 compostos. Os três óleos essenciais estudados evidenciaram perfis químicos distintos: OE1 apresentou como compostos maioritários α -pineno (41,6%), β -pineno (27,6%) e limoneno (6,4%), OE2 apresentou α -pineno (31,1%), β -mirceno (16,3%) e sabineno (7,5%), enquanto que OE3 apresentou δ -cadineno (16,0%), α -pineno (12,2%) e sabineno (9,4%). O perfil químico distinto dos óleos essenciais foi ainda evidenciado pela análise de componentes principais (PCA), obtendo-se uma clara separação das amostras analisadas. Numa das amostras comerciais, foi detetada a presença de propaclor, um herbicida banido na União Europeia. Todos os óleos essenciais demonstraram ter atividade antimicrobiana relevante, uma vez que apresentaram atividade microbicida contra *Candida albicans* e pelo menos seis das dez bactérias testadas. Um dos óleos comerciais evidenciou um potencial antimicrobiano superior, inibindo o crescimento de todos os microrganismos testados (MIC entre 0,039 a 1,25%, v/v), o que poderá estar relacionado com o seu conteúdo superior em sesquiterpenos, particularmente em sesquiterpenos oxigenados.

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CP045

REPOSICIONAMENTO NA ÁREA DOS PRODUTOS COM BENEFÍCIOS NA SAÚDE DE UMA SOBREMESA GELIFICADA TRADICIONAL: MELHORIA DO PERFIL NUTRICIONAL

Sónia Oliveira, Marco Silva, Anabela Raymundo e Isabel Sousa

Universidade de Lisboa, Instituto Superior de Agronomia, LEAF Research Center (Linking Landscape Environment Agriculture and Food), Tapada da Ajuda, 1349-017 Lisboa, Portugal

Corresponding author

e-mail adress: soliveira@isa.ulisboa.pt

A crescente procura por alimentos que proporcionam benefícios que possam reduzir o risco de doenças e / ou promover a saúde, tem proporcionado o aparecimento de novos produtos. Neste contexto, numa parceria entre o Instituto Superior de Agronomia e a empresa Mandarin, efetuou-se o desenvolvimento de duas gamas de preparados em pó para pudins sem adição de açúcar e com incorporação de fibra, tendo em vista a obtenção de produtos o mais próximos possível do produto *core* da empresa – o pudim flan. Os produtos desenvolvidos foram caracterizados, levando-se em consideração diferentes parâmetros: características sensoriais, cor, humidade, a_w , textura, para posterior seleção dos produtos mais próximos da referência. O desenvolvimento das novas formulações, sem açúcar e com incorporação de fibra, teve ainda como objetivo a declaração de alegações nutricionais para as duas gamas de produtos desenvolvidos – “valor energético reduzido” e “rico em fibras”, respetivamente.

No desenvolvimento das formulações sem açúcar, as saquetas foram formuladas com a incorporação de edulcorantes que substituem o açúcar, tradicionalmente adicionado no momento de preparação da sobremesa em casa. Os edulcorantes testados foram selecionados com base no seu poder adoçante, aporte calórico e *aftertaste*. Foram testados diferentes tipos de edulcorantes, como a aplicação individual e combinada entre estes. As formulações com incorporação de fibra também foram desenvolvidas com adição de edulcorantes, de forma a igualmente se obter uma redução do valor energético. As fibras alimentares testadas tiveram como principal fator de seleção o seu teor em fibra solúvel, i.e., a componente pré-biótica. As formulações finais sem açúcar e com incorporação de fibra, foram selecionadas com base nos resultados obtidos em provas sensoriais triangulares. Nestas provas, as formulações de pudins que não foram identificados como diferentes relativamente à referência, foram analisadas quanto à sua composição nutricional, confirmando a possibilidade de se usar as alegações visadas. Os resultados revelaram que as formulações desenvolvidas – sem açúcar e com incorporação de fibra – cumprem os pressupostos legais para a declaração de ambas as alegações nutricionais.

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CP046

A multi-spectroscopic and thermodynamic study on the interaction of food polyphenols with gluten reactive peptides: from chemistry to health implications

Ricardo Dias, Susana Soares, Rosa Pérez-Gregório, Nuno Mateus, Victor de Freitas

QUINOA-LAQV/REQUIMTE, Departamento de Química e Bioquímica, Faculdade de Ciências da Universidade do Porto, Porto, Portugal

Celiac Disease (CD) is a chronic hypersensitivity disorder triggered by dietary exposure to gluten-containing foods in genetically predisposed individuals [1]. Over the past decades, CD has emerged as a major public health problem and an adherence to a strict gluten-free diet remains the only available treatment for CD patients [2]. In many cases, however, CD patients experience persistent or recurrent symptoms despite their best efforts to avoid dietary gluten and may develop uncommon but severe gastrointestinal complications [3]. Therefore, new solutions are needed to improve the quality of life of CD patients. In that sense, there is a growing body of evidence indicating that dietary polyphenols are health promoting phytochemicals with the potential to modulate predisposition to intestinal chronic inflammatory conditions [4]. Apart from their intrinsic activities as either antioxidant or anti-inflammatory agents, in a CD perspective, food tannins stand out because of their ability to interact with proline-rich gluten reactive peptides, effectively preventing them from becoming bioavailable at the intestinal level [5].

The aim of this study is to provide molecular and thermodynamic level insights into the interaction between the most bioactive gluten peptide, the 32-mer, and some common flavonols at near physiological conditions by means of both NMR, ITC and fluorescence quenching experiments. Accordingly, these biomolecular interacting systems were fully characterized in terms of their binding affinity, interaction mechanism and when possible, the specificity and primary binding surfaces in peptide-polyphenol complexes were also determined. The biological implications of such polyphenols on a CD framework was additionally explored by using the human intestinal Caco-2 cell line as a model of the intestinal barrier on transwell assays. Overall, this study intends to promote an advancement of knowledge concerning the significance of natural phenolic compounds in a nutritional context to prevent CD.

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- [1] Leonard, M. M.; Sapone, A.; Catassi, C.; Fasano, A. *JAMA* **2017**, *318*, 647.
- [2] Ciacci, C.; Zingone, F. *Diseases* **2015**, *3*, 102.
- [3] Lebwohl, B.; Sanders, D. S.; Green, P. H. R. *The Lancet* **2018**, *391*, 70.
- [4] Zhang, H.; Tsao, R. *Current Opinion in Food Science* **2016**, *8*, 33.
- [5] Dias, R.; Brás, N. F.; Fernandes, I.; Pérez-Gregório, M.; Mateus, N.; Freitas, V. *International Journal of Biological Macromolecules* **2018**, *112*, 1029.

CP047

Quantification of iodine in commercial of table salts: Comparison between iodometric and spectrophotometric methods

Nair Alua,^{1,2} M. Celeste Serra^{1,2}

¹Área Departamental de Engenharia Química, ISEL, 1959-007 Lisboa, Portugal

²Centro de Estudos de Engenharia Química, ISEL, 1959-007 Lisboa, Portugal
mcserra@deq.isel.ipl.pt

Iodine is a trace element, not synthesized by the humans, but necessary for physiological functions. In this way, iodine should be obtained from dietary, consuming foods that containing it.

Considering that iodine is essential for the synthesis of thyroid hormones which have a multiple key functions in metabolism, especially in the brain, iodine deficiency might have a huge impact on health [1].

Although daily needs are in the order of micrograms (100 micrograms for infants and 150 micrograms for adults), the importance to ingest iodine and its dietary deficiency are relevant issues.

since 1993, the World Health Organization (WHO) expresses its concern on this subject, recommending low-cost and high-efficiency procedures as the universal fortification of salt with iodine (iodized salt) and its use in school meals [2].

In this study, table salts were purchased in local markets in the form of natural and iodized salts. The amount of iodine in the samples was determined by the iodometric method and using spectrophotometric assays with malachite green dye. The aim was to compare the results obtained by the both methods.

In the spetrofotometric method a calibration curve was obtained using iodate standard solutions in the concentration range between 3 and 15 mg/L and the absorbance measurements were carried out at 620 nm [3].

Comparing the results of the iodine content determined by the methods a mean deviation of about 16% was found. The spectrophotometric method is simple, rapid and with reasonable sensibility but it must be improved for application on iodine quantification in natural salt samples.

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References

- [1] World Health Organization and UNICEF, Iodine deficiency in Europe: a continuing public health problem. **2007**.
- [2] Stipanuk, M. H.; Caudill, M. A. *Biochemical, Physiological, and Molecular Aspects of Human Nutrition* **2012**, 3rd ed.
- [3] Kokayan, M.; Limchoowong,N.; Shricharoen,P.; Chantai,S, *Japan Society for Analytical Chemistry* **2016** vol 32,1231-1236.

CP048

AMIDO RESISTENTE: O QUE É, ONDE ESTÁ E QUAL A SUA IMPORTÂNCIA

Olga Amaral¹, Catarina Sousa Guerreiro², Fábio Lebre¹, Carla Patinha¹, Marília Cravo²

¹ Departamento de Tecnologias e Ciências Aplicadas, Instituto Politécnico de Beja, Portugal

² Faculdade de Medicina da Universidade de Lisboa, Portugal

olga.amaral@ipbeja.pt

É hoje consensual que a alimentação é um dos fatores que mais influencia o estado de saúde ou doença dos indivíduos. Alguns alimentos, para além de satisfazerem as necessidades nutricionais básicas, contêm uma ou mais substâncias fisiologicamente ativas que, em quantidades adequadas, podem promover a saúde e bem-estar e reduzir o risco de determinadas doenças.

Antes da década de 80, era assumido que todo o amido era hidrolisado e absorvido no intestino delgado. Estudos então realizados revelaram que uma parte do amido ingerido não é hidrolisada e resiste ao processo digestivo. Esta fração denominou-se **Amido Resistente (AR)** tendo sido definido como “*a soma do amido e produtos da sua degradação não absorvidos no intestino delgado de indivíduos saudáveis*”.

O AR resiste à digestão no intestino delgado sendo em seguida hidrolisado, no cólon, pela microbiota intestinal. Desta forma o AR comporta-se como prebiótico e apresenta benefícios fisiológicos decorrentes dos compostos formados durante a fermentação. Quando em substituição do amido digerível reduz o valor energético dos alimentos e alguns estudos apontam também para a possibilidade de alimentos ricos em AR induzirem maior saciedade.

Há evidências de que o AR contribui favoravelmente para a saúde do cólon inclusive a diminuição do risco de cancro coloretal e foi também demonstrado o efeito positivo na prevenção das doenças cardiovasculares. Como componente da fibra alimentar pode ajudar na prevenção e controlo da obesidade e a influência do AR na resposta glicémica também sugere benefícios na prevenção e controlo da diabetes.

A obtenção de pão com elevado teor em AR, sem recorrer à adição deste composto como ingrediente, foi o objetivo de trabalhos de investigação que temos vindo a desenvolver. Foi possível obter um pão com um teor em AR três vezes superior ao encontrado no pão tradicional. Esta formulação revelou valores de glicémia pós-prandial e um Índice Glicémico mais baixo comparativamente ao pão tradicional, sugerindo que a presença de AR influencia a digestibilidade da fração de amido disponível no pão. Também induziu maior saciedade que o pão tradicional.

Estudos em curso testaram a inclusão de farinhas de leguminosas, nomeadamente grão-de-bico, feijão branco, feijão preto, lentilhas castanhas, lentilhas laranja e ervilha, no fabrico de variedades de pão. Os pães obtidos revelaram valores mais elevados de AR e de proteína relativamente ao pão comum e também boa aceitação por parte do consumidor. A proteína destas variedades de pão apresenta-se como de elevado valor biológico resultando da complementaridade das leguminosas e dos cereais. Estas formulações constituem alimentos interessantes do ponto de vista nutricional e que podem contribuir para uma dieta mais saudável.

CP049

CORANTES NATURAIS DE ORIGEM VEGETAL APLICADOS NO SETOR DA PASTELARIA

Filipa S. Reis^{1,*}, M. Inês Dias¹, Sandrina A. Heleno¹, Paula Rodrigues¹, João C.M. Barreira¹, Andreia Oliveira², Lillian Barros¹, Isabel C.F.R. Ferreira¹

¹Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal.

²TecPan- Tecnologia e Produtos para Pastelaria e Panificação, Lda. Rua D, 28, Zona Industrial, 5370-565 Mirandela

*freis@ipb.pt

Nos últimos anos o consumidor tem estado mais atento aos ingredientes que são adicionados aos produtos que ingere e tem vindo a optar por alimentos contendo aditivos naturais em alternativa aos artificiais [1,2]. Este trabalho apresenta os resultados obtidos na incorporação de corantes naturais obtidos de diferentes fontes vegetais num produto de pastelaria, ao longo de 6 meses. Os corantes foram obtidos a partir de beterraba, amora, cereja, curcumina e anato. Depois de incorporar os corantes no produto de pastelaria, estas amostras foram divididas em sets de forma a avaliar os seguintes parâmetros: cor, pH, valor nutricional e carga microbiana ao longo do tempo. Os valores obtidos foram comparados com amostras controlo (sem adição de corante) e amostras incorporadas com o corante artificial correspondente, utilizado normalmente pela empresa TecPan. As amostras foram armazenadas expostas e ao abrigo da luz, e os resultados foram comparados. O valor nutricional das amostras, assim como a carga microbiana permaneceram praticamente inalterados ao longo do tempo. Nos produtos incorporados com corantes vermelhos, a beterraba conferiu valores de pH mais elevados. Relativamente aos parâmetros de cor, os produtos sem adição de corantes apresentaram os valores de L^* mais elevados, e os valores mais baixos de a^* . Quanto ao parâmetro b^* , os valores mais elevados foram registados nas amostras incorporadas com beterraba ou, no caso das amostras armazenadas no escuro, na amostra controlo. Quanto à adição de curcumina (amarelo), esta induziu valores de a^* mais elevados e de b^* mais baixos, comparativamente com o corante artificial correspondente. Aos 6 meses registam-se os valores de pH mínimos, sendo que os valores de L^* e b^* tendem a diminuir ligeiramente a partir do 4º e 5º mês, em todas as amostras. Nas amostras incorporadas com anato (gama dos laranjas), este induziu os valores de L^* mais baixos e os mais elevados de b^* . Ao fim dos 6 meses registam-se os valores de pH mais baixos em todas as amostras.

No geral, o trabalho desenvolvido ao longo de 6 meses mostra-nos que o corante adicionado teve maior efeito nos parâmetros de pH e cor, revelando possíveis alternativas para o mercado dos corantes naturais.

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[1] Saltmarsh, M. RSC Publishing: UK, 2013.

[2] Caroch, M.; Morales, P.; Ferreira, I.C.F.R. *Trends Food Sci Technol* 2015, 45, 284-295.

CP050

GASTROINTESTINAL ABSORPTION OF ANTHOCYANINS: A MOLECULAR APPROACH

Hélder Oliveira, Iva Fernandes*, Victor de Freitas and Nuno Mateus

REQUIMTE/LAQV, Chemistry and Biochemistry Department, Faculty of Sciences University of Porto, Portugal

**iva.fernandes@fc.up.pt*

Anthocyanins are naturally occurring bioactive compounds that are extensively distributed in plant-derived foodstuffs and, consequently, largely consumed by humans. Their consumption is related to decreased risks of developing cardiovascular disease and cancer (1). Amongst polyphenols classes, anthocyanins are the ones considered to have the lowest bioavailability. However recent reports suggest an undervaluation of the real bioavailability of these compounds.

An early appearance of anthocyanins in blood and urine after consumption of anthocyanin-rich foods, is not compatible with an exclusive absorption at the intestinal level, as initially acknowledged (2). Bioavailability is highly dependent on the interactions between food components when ingested together (3). However, only limited scientific evidences exist to provide information on the bioavailability of anthocyanins in the gut.

Thus, this study aimed to better understand the influence of food matrix components on anthocyanin absorption and molecular mechanisms potentially involved on their bioavailability. The kinetics of absorption both at gastric and intestinal level using MKN-28 and caco-2 cancer cell lines, was evaluated for complex anthocyanins from purple fleshed sweet potato, which revealed higher absorption values than previously reported for other anthocyanins.

Food matrix evaluation using anthocyanin-rich extracts from purple fleshed sweet potato showed a decreased efficiency of anthocyanin absorption in the presence of glucose and proteins but not starch.

Recent evidence suggested the involvement of glucose transporters at gastric level on anthocyanins absorption (4). Thus, the molecular mechanism of absorption of anthocyanins on the stomach was evaluated using gene silencing with a nano-technological approach. The results, for different anthocyanins with particular structural features, extracted from both red wine and purple fleshed sweet potato, suggested the involvement of GLUT1 and GLUT3 transporters, although the transport mechanism was not exclusive to these transport systems. Also, a simulation of gastrointestinal enzymatic action was performed to evaluate the first line of anthocyanin degradation.

These results bring new insights on the comprehension of anthocyanins bioavailability.

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1. Murador, D., Braga, A.R., Da Cunha, D., De Rosso, V., Alterations in phenolic compound levels and antioxidant activity in response to cooking technique effects: a meta-analytic investigation. *Crit. Rev. Food Sci. Nutr.* (2016), pp. 1-9
2. Fernandes, I., Faria, A., Calhau, C., de Freitas, V., Mateus, N., Bioavailability of anthocyanins and derivatives. *J. Funct. Foods*, 7 (2014), pp. 54-66
3. Phan, M. A. T., Paterson, J., Bucknall, M., & Arcot, J. Interactions between phytochemicals from fruits and vegetables: Effects on bioactivities and bioavailability. *Critical Rev. in Food Sci. and Nutrition* (2016), pp. 1-20.
4. Oliveira, H., Fernandes, I., Brás, N. F., Faria, A., de Freitas, V., Calhau, C., Mateus, N., Experimental and theoretical data on the mechanisms by which red wine anthocyanins are transported through a human MKN-28 gastric cell model. *J. Agr. Food Chem.* (2015)

CP051

PHYSICAL AND CHEMICAL CHARACTERIZATION OF ANTHOCYANINS FROM PURPLE-FLESHED SWEET POTATO

Hélder Oliveira, Iva Fernandes*, Victor de Freitas and Nuno Mateus

REQUIMTE/LAQV, Chemistry and Biochemistry Department, Faculty of Sciences University of Porto, Portugal

*iva.fernandes@fc.up.pt

Anthocyanins represent one of the most amazing classes of compounds among polyphenols. These molecules have unique characteristics such as their structural dependence on pH [1]. The kinetic and equilibrium network of anthocyanins has been widely assessed in order to understand their behavior and stability under different pH conditions.

Among the different types of anthocyanins, Purple-Fleshed Sweet Potato (PFSP) anthocyanins primarily exist as poly-acylated and poly-glycosylated structures derived from Peonidin and Cyanidin [2]. Acylation with various phenolic acids makes PFSP anthocyanins unique and also provides some advantages towards pH and heat resistance, light sensitivity, and overall stability [3], as anthocyanins are known to be reactive compounds that have their stability affected by oxygen, heat, light, pH and enzymes [4]. The study of their equilibrium network is therefore essential. Also, anthocyanins are reported to have poor light-emitting properties, however the scarce information on this matter was performed with monoglucosides and non acylated anthocyanins [5].

Thus, the aim of this study was to characterize the physical and chemical properties of anthocyanins from red wine. For that, a structural characterization of two main Purple-Fleshed Sweet Potato anthocyanins was performed using LC-MS and NMR techniques. The study of the equilibrium network was performed with the use of *pH jump* techniques and the fluorescence properties of the two isolated anthocyanins were also assessed.

The results suggested a higher stability at a broader range of pH values (with lower hydration and higher acidity constants) of the isolated anthocyanins when compared to the already published kinetic and equilibrium parameters of the parent non acylated anthocyanin. Also, unique fluorescence properties were reported for the anthocyanins of PFSP for the first time with an *ex/em* pair of λ_{ex} 610 nm/ λ_{em} 640 nm. A biological experiment was performed using gastric and intestinal cell lines, and PFSP anthocyanins intracellular localization with the use of fluorescence microscopy techniques.

Acknowledgements: The authors would like to thank FCT and M2B-PhD for the PhD grant (PD/BD/106062/2015)

1. Pina, F., *Chemical applications of anthocyanins and related compounds. A source of bioinspiration*. Journal of Agricultural and Food Chemistry, 2014. **62**(29): p. 6885-97.
2. Gould, K., K.M. Davies, and C. Winefield, *Anthocyanins: Biosynthesis, functions and applications*. New York: Springer, 2008.
3. Xu, J., et al., *Characterisation and stability of anthocyanins in purple-fleshed sweet potato P40*. Food Chemistry, 2015. **186**: p. 6.
4. Wallace, T. and M. Giusti, *Anthocyanins in Health and Disease* CRC Press, 2014. ISBN: 978-1-4398-9471-2.
5. Drabent, R., et al., *Ultraviolet Fluorescence of Cyanidin and Malvidin Glycosides in Aqueous environment*. Spectroscopic Letters, 2007. **40**: p. 165-182.

CP052

CHARACTERIZATION OF TOMATO AND WINERY BY- PRODUCTS

Soudabeh Ghalamara, Sara Silva, Manuela Pintado

Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa/Porto, Rua Arquitecto Lobão Vital, 172, 4200-374 Porto, Portugal. Email: sghalamara@ucpcrp.pt

Over the last years, special attention has been given to the use of natural compounds from food industry byproducts and their conversion/incorporation into biofuel, food ingredients, nutraceuticals and other added value bio-products [1]. Phenolic compounds, found in several agro-food byproducts, have been associated with an array of interesting biological effects such as antioxidant capacity and antimicrobial properties. Wine (grape pomace and stalks) and tomato industry byproducts contain a wide range of potential bioactive compounds and studies carried out in vivo and in vitro over the last few years have shown the beneficial effects of administering these bioactive compounds. [2]. As such, in this work tomato and winery by-products were submitted to a preliminary chemical characterization in order to gather some insights into their composition, in terms of dietary fiber and macromolecular fractions (hemicelluloses, cellulose, lignin and pectin). This characterization completed with the definition of the most interesting compounds to be targeted for extraction, fractionation and valorization in subsequent activities aiming at their integrated valorization. Overall tomato byproducts, which were measured in two samples respectively, illustrated 69.81% and 25.53% fiber content and also winery byproducts whose samples were measured in two white and red grapes illustrated 6.48% and 4.68% fiber content, making them excellent candidates for nutraceutical, medical, and food applications. They are also good sources of lignin, cellulose, and hemicellulose and which makes them an interesting source for the development of new environmentally friendly composites.

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References

- [1] Maier, T.; Schieber, A.; Kammerer, D. R.; Carle, R. (2009). Residues of grape (*Vitis vinifera* L.) seed oil production as a valuable source of phenolic antioxidants. *Food Chemistry*, 112(3), 551–559.
- [2] Viveros, A.; Chamorro s.; Pizarro, M.; Arija, I.; Centeno, C.; Brenes, A. (2011). Effects of dietary polyphenol-rich grape products on intestinal microflora and gut morphology in broiler chicks *Poult. Sci.*, 90, pp. 566-578.

CP053

PROTEINS AND PEPTIDES EXTRACTION FROM FISH BY-PRODUCTS

Soudabeh Ghalamara¹, Sara Silva¹, Carla Brazinha², Manuela Pintado¹

¹*Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa/Porto, Rua Arquitecto Lobão Vital, 172, 4200-374 Porto, Portugal. Email: sghalamara@ucpcrp.pt*

²*LAQV/Requimte, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Campus de Caparica, 2829-516 Caparica, Portugal*

With the rise in awareness of the association between diet and health, there has been an increase in the research focused on the identification of natural bioactive compounds (such as proteins/peptides) that may exhibit some beneficial health effect and consequently be used as functional ingredients [2]. Byproducts represent a sustainable, environmentally-friendly and relatively low cost source of bioactive ingredients. Fishery bioactive peptides, given their structures and amino acid composition, have been shown to display a wide range of biological functions including antioxidant, antimicrobial, opioid agonistic, prebiotic, mineral binding, anti-thrombotic or hypocholesterolemic effects [1, 3]. As such, fishery byproducts may represent an interesting source of biologically relevant peptides to be used in food formulations or cosmetic/pharmaceutical products. Considering the arguments above, the present work aimed to characterize the composition of two fishery by products, Sardine cooking water (from the canning industry) and cod blood (from the cod salting industry) and produce and characterize potentially bioactive peptide fractions from. It aimed to obtain fractions enriched in peptides with a molecular weight cut-off (MWCO) between 2.5 and 50kDa from cod blood and fractions enriched in peptides with a molecular weight cut-off (MWCO) of 2.5 and 1 kDa from sardine cooking wastewater. Fast protein liquid chromatography (FPLC) characterization completed with the definition of the most interesting fractions to be targeted for functional properties aiming at their great potentials for nutraceutical, medical, and food applications. Results provided the baseline data that they are good sources in antioxidant and have a great potential for food and/or cosmetics.

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References

- [1] Kim, S.; Mendis, E. **(2006)**. Bioactive compounds from marine processing byproducts – A review. *Food Research International*, 39, 383–393.
- [2] Ryan, J. T.; Ross, R. P.; Bolton, D.; Fitzgerald, G. F.; Stanton, C. **(2011)**. Bioactive peptides from muscle sources: Meat and fish, review. *Nutrients*, 3, 765–791
- [3] Rajanbabu, V.; Chen, J.Y. **(2011)**. *Fish and Shellfish Immunology*, 30, 39–44.

CP054
**INCORPORATION OF ZnO-REDUCED GRAPHENE OXIDE
NANOCOMPOSITE ON ALGINATE FILMS FOR ACTIVE FOOD
PACKAGING**

Zélia Alves¹, Paula Ferreira¹, Cláudia Nunes^{1,2}

¹CICECO - Aveiro Institute of Materials & ²QOPNA, Department of Chemistry, University of Aveiro, 3810-193 Aveiro, Portugal

zeliaralves@ua.pt

Food packaging has a role to protect the food from contaminations and physical damage, ensuring its quality and safety in the whole supply chain. In addition to convenience, communication, and containment, the development of more sustainable food packaging materials with active properties is increasing which leads to the development of new packaging technologies. To extend shelf-life, maintaining or improving the condition of packaged food, the development of active packaging has been a very hot topic [1]. Zinc oxide nanoparticles have been considered feasible to incorporate in the food active packaging system and explored as an antimicrobial agent against bacteria. In addition, its high ultraviolet light absorption capacity avoids food deterioration by oxidation [2]. Furthermore, reduced graphene oxide can provide electric conductive [3] to the food packaging material enabling its application in packaged food sterilization by the innovative pulse electric field methodology, where the food is minimally processed maintaining its original nutritional characteristics.

With the purpose to develop an active bioplastic for food packaging, alginate biopolymer was selected due to their abundant availability, low toxicity, and film forming ability. Therefore, the effect of ZnO-reduced graphene oxide (ZnO-rGO) composite on alginate matrix was investigated. Firstly, the reduction of graphene oxide and the zinc oxide synthesis are performed simultaneously by a one-step hydrothermal method. The alginate films with ZnO-rGO composite are prepared by solvent casting and are characterized concerning their crystallographic and optical characteristics, mechanical properties, surface hydrophilicity, water solubility, and electrical conductivity. Antimicrobial activity was also evaluated against prominent foodborne pathogens.

This bionanocomposite can bring innovation in active packaging technologies particularly in the antimicrobial activity and sterilization of packaged food by pulsed electric field to maintain or improve the food quality and safety.

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[1] Ahmed, I.; Lin, H.; Zou, L.; Brody, A. L.; Li, Z.; Qazi, I. M.; Pavase, T. R.; Lv, L. *Food Control* **2017**, *82*, 163-178.

[2] Akbar, A.; Anal, A. K. *Food Control* **2014**, *38*, 88-95.

[3] Wang, X.; Bai, H.; Yao, Z.; Liu, A.; Shi, G.; *J. Mater. Chem* **2010**, *20*, 9032-90

CP055

INCORPORATION OF COFFEE SILVERSKIN IN POTATO STARCH FILMS

Gonçalo Oliveira¹, Idalina Gonçalves^{1, 2}, Cláudia Nunes^{1,2}, Manuel A. Coimbra²,
Paula Ferreira¹

¹ CICECO – Aveiro Institute of Materials, University of Aveiro, 3810-193 Aveiro, Portugal

² QOPNA, Department of Chemistry, University of Aveiro, 3810-193 Aveiro, Portugal

E-mail: gvso@ua.pt

Most conventional food packaging are made of non-biodegradable petroleum-based polymers that, when disposed into landfills, give rise to environmental concerns. As alternative, biodegradable and renewable feedstocks have been investigated. Starch has been used for bioplastics production due to its thermoplastic properties, film forming ability, and biodegradability. Nevertheless, starch films have poor water barrier properties and brittleness, limiting their application range. To overcome these drawbacks, many physical, chemical, and blending strategies have been used [1–3]. On the other hand, food waste is a recurrent problem due, among other reasons, to the short foodstuffs shelf-life. As a solution, the development of active packaging with antioxidant activity is being investigated. In this work, coffee silverskin, a byproduct from the coffee roasting process with inherent antioxidant activity, was incorporated into starch formulations, at different concentrations (1, 5 and 10% w/w of starch dry weight). Starch/coffee silverskin films have yellowish coloration whose intensity increases with the coffee silverskin dosage. In addition, these films show increased flexibility, antioxidant activity, surface hydrophobicity and low water vapor permeability, when compared to the pristine starch films. Therefore, the addition of coffee silverskin to starch formulations revealed to be a promising strategy to produce active biobased materials, opening applications in the active food packaging sector.

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[1] X. Tang and S. Alavi, *Carbohydrate Polymers* **2011**, 85, 7–16.

[2] O. Moreno, L. Atarés, and A. Chiralt, *Carbohydrate Polymers* **2015**, 133, 353–364.

[3] D. Piñeros-Hernandez, C. Medina-Jaramillo, A. López-Córdoba, and S. Goyanes, *Food Hydrocolloids* **2017**, 63, 488–495.

CP056

BIOFOODPACK - Biocomposite Packaging for Active Preservation of Food

Cláudia Nunes^{1,2}, Ana Barra¹, Zélia Alves¹, Manuel A. Coimbra², Paula Ferreira¹,

¹CICECO - Aveiro Institute of Materials, & ²QOPNA University of Aveiro, Portugal
claudianunes@ua.pt

Polysaccharides have been exploited to develop edible and biodegradable films to extend shelf-life and improve quality of food while reducing packaging waste [1]. BIOFOODPACK project aims to develop a sustainable biocomposite food packaging material to actively interact with foodstuffs, leading to improved food safety with minimal processing, reducing food loss and waste. The addition of nanofillers can improve the mechanical and barrier properties of biomaterials and, also, attribute with electrical conductivity properties for active and intelligent packaging [2]. Electrical conductivity is an advantageous property for in-pack processing of food at low temperature using pulsed electric fields, maintaining the nutritional qualities of the food and increasing their shelf-life. Conventional electrically conductive polymers have limited biodegradability and biocompatibility and should be replaced by suitable biomaterials.

In this work, the appropriated fillers, such as reduced graphene oxide (rGO), clays, and iron oxide, were incorporated in the matrix of polysaccharide or mixtures of polysaccharides (chitosan and/or alginate) to improve mechanical, water resistance, and gas barrier properties, as well as to confer electrical conductivity. Electrical conductive bionanocomposites of chitosan and rGO were produced by a green methodology. The reduced graphene oxide was hydrothermally reduced in the presence of caffeic acid and was dispersed into chitosan. The final bionanocomposites achieved an electrical conductivity of 8.4 mS·cm⁻¹ in-plane and 3.4x10⁻⁴ mS·cm⁻¹ through-plane. The reduced graphene oxide promoted a great enhancement of antioxidant activity and a mechanical reinforcement of chitosan matrix, increasing the tensile strength and decreasing the water solubility. The electrical conductivity, mechanical properties and antioxidant activity of the bionanocomposites are able to be tuned according to the filler content.

Due to the intrinsic biological properties of chitosan and the electrical conductivity of RGO, these active bionanocomposites are promising for active food packaging to process food in-pack by pulsed electric fields.

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[1] Nunes, C.; Maricato, E.; Cunha, Â.; et al. *Green Chem.* **2016**, *18*, 5331-5341.

[2] Zhou, T.; Qi, X.; Bai, H.; Fu, Q. *RSC Adv*, **2016**, *6*, 34153–34158.

CP057

THE RELEVANCE OF THE PROCESS OF STRAWBERRY SORBET PRODUCTION ON COLOUR STABILISATION

Elisabete Coelho¹, Lisa Barbosa¹, Cláudia Nunes^{1,2}, Guido R. Lopes¹, Sónia Mendo³, Tito Gomes⁴, Bernardo Embaixador⁴, and Manuel A. Coimbra¹

¹ QOPNA, ² CICECO, Departamento de Química, Universidade de Aveiro. ³ CESAM, Departamento de Biologia, Universidade de Aveiro. ⁴ Beyondleaves, Lda, Aveiro. ecoelho@ua.pt

Sorbet is a fat-free product produced with fruits or fruit juice. As opposed to traditional ice creams, sorbets do not contain milk constituents, which is particularly important for people suffering from lactose allergy or intolerance. Due to the growing consumer interest in functional food, sorbets containing the polysaccharide inulin may be a desirable alternative to traditional ice creams [1]. Strawberries are perishable fruits widely consumed fresh, as well as processed. Moreover, these fruits could be a valuable component of frozen desserts, because freezing is one of the most successful methods for the long-term preservation of the natural quality attributes of these fruits. However freezing cause several changes in chemical composition and organoleptic properties [2].

The strawberry sorbet developed in the company Beyondleaves is produced by grinding the fresh strawberries and adding sugar syrup, lemon juice, inulin, and emulsifier. The mixture is then cooled under stirring until frozen. However, the sorbet develops a darkened surface during storage, due to enzymatic browning, attributed to polyphenoloxidase activity. Aiming to define a strategy to prevent browning, a sorbet was produced using the same recipe but with two different procedures: 1) the strawberries immersion in sugar syrup with lemon juice for 10 min before grinding; 2) the coating of strawberries with lemon juice before grinding with sugar syrup.

The CIELab colour analysis of the strawberry sorbet revealed no significant differences in L^* , a^* , b^* coordinates between the surface and the interior along three weeks of storage, for both procedures. The direct contact of the strawberries with the acidity of the lemon juice allowed to obtain a sorbet with a more stable colour during cold storage by inhibition of the activity of the enzymes involved in the enzymatic browning.

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- [1] Topolska K.; Filipiak-Florkiewicz A.; Florkiewicz A.; Cieslik E. *European Food Research and Technology* **2017**, *243*, 701-709.
- [2] Hipólito C.; Ramalheira R.; Beirão da Costa S.; Moldão-Martins, M. *LWT - Food Science and Technology* **2016**, *68*, 462-469.

CP058

OPTIMIZATION OF STORAGE SILOS FOR MULTI-COLOURED DRY PASTA PRODUCTION

Catarina Magalhães¹, Susana Fonseca^{1,2} and Alberta Araújo^{1,3}

¹ESTG – Instituto Politécnico de Viana do Castelo, 4900-348 Viana do Castelo, Portugal

² GreenUPorto&LAQV-REQUIMTE, DGAOT, Faculdade de Ciências da Universidade do Porto, Campus Agrário Vairão, Rua Padre Armando Quintas 7, 4485-661 Vila do Conde, Portugal

³CEB – Centre of Biological Engineering, University of Minho, 4710-057 Braga, Portugal

e-mail: alberta@estg.ipvc.pt

The objective of this study was the management of storage silos in a dry pasta production process company between the production and the packaging stages (silage), in order to optimize the mass production of multi-coloured dry pasta.

This industrial unit has 60 silos, all with the same storage size, distributed into 4 batteries, each with 15 silos. For this study, the database of manufacturing and packaging lines was updated to support the planning and quantification of the minimum batches for multicolour dry pasta production. The management of silos was done together with the manufacturing and packaging in a programmed way, taking into account only the experience and dedication of both teams, without the support of any tool. The good management of silos is a difficult task that depends on several factors and it is of special importance in the production of the bicolour, tricolour or four colour dry pasta, called specialties. This production requires extreme attention, since the factory has 60 silos of cut pasta and the final production can only start when all the colours were in the respective silos. It is defined that for each mass production with more than one colour, should be used no more than 15 silos. Therefore, it is important to define minimum batches of mass production with more than one colour, so that the production can be optimized, and the waste reduced without affecting the quantity of silos available to the normal operation of the packaging lines. In this way, the data and the capacities of the lines were crossed and the ideal quantities of these products were calculated. The decision matrix was elaborated on the basis of updated data and takes into account essentially the sieves and packaging lines, to which the mass should be forwarded. The decision matrix will connect the manufacturing outputs and the packaging inputs. The decision matrix was developed in Microsoft® Excel- It is a simple matrix that relates the products /references, the moulds of manufacture and the preferential and alternative packaging lines, if it exists, and the consequence of the mass being placed in the first, second, third or fourth battery. Thus, a smooth flow of each of the coloured pasta is achieved, reducing waste and a normal operation of the production and packaging lines. It is also concluded that with the use of adequate planning, production of pasta with more than one colour with maximum and minimum quantities defined and using the decision matrix, it is not necessary to purchase new equipment.

Keywords: dry pasta, decision matrix, optimization of production

CP059

CONTRIBUTO PARA A IMPLEMENTAÇÃO DA NORMA BRC FOOD NUMA INDÚSTRIA DE CARNES

Madalena Correia¹ and Alberta Araújo^{1,2}

¹ESTG – Instituto Politécnico de Viana do Castelo, 4900-348 Viana do Castelo, Portugal

²CEB – Centre of Biological Engineering, University of Minho, 4710-057 Braga, Portugal

e-mail: alberta@estg.ipvc.pt

Atualmente, à indústria alimentar é exigida a produção de produtos com elevada qualidade e a baixo custo, ou seja que cumpram os requisitos e especificações aplicáveis. De modo a gerir e melhorar de forma contínua os procedimentos e processos, as empresas têm optado por implementar sistemas globais de gestão de qualidade, como é o exemplo de normas internacionais, tais como a BRC Food. Esta norma é globalmente reconhecida por vários retalhistas, empresas alimentares e produtores. Assim, com o intuito de melhorar o sistema de gestão da qualidade e com vista a atingir novos mercados de comercialização, a empresa propôs-se a implementar a *BRC Food versão 7*. Este sistema da qualidade providencia uma estrutura para gerir a segurança, qualidade, integridade e legalidade dos produtos alimentares, assim como o controlo de operações para atingir esses objetivos. É internacionalmente reconhecida pela GFSI. A atividade desta empresa centra-se na comercialização de carne de suíno, em carcaça ou desmanchada, carne de bovino, como picanhas, alcatras, lombo e carne de caprino, ovino e aves. A empresa não possui nenhuma certificação, estando apenas implementado o sistema *HACCP* e o respetivo Programa de Pré-Requisitos. Inicialmente realizou-se uma auditoria diagnóstica, onde foram identificadas várias não conformidades, de onde foi elaborado um plano de trabalhos e de obras, de modo a responder aos requisitos da norma. No total foram redigidos vários procedimentos e impressos de acordo com as exigências deste sistema de Gestão de Qualidade. Na elaboração dos fluxogramas foram considerados 2 pontos críticos de controlo 1 e 2, o acondicionamento a vácuo e o detetor de metais e descritos os respetivos controlos. A implementação dos documentos permitiu consolidar as práticas já realizadas na empresa, tendo sido realizada recentemente uma auditoria final ao sistema global, de onde resultou a respetiva certificação com classificação B e 14 não conformidades menores. Após implementação, verificou-se que a empresa tem um controlo mais eficiente e dinâmico dos riscos para a segurança alimentar, proporcionou melhorias na documentação, incorporou os Programas de Pré-Requisitos no sistema de gestão da empresa, permitiu uma comunicação organizada e eficaz com as partes interessadas, facilitou o cumprimento da legislação aplicável e prevê-se uma redução dos custos de possíveis erros na cadeia de produção.

Palavras-chave: Sistema de global de gestão da Qualidade; BRC Food, não conformidades BRC Global Standards, “Global Standard Food Safety Issue 7,” **2015**.

CP060

PORTUGUESE OLIVE OILS AND TABLE OLIVE WITH QUALITY CERTIFICATION SCHEMES: ACHIEVEMENTS AND NEEDS

Tânia Gonçalves Albuquerque^{1,2*}, Helena S. Costa^{1,2}, M. Beatriz P.P. Oliveira²

¹ *Departamento de Alimentação e Nutrição, Instituto Nacional de Saúde Doutor Ricardo Jorge, I.P., Lisboa, Portugal*

² *REQUIMTE, LAQV/Faculdade de Farmácia da Universidade do Porto, Portugal*
*tania.g.alb@gmail.com

Olive oil is, all over the World, but especially among Mediterranean consumers, perceived as a source of valuable natural compounds with putative health benefits. To protect consumers, but also producers from unfair practices, European Union has launched legislation on different EU quality schemes, namely Protected Designation of Origin (PDO), Protected Geographical Indications (PGI) and Traditional Specialty Guaranteed (TSG). The current review intends to provide an overview of relevant research concerning Portuguese PDO olive oils and table olives.

The electronic databases PubMed, Web of Science, Google Scholar, Science Direct, Database of origin and registration (DOOR) and Food and Agriculture Organization of the United Nations Statistics (FAOSTAT) were searched to perform this review. The following criteria were applied for manuscripts inclusion: (i) English or Portuguese language; and (ii) data on Portuguese olive oils and table olives. Studies on marketing and business, as well as consumers' preferences were excluded.

Concerning olive oils and table olives, across European countries, up to now, there are 102 olive oils and 21 table olives registered as PDO or PGI, and the countries with the highest percentage of registered foods are Italy, Spain and Greece, which are Mediterranean countries.

For the phytochemical characterization of Portuguese PDO olive oils and table olives, there is a lack of information in the literature, especially for PDO Negrinha de Freixo and PDO Elvas and Campo Maior table olives. Regarding olive oils, PDO Trás-os-Montes and PDO Norte Alentejano are the most studied. According to this literature review, for Portuguese PDO olive oils, the most frequent compounds assessed up to now are vitamin E and carotenoids. For instance, a range between 95.9 and 260 mg/kg for α -tocopherol was reported for PDO Trás-os-Montes olive oils, while for PDO Norte Alentejano olive oils it varied from 92.6 to 198 mg/kg.

Undoubtedly, data concerning the phytochemical characterization of these PDO olive oils and table olives is of utmost importance to accurately distinguish them from other similar products and to highlight their differences. Further studies, especially concerning parameters that allow confirming the authenticity and origin of Portuguese PDO olive oils and table olives are crucial.

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CP061

DIFFERENTIATION OF APPLE JUICES ACCORDING TO VARIETY AND GEOGRAPHIC ORIGIN BASED ON GLOBAL VOLATILE PATTERNS

Sonia Medina¹, Rosa Perestrelo¹, Rui Santos¹, Regina Pereira², José S. Câmara^{1,3*}

¹CQM – Centro de Química da Madeira, Universidade da Madeira, Campus da Penteada, 9020-105 Funchal, Portugal

²Direcção Regional da Agricultura. Avenida Arriaga, n.º 21 A, Edifício Golden Gate, 3.º andar 9000-060 Funchal

³ Faculdade de Ciências Exatas e da Engenharia da Universidade da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal;

*Email: jsc@staff.uma.pt

Apple (*Malus domestica*) juice is a complex matrix with hundreds of volatile organic compounds (VOCs) related to the perceived odour attributes linked to aroma quality [1]. The VOCs concentration may change by variety, fruit ripeness, geographic origin or production system. In fact, for fruit juices, the main authenticity issues are related with false labelling of products in terms of their variety or geographical origin [2]. For that reason, the aim of the present study was to establish distinctive characteristics for the discrimination of apple juices according to apple variety and geographic origin from Madeira Island on the basis of their global volatile pattern by headspace solid-phase microextraction coupled with gas chromatography and mass spectrometry (HS-SPME/GC-MS) together with chemometrics tools. The results obtained through chemometrics analysis revealed a perfect discrimination between the apple varieties, with Rijo apple juices as samples with the major relative concentration of ethanol, ethyl butanoate, ethyl 2-methylbutanoate and ethyl hexanoate that bring sweet and fruity aroma descriptors. Moreover, this study allowed geographical origin-based classification of Azedo apple juices, demonstrating that VOCs profile could serve as authenticity indicators to verify variety and geographic origin of apples juices of regional apples varieties. These results could enable regional government to valorize apple varieties to receive the certification as Protected Designation of Origin (PDO) or Traditional Speciality Guaranteed (TSG), providing local producers multiple benefits and a legal protection against misuse of the products.

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[1] Aprea, E.; Corollaro, M. L.; Betta, E.; Endrizzi, I.; Demattè, M. L.; Biasioli, F.; Gasperi, F. *Food Research International* **2012**, *49*, 677–686.

[2] Gan, H. H.; Soukoulis, C.; Fisk, I. *Food Chemistry* **2014**, *146*, 149-156.

CP062

CARACTERIZAÇÃO FÍSICO-QUÍMICA DE AZEITES MONOVARIETAIS PROVENIENTES DA REGIÃO DO ALENTEJO

Sofia Costa¹, Carolina Rodrigues¹, Victor Gomes Lauriano Souza¹, Ana Luísa Fernando¹

¹MEtRICs, Departamento de Ciências e Tecnologia da Biomassa (DCTB), Faculdade de Ciências e Tecnologia, Universidade NOVA de Lisboa, Caparica, Portugal
(Costa: as.ribeiro@campus.fct.unl.pt; Rodrigues: cpe.rodrigues@campus.fct.unl.pt; Souza: v.souza@campus.fct.unl.pt; Fernando: ala@fct.unl.pt)

O azeite é um dos principais componentes da dieta mediterrânica e a maior área de produção de azeite em Portugal localiza-se na região do Alentejo. A qualidade do azeite está dependente de diversos fatores diretamente relacionados com o cultivar, bem como o modo de cultivo e todo o processo de laboração até à obtenção do produto final. A caracterização físico-química de azeites contribui para a obtenção de um produto de qualidade, permitindo a sua classificação. A caracterização de azeites monovarietais permite identificar a singularidade das características de cada cultivar que lhe conferem propriedades únicas, permitindo acrescentar valor. Como tal, pretendeu-se com este estudo contribuir para o conhecimento da composição química de azeites monovarietais provenientes da região do Alentejo.

Para obtenção dos azeites em estudo, foram utilizadas sete cultivares distintas: Arbequina, Blanqueta, Cordovil, Cobrançosa, Galega vulgar, Picual e Verdeal de Serpa, provenientes de diferentes explorações agrícolas localizadas na região do Alentejo. Após colheita das azeitonas, o azeite foi extraído com recurso ao método Abencor. Visando a obtenção da caracterização físico-química dos azeites obtidos, diversas análises foram realizadas tanto às azeitonas como ao azeite extraído destas. O teor de humidade nas azeitonas é variável dependendo da cultivar (43,8% a 59,6%) sendo a Galega vulgar a que apresenta o valor mais elevado para este parâmetro. O valor de gordura em matéria seca apresenta-se semelhante na maioria das cultivares (38% a 46,7%) apresentando a Verdeal de Serpa o maior valor. Relativamente ao teor de ácidos gordos livres, todas as amostras de azeite apresentaram valores inferiores a 0,4% de ácido oleico, correspondendo à classificação de azeite virgem extra segundo a legislação em vigor. Os valores obtidos relativamente ao índice de peróxidos classificam os azeites em estudo como azeite virgem extra (inferiores a 20 mEq.O₂/kg), apresentando a cultivar Arbequina o valor mais elevado para este parâmetro (11 mEq. O₂/kg). Quanto aos valores obtidos para os índices espectrofotométricos, no parâmetro k_{232} os valores variaram entre 0,17 (cultivar Galega vulgar) e 2,49 (cultivar Blanqueta) enquanto que no parâmetro k_{270} as cultivares Blanqueta, Cobrançosa e Verdeal de Serpa apresentaram valores limítrofes à sua classificação como azeite virgem extra. Analisando o Δk observa-se que a maioria dos azeites em estudo permite a classificação dos produtos como azeite virgem extra, uma vez que se encontram abaixo do limite estabelecido de 0,01. Relativamente ao teor de compostos fenólicos totais, estes oscilaram entre 27 (Arbequina) e 262 mg EAG/kg (Verdeal de Serpa). A actividade antioxidante variou entre 0,43 (Galega vulgar) e 0,87 mg equivalentes ácido ascórbico/ kg (Blanqueta).

CP063

CISTUSRUMEN PROJECT – USE OF *CISTUS LADANIFER* L. IN RUMINANT DIETS TO IMPROVE PRODUCTS QUALITY

Cristina Pinheiro^{1,2*}, Ana L. Garrido², Elsa Lamy¹, Lénia Rodrigues¹, Letícia Fialho³, Liliana Cachucho³, David Soldado³, Olinda Guerreiro³, Eliana Jerónimo^{1,3}

¹ICAAM, U. Évora, Ap. 94, 7006-554 Évora

²Departamento de Zootecnia, ECT, U. Évora, Ap. 94, 7006-554 Évora

³Centro de Biotecnologia Agrícola e Agro-Alimentar do Alentejo(CEBAL)/IPBEJA, Rua Pedro Soares, s.n, Campus IPBeja, 7801-908 Beja, Portugal

[*ccp@uevora.pt](mailto:ccp@uevora.pt)

The production of small ruminants, is of significant economic interest in the Mediterranean region, and is mostly based on pasture utilization and follows the pasture availability pattern. Due to climate changes, numerous essential activities in this region are being increasingly affected, more specifically, the performance of sheep and goat, which have been decreasing during the last years because to the constant increase of animal food cost. This problematic leads to the development of alternative systems, and search by alternative feeding resources.

Cistus ladanifer L. (rockrose) is a perennial shrub, of the family *Cistaceae*, which grows spontaneously in the Mediterranean countries, it is well adapted to the climate and possibly to upcoming environmental changes. In Portugal, it is widely distributed from north to south, and is one of the most abundant shrubs. This plant is rich in phenolic compounds, particularly flavonoids in the exudate secreted by the plant and condensed tannins in the leaves and stems. Since that in the Mediterranean countries the extensive livestock production systems are often based on the consumption of tannin-rich feed, especially during periods of pasture scarcity, the use of this natural resource may be a viable solution for animal food. This type of diet, rich in phenolic compounds, may have an important effect on chemical and sensorial characteristics of ruminant products [1-3].

CistusRumen project aims to explore the utilization of the *Cistus ladanifer* plant or its condensed tannins in small ruminant diets, namely evaluating the potential of these nutritional strategies to improve the quality of their products (meat, milk and cheese), particularly the fatty acid profile, oxidative stability and organoleptic properties. Result show that these nutritional strategies allow improve the nutritional value of lipids from lamb meat, increasing the healthy fatty acids levels (vacenic and rumenic acids) [2,3]. Moreover, inclusion of *Cistus ladanifer* in lamb diets also limit the lipid oxidation in meat, even in meat more susceptible to oxidation [4]. The same nutritional strategies are being tested in dairy production systems, with evaluation of its impact on the quality of milk and cheese.

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[1] Vasta, V.; Nudda, A.; Cannas, A.; Lanza, M.; Priolo, A. *Animal Feed Science and Technology* **2008**, *147*, 223-246. [2] Jerónimo, E.; Alves, S.; Dentinho, M.; Martins, S.; Prates, J.; Vasta, V., Santos-Silva, J., Bessa, R. **2010**. *Journal of Agricultural and Food Chemistry*, *58*, 10710-10721. [3] Guerreiro, O.; Alves, S.; Soldado, D.; Cachucho, L.; Almeida, J.; Francisco, A.; Santos-Silva, J.; Bessa, R., Jerónimo, E. unpublished data. [4] Jerónimo, E.; Alfaia, C.; Dentinho, M.; Prates, J.; Vasta, V., Santos-Silva, J., Bessa, R. **2012**. *Meat Science*, *92*: 841–847.

CP064

DOE: HIGH PRESSURE PROCESSING AS A PRE-TREATMENT FOR PRODUCTION OF RAW EWE MILK-CHEESE

Rita S. Inácio^{1,2}, Jorge A. Saraiva², Ana M. P. Gomes¹

¹*Center of Biotechnology and Fine Chemistry (CBQF), School of Biotechnology of Portuguese Catholic University, Porto, Portugal*

²*Research Unit of Organic Chemistry, Natural and Agro-food Products (QOPNA), Chemistry Department, Aveiro University, Aveiro, Portugal. ritainacio@ua.pt*

Serra da Estrela protected designation of origin cheese is produced with raw milk from a specific geographical area, which has been becoming scarcer given the many hurdles. However, high pressure (HP) milk treatment may lead to cheese yield increment, yet the pressure intensity, holding time under pressure, and waiting time before and after HP treatments still need to be studied to do so, hence were established as the main objectives of this research work. In a first step, a screening experimental design was performed (100 – 300 MPa; 5 – 30 min; 1 – 48 h waiting time before HP; 1 – 24 h after HP, according to the four variables selected), and the results achieved allowed to pinpoint that the pressure intensity, holding time under pressure, and time after HP are the most important factors. Then, a second screening experiment (100 - 400 MPa; 5 min; 48h, 24h) revealed that HP at 400 MPa was a too intense treatment for beneficial microbiota to contribute positively to cheese ripening. Finally, the application of a response surface model (100 – 300 MPa; 5 – 30 min, 24h before HP, 24h after HP), considering of high importance a lower reduction of lactococci, lactobacilli, and enterococci viable cell numbers, allowed to achieve as optimum HP conditions the treatment at 121 MPa for 30 min. After the model was validated, having been confirmed the predicted results given by statistical software, a further scale-up experiment was performed. In such real production environment, a cheese yield increase of 10.4% was achieved with milk pre-treated under the optimal conditions. Furthermore, HP milk treatment led to some microbial reduction in milk, small effect on curd and without significant differences in ripened cheese microbiota (total mesophilic, lactococci, enterococci, staphylococci, *Enterobacteriaceae*, coliforms, *E. coli*, and yeasts and moulds viable cells number) and with interesting impact on sensory attributes. Based on the above results, HP can be seen as a promising non-thermal treatment for ewes milk to inactivate contaminant bacteria yet with no negative effect on lactic acid bacteria responsible for the unique flavor, texture and taste of Serra da Estrela Cheese.

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CP065

Physicochemical characteristics of a southern European cabbage "Penca da Póvoa" (*Brassica oleracea* L. var. *Costata*) dietary powder obtained by different drying processes

Cristina Duarte¹, Patrícia Sousa ¹, Rita Pinheiro^{1,2}, Manuela Vaz Velho

¹ Instituto Politécnico de Viana do Castelo, Portugal

² Centro de Engenharia Biológica, Universidade do Minho, Braga, Portugal
duartede@ipvc.pt

The Southern European Atlantic Diet (SEAD) is the traditional diet of northern Portugal and Galicia, a region in northwest of Spain [1]. Cabbages are a traditional vegetable widely grown and consumed among these regions and are part of the southern European Atlantic Diet. The nutritional use of local vegetables and their potential health benefits are recognized as important domains of research. Also, from the sustainability and food security point of view, it is also considered with great potential once using processing cabbage by-products and surplus, which are usually discarded, to produce value-added products [2, 3]. The aim of this study was to produce a nutritional rich dietary fibre powder from cabbage using different drying processes: convective air-drying and freeze-drying. The type of Brassica species known as "Penca da Póvoa" (*Brassica oleracea* L. var. *costata*) cabbage was used to produce the dietary fibre powder. The work focused on colour (L^* , a^* , b^*), moisture and chemical (ash, protein, carbohydrates and fibre) properties behaviour of cabbage powder produced under two different drying processes. Fresh cabbage was dried through two different drying methods: air-drying (80°C, 2h with previous bleaching) and freeze-drying. An ANOVA with Tukey test was used to investigate significant differences ($p < 0.05$) in physicochemical parameters. Results showed that fresh cabbage presented lower ash, protein, carbohydrates and fibre contents than cabbage dried powder ($p < 0.05$) regardless of the type of drying process. No significant differences ($p > 0.05$) were found in carbohydrates content for air-drying and freeze-drying, $24.4 \pm 3.90\%$ and $25.1 \pm 3.97\%$, respectively. However, air-drying led to higher protein contents ($2.86 \pm 0.058\%$) than freeze-drying ($2.55 \pm 0.01\%$). On the contrary, freeze-drying led to higher fibre content ($15.9 \pm 0.79\%$) when compared to air-drying ($14.8 \pm 0.65\%$). On the other hand, cabbage colour was strongly influenced by drying process methods and conditions. Greenness (a^*) and yellowness (b^*) parameters, in both drying processes, were significantly different ($p < 0.05$). Regarding lightness parameter (L^*) no significant differences ($p > 0.05$) were found between fresh cabbage and the drying process cabbage. Results obtained led to the conclusion that the type of drying process influences the nutritional characteristics of the cabbage powder produced. From this work it was concluded that drying processes can be an important method to produce a rich dietary fibre with potential application for the development of new value-added products.

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[1] Guallar-Castillón P., Oliveira A., Lopes C., López-García E., Rodríguez-Artalejo F. Atherosclerosis, 2013, 226, 502-509.

[2] Batista C., Barros L., Carvalho A., Ferreira I. Food and Chemical Toxicology, 2011, 49, 1208-1214.

[3] Tanongkankit Y., Chewchan N., Devahastin S. Food and Bioproducts processing, 2012, 90, 541-548.

CP066

NEWFOOD PROJECT - FOOD TECHNOLOGIES VALORIZATION IN TRADITIONAL FOODS SECTOR

Leandro Oliveira¹, Graça Teixeira¹, Duarte Torres^{2,3} & Eduardo Luís Cardoso¹

¹*Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Arquiteto Lobão Vital, 172 4200-374 Porto, Portugal, email: ecardoso@porto.ucp.pt*

²*Faculdade de Ciências da Nutrição e Alimentação, Universidade do Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal*

³*EPIUnit - Instituto de Saúde Pública, Universidade do Porto, Rua das Taipas, nº 135, 4050-600 Porto, Portugal*

The European food and drink sector is unique in its very high regional and continent-wide cultural diversity, which is not only a point of pride for many citizens, but also provides a framework ideally suited to foster creativity and innovation. The great variety of regional culinary traditions that have developed across Europe over the centuries ensure that the food and drink sector is deeply rooted in society [1].

The NEWFOOD - Food Technologies Valorization project joins the ambitions of the 4 public Universities of the Northern Region (University of Trás-os-Montes and Alto Douro, Portuguese Catholic University - Porto Regional Center, University of Minho and University of Porto) to accelerate the expansion and consolidation of the so-called "traditional products" through a proposal of innovation catalyzed by the transfer of knowledge and technology.

This project proposes three Actions that are articulated: (i) develop a knowledge and skills map of the Region and an inventory of the needs of the sector to ensure the innovation process focused on the central axes of expansion and consolidation of the sector; (ii) promote innovation projects aimed at generating new products / solutions of economic relevance in the "Traditional Products" sector and (iii) actively disseminate knowledge, skills and resources to the entities involved, including stakeholders from the relevant economic sectors.

Critical factors for the competitiveness of the traditional products sector will thus be worked out. Given the territorially distributed nature of the project, it will also promote the competitiveness of the Region associated with Agro-food activity, but also with related activities such as Tourism.

The dissemination, both national and international, of knowledge and traditional products will contribute to the notoriety and attractiveness of the Region and the Country, adding value in the production chains. In this way, it is intended to support the internationalization of value added products such as traditional products, thus promoting the competitiveness of the agri-food industry.

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[1] European Technology Platform Food for Life. Food for Tomorrow's Consumer. 2016, Brussels, Belgium: ETP 'Food for Life'.

CP067

CONVECTIVE AIR-DRYING AND FREEZE-DRYING EFFECT ON PHYSICO-CHEMICAL PROPERTIES OF DEHYDRATION VEGETABLES: CUCUMBER (*Cucumis sativus*) AND ZUCCHINI (*Cucurbita pepo* L.)

Ana Patrícia Sousa¹, Manuela Vaz Velho¹, Rita Pinheiro^{1,2}

¹*Escola Superior de Tecnologia e Gestão, Instituto Politécnico de Viana do Castelo, Viana do Castelo, Portugal*

²*Centro de Engenharia Biológica, Universidade do Minho, Braga, Portugal
apatriciasousa@estg.ipvc.pt*

In last years, fruits and vegetables have received considerable attention, as these materials have been reported to contain a wide array of phytochemicals, which are claimed to exert many health benefits [1]. However, these products are often overproduced and discarded, generating large amounts of waste. Fruits and vegetables have high moisture content (around 80%) and deteriorate over a short period of time [2]. One possibility to take advantage of these products is through drying process, which is a way to take advantage of them by assigning added value. Therefore dried fruits and vegetables have gained interest in the food industry [3].

The objective of this work was to produce dehydrated vegetables, Cucumber (*Cucumis sativus*) and Zucchini (*Cucurbita pepo* L.), using two different drying processes: convective air-drying and freeze-drying. Concerning convective air-drying, two temperatures, 60°C and 70°C, were studied. The work focused on texture, colour, moisture and ash properties behaviour of Cucumber and Zucchini produced under two different drying processes. An ANOVA with Tukey test was used to investigate significant differences ($p < 0.05$) in parameters. After washing and disinfection, vegetables were cut into 4.5 mm thick discs and then went to drying process. Samples were taken after 6, 8, 14, 16, 18 and 24 hours, for both temperatures.

Results showed that fresh Cucumber and Zucchini presented ash content much lower than dehydrated vegetables ($p < 0.05$) regardless of the type of drying process and temperature. It was found that $\approx 5\%$ moisture content was reached with 60°C air-drying after 18h and 16h for Cucumber and Zucchini, respectively and with 70°C after 16h and 8h for Cucumber and Zucchini, respectively. A moisture content of $\approx 10\%$ was reached at the end of the freeze-drying process for both vegetables. Concerning texture characteristics, drying process strongly decreased hardness values for both vegetables studied ($p < 0.05$). As to colour parameters, freeze drying process increased the brightness (L^*) of the Cucumber ($p < 0.05$). There were no significant differences on L^* with air-drying process, for both temperatures. The opposite behaviour was obtained in the case of Zucchini.

From this work it was concluded that drying processes can be a good alternative to obtain a commercial value-added product. Making it possible the use of vegetable surplus production, increasing its shelf-life and with lower transportation costs.

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[1] Karam, M. C., Petit, J., Zimmer, D., Djantou, E. B., & Scher, J. *Journal of Food Engineering* **2016**, 188, 32-49.

[2] Orsat, V., Changrue, V., & Raghavan, G. *Stewart Postharvest Review* **2006**, 6, 4-9.

[3] Zhang, M., Tang, J., Mujumbar, A. S., & Wang, S. *Trends in Food Science & Technology* **2006**, 17, 524-534.

CP068

CALLUNA VULGARIS (L.) HULL: COMPOSIÇÃO NUTRICIONAL E CARACTERIZAÇÃO DO PERFIL FENÓLICO

Filipa Mandim¹, Lillian Barros¹, Eliana Pereira¹, Paulo F. Santos², Isabel C. F. R. Ferreira^{1*}

¹Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

² Centro de Química – Vila Real (CQVR), Universidade de Trás-os-Montes e Alto Douro, 5001-801 Vila Real, Portugal

*iferreira@ipb.pt

O aumento da qualidade de vida, através da adoção de um estilo de vida saudável e de boas práticas alimentares, tem cada vez mais importância na sociedade atual. O consumo de produtos de origem natural é cada vez mais procurado, contribuindo para que a caracterização e exploração destes produtos seja uma importante e ascendente área de investigação [1].

Calluna vulgaris (L.) Hull, vulgarmente conhecida por urze ou torga, é um arbusto de pequenas dimensões. É amplamente utilizada na medicina tradicional devido às diferentes propriedades medicinais que lhe são associadas, entre as quais, propriedades antissépticas, anti-inflamatórias, antirreumáticas e diuréticas [2].

As sumidades floridas deste arbusto foram analisadas relativamente ao seu valor nutricional. Foi determinado o teor em cinzas, gorduras, proteínas, hidratos de carbono, e o valor energético, utilizando métodos oficiais de análise de alimentos [3]. Foram ainda determinados os perfis individuais de ácidos gordos, ácidos orgânicos, açúcares livres e tocoferóis por métodos cromatográficos. Os hidratos de carbono foram os macronutrientes maioritários, seguidos de proteínas e lípidos. Os açúcares identificados foram glucose e frutose. Os ácidos oxálico, quínico, ascórbico e cítrico foram os quatro ácidos orgânicos identificados. Verificou-se também a presença das quatro isoformas de tocoferóis e de dezasseis ácidos gordos.

O perfil fenólico de cinco extratos orgânicos obtidos através de um processo de extrações sucessivas, por maceração, à temperatura ambiente e sob vigorosa agitação, com solventes orgânicos de crescente polaridade (*n*-hexano, diclorometano, acetato de etilo, acetona e metanol) foi analisado por HPLC-DAD-ESI/MS; bem como o de dois extratos aquosos: infusão e decocção. Dos 12 compostos fenólicos identificados, a miricetina-3-O-glucósido e a miricetina-O-ramnósido revelaram ser os compostos maioritários.

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[1] Martins, N.; Ferreira, I. C. F. R. *Trends in Food Science & Technology* **2017**, 67, 12-18.

[2] Monschein, M.; Neira, J. I.; Kumert, O.; Bucar, F. *Phytochemistry Reviews* **2010**, 9, 205-215.

[3] George, W.; Latimer, J. *Official Methods of Analysis of AOAC International* – 20th Ed. (W. George & J. Latimer Editores) **2016**.

CP069

Avaliação do perfil fenólico de duas plantas comumente utilizadas na medicina tradicional, após aplicação de irradiação ionizante

Eliana Pereira¹, Andreia Pimenta², Filipa Mandim¹, Ricardo C. Calhella¹, Amílcar L. Antonio¹, Lillian Barros¹, Celestino Santos-Buelga³, Sandra Cabo Verde², Isabel C.F.R. Ferreira^{1*}

¹Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal;

²Centro de Ciências e Tecnologias Nucleares, Instituto Superior Técnico, Universidade de Lisboa, Estrada Nacional 10 (km 139,7), 2695-066 Bobadela LRS

³GIP-USAL, Facultad de Farmacia, Universidad de Salamanca, Campus Miguel de Unamuno, 37007 Salamanca, Spain.

*iferreira@ipb.pt

Os compostos fenólicos têm sido associados a diferentes efeitos benéficos nomeadamente, na prevenção de doenças, nomeadamente diabetes, cancro, doenças cardiovasculares, obesidade, doenças neuro-degenerativas, entre outras. São várias as matrizes que representam uma boa fonte deste tipo de compostos, principalmente no reino vegetal [1,2]. Assim, este estudo pretendeu avaliar os efeitos da radiação gama na composição fenólica de extratos aquosos, obtidos por infusão de duas plantas comumente apreciadas pelo consumidor e usadas na medicina tradicional - *Aloysia citrodora* L. e *Mentha x piperita* L.. O tratamento de irradiação foi realizado através de uma câmara de ⁶⁰Co, aplicando as doses de 1 e 10 kGy e os resultados foram comparados com amostras controlo (0 kGy). O perfil fenólico foi obtido por HPLC-DAD-ESI/MS. Foram identificados 11 e 14 compostos fenólicos (derivados de flavonoides e ácidos fenólicos) nas espécies *A. citrodora* e *M. piperita*, respetivamente. Relativamente aos resultados obtidos após a aplicação deste tipo de processamento, foi evidente que as amostras submetidas a uma dose de irradiação de 10 kGy, revelaram diferenças estatisticamente significativas no perfil fenólico de ambos os extratos estudados, comparativamente com a amostra controlo (0 kGy), evidenciando um aumento na maioria dos compostos, como também nos teores de ácidos fenólicos totais e compostos fenólicos totais [3]. Assim, este estudo contribuiu para um conhecimento mais amplo dos efeitos da irradiação gama na caracterização destas moléculas em algumas plantas medicinais, revelando também que este tipo de processamento é uma técnica recomendada para aplicação nesta matriz.

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[1] Esfanjani, A.F.; Assadpour, E.; Jafari, S.M. *Trends in Food Sci & Technol*, **2018**, *76*, 56-66.

[2] Qin, Y.; Wang, L.; Liu, Y.; Zhang, Q.; Li, Y.; Wu, Z. *J. Funct Foods*, **2018**, *46*, 57-65.

[3] Pereira, E.; Pimenta, A.I.; Calhella, R.C.; Antonio, A.L.; Cabo Verde, S.; Barros, L.; Santos-Buelga, C.; Ferreira, I.C.F.R. *LWT - Food Sci Technol*, **2016**, *71*, 370-377.

CP070

PROTEOLYSIS OF PDO SERPA CHEESE MADE WITH *CYNARA CARDUNCULUS* L. ECOTYPES DURING RIPENING

Pinheiro, C.^{1,2}, Garrido, A. L.², Lage, P.³, Lamy, E.¹, Rodrigues, L.¹, Alvarenga, N. B.^{3,4,5}, Dias, J.^{3,6}, Martins, A. P. L.^{4,5} and Duarte, M. F.^{1,7}

¹ICAAM, U. Evora, Ap. 94, 7006-554 Évora

²Departamento de Zootecnia, ECT, U. Evora, Ap. 94, 7006-554 Évora

³ESA-Instituto Politécnico de Beja, Rua Pedro Soares, 7800-295 Beja, Portugal

⁴UTI-INIAV, Quinta do Marquês, Oeiras, Portugal

⁵LEAF-ISA, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisbon, Portugal

⁶GeoBioTec, Un. Nova de Lisboa, Campus da Caparica, 2829-516 Caparica, Portugal

⁷CEBAL/IPBeja, Rua Pedro Soares, s.n, Campus IPBeja, 7801-908 Beja, Portugal

Portugal and Spain have a strong tradition of cheesemaking from raw ewe's cheese made with the aqueous extracts of *Cynara cardunculus* L. dried flowers. Serpa cheese is an example of a Portuguese regional cheese with the label of Protected Designation of Origin (PDO), that is characterized with a semi-soft texture and an exquisite flavor.

The renewed interest in the enzymes of the *Cynara cardunculus* L. coagulant prompted to the aim of this work that was to evaluate the effect of *Cynara cardunculus* L. three ecotypes on Serpa cheese proteolysis. Therefore, cheese samples were analysed by urea-PAGE, and nitrogen fractions (total nitrogen, water soluble nitrogen and non-protein nitrogen) and three ecotypes were used (*Cynara* 1, *Cynara* 2, *Cynara* 3) and compared with a commercial animal rennet (Animal) after 0, 2 and 5 weeks of ripening. It was possible to establish the pattern of the casein fractions degradation and, at the end of ripening (5weeks), results showed that no significant differences were found in cheeses made with the three ecotypes, and they showed a higher degradation of α s-caseins (47,42%) than β -caseins (24,27%). However, differences were found between cheeses made with the vegetable coagulant and those made with animal coagulant, especially regarding β -caseins results. Observing the nitrogen fractions, all samples obtained with vegetable coagulant presented a higher degree of proteolysis than the samples coagulated with rennet, being *Cynara* 1 the coagulant that presented higher proteolytic power.

Keywords: urea-PAGE; *Cynara cardunculus* L; proteolysis; caseins; Serpa cheese.

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CP071

PRODUCTION OF MISO FROM PORTUGUESE GRASS PEA VARIETIES: A NEW USE FOR TRADITIONAL LEGUMES TO PROMOTE THE COMSUMPTION OF GRASS PEA

Rafaela Santos¹, Ana Mansidão¹, Mariana Mota¹, Catarina Prista¹, Anabela Raymundo¹

1LEAF, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda 1349-017 Lisboa, Portugal. Email of author for contact: rqsantos@isa.ulisboa.pt

Grass pea (*Lathyrus sativus* L.) is a robust grain legume with high protein, fiber, starch and phenolics content, and its consumption is linked to several health benefits[1]. In Portugal, grass pea is part of the traditional heritage of dryland communities, representing an important source of revenue for some local economies such as Alvaiázere, which are trying to re-introduce the production and the consumption this forgotten legume[2].

Eastern fermented foods, based on seed fermentations are among the most desired by consumers for their nutrition value and potential as functional foods. However, these products are usually produced from soybeans, not common in Portuguese gastronomy, and spontaneous and poorly characterized fermentations under non-controlled conditions, non-compatible with the high quality standards demanded by Western consumers.

Traditionally, grass pea is processed by cooking after soaking, and additional processing strategies, such as fermentation, can improve its nutritional/organoleptic quality, once many fermentation processes of plant crops result in a significant increase in their soluble fraction and digestibility and a decrease of toxic compounds[3]. The aim of the present study was to develop two types of miso – red miso and white miso – using traditional grass pea and ancient Eastern methodologies, under standardized and controlled conditions. Soybean fermentation was used as control.

Linear viscoelastic behaviour and texture characterization of the different types of miso were evaluated along the fermentation process. Firmness and adhesiveness of the white miso decreased after 15 days, while the firmness of red miso decreased after 1 month. As for adhesiveness, red miso remained constant (using grass pea) or had a slight decreased (using soybeans). During the next six months, no significant changes were observed in these two parameters. In terms of viscoelastic components, a reduction of the degree of structure over time was observed for two types of miso – red miso and white miso – and for the two legumes. However, miso from grass pea had higher values of G' and G'' . This aspect may reflect the higher degree of internal structure of grass pea miso resulting from its highest carbohydrate.

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[1] Arnoldi, A.; Zannoni, C.; Lammi, C.; Boschin, G. *Critical Reviews in Plant Sciences* **2015**, *34*, 144-168.

[2] Vaz Patto, M. C. *Grain Legumes* **2009**, *54*, 38-39.

[3] Murekatete, N.; Hua, Y.; Kong, X.; Zhang, C. *International Journal of Food Engineering* **2012**, *8*, 1-15.

CP072

AVALIAÇÃO DA FLOR DE CARDO *CYNARA CARDUNCULUS* L. DE ECÓTIPOS DO ALENTEJO PARA O FABRICO DE QUEIJO

S. Gomes¹, M.J. Trigo², A.T. Belo¹, N.B. Alvarenga^{2,7}, J. Dias³, P. Lage³, M.J. Carvalho³, C. Pinheiro^{4,5}, E. Machado⁵, A.F. Belo⁴, C. Cruz⁴, A. Paulino⁶, T. Brás⁶, M.F. Duarte^{4,6}, A.P.L. Martins^{2,7}
sfgomes86@gmail.com

¹UEISPSA-INIAV, Pólo de Santarém, 2005-048 Vale de Santarém, Portugal

²UTI-INIAV, Quinta do Marquês, 2780-157 Oeiras, Portugal

³ESA-Instituto Politécnico de Beja, (IPBeja), 7800-295 Beja, Portugal

⁴ICAAM, Universidade de Évora, Ap. 7006-554 Évora, Portugal

⁵ECT, Universidade de Évora, 7000-671 Évora, Portugal

⁶CEBAL/IPBeja, 7801-908 Beja, Portugal

⁷LEAF-ISA, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal

O uso da flor de cardo *Cynara cardunculus* L. como coagulante é obrigatório em alguns tipos de queijos tradicionais, designadamente os que beneficiam de Designação de Origem Protegida (DOP). A utilização da flor não é, em geral, sujeita a um controlo de utilização tecnológica adequado ao importante papel que os coagulantes têm para as características do queijo. A planta continua a crescer de forma espontânea e a flor é colhida sem qualquer critério que não seja o conhecimento empírico. Em consequência, a utilização do cardo é suscetível de introduzir um elevado grau de incerteza no fabrico de queijo, dada a relevância que lhe é atribuída e que vem sendo demonstrada em diversos estudos. Este trabalho teve como objetivo caracterizar, avaliar e comparar o potencial da flor de diferentes ecótipos de cardo da região do Alentejo para a utilização no fabrico de queijo.

Amostras representativas de flor de cardo de diferentes populações dispersas pela região do Alentejo, designadas por ecótipos, foram recolhidas ao longo de duas épocas de floração sucessivas. As amostras foram avaliadas através de critérios relacionados com as respetivas propriedades tecnológicas considerando a sua utilização como coagulante no fabrico de queijo. A partir de uma extração de tipo tradicional (maceração em almofariz de pistilos da flor) com tampão acetato pH 5.5, a atividade coagulante dos extratos foi avaliada segundo a norma IDF 199/ISO 23058. A atividade proteolítica foi avaliada através da libertação de NNP em ensaios de coagulação a 32°C. O efeito no rendimento potencial no fabrico de queijo foi avaliado após dessoramento, considerando as propriedades de sinérese da coalhada obtida em ensaios de coagulação à escala laboratorial. A evolução da coagulação para os extratos de flor de cada ecótipo e as propriedades do coágulo foram monitorizadas em tempo real e analisadas utilizando o Optigraph.

Os resultados foram analisados através de técnicas exploratórias de estatística multivariada, procurando a comparação entre ecótipos e a avaliação da diversidade natural do cardo, a qual pode eventualmente justificar alguma da variabilidade da qualidade ou das características do produto final e contribuir para a clarificação da respetiva influência na produção e qualidade do queijo.

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CP073

Effect of foliar mitigation treatments on Touriga Nacional grape berry quality

**Rupesh Kumar Singh^a, Virgílio Falco^a, Marta Nogueira^a, Jessica Afonso^a,
Fernanda Cosme^a**

^a*Centro de Química de Vila Real (CQ-VR), UTAD, 5000-801, Vila Real, Portugal*

The grapevine physiology is influenced by several factors, such as temperature, precipitation, potential evapotranspiration and sunshine hours. Thus, due to climatic changes, effects in the grapevine physiology and consequently on the grape berry composition and quality have been observed. These changes in solar radiation, temperature and precipitation resulting from climate change have led to the development of mitigation strategies, such as foliar exogenous application of kaolin $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$, a radiation-reflecting inert mineral, that has demonstrated to be an effective short-term climate change mitigation strategy for Mediterranean vineyards [1]. Kaolin, a white, inert clay mineral, has been used to reduce heat stress in plants by reflecting infrared radiation [2,3]. This work aimed to study the effect of the foliar mitigation treatment with kaolin and potassium silicate on the phenolic, metallic and volatile composition of the grape berries composition from Touriga Nacional (*Vitis vinifera* L.) grape varieties. The vineyard was located in Vila Nova de Foz Côa, in the Douro Region, north of Portugal. The grapes were harvested at technological maturity. The results obtained show that the phenolic composition differs significantly between treatments. In general, the amount of total anthocyanins increased in grapes subjected to foliar treatment. There was also a change in the anthocyanin profile compared to the control. It was also studied the influence of the treatments on the free and bound volatile compounds in grapes, and the results show that the amount of glucosyl-glucose in the Touriga Nacional grape variety skin decrease slightly after application of both treatments (potassium silicate and aluminum silicate). This study shows that the composition is distinct among the treatments applied. These results allow the identification of the best treatment to be applied, in order to improve the mitigation effects due to thermal stress.

Keywords; Climate changes, mitigation treatments, Touriga Nacional, phenolic compounds, volatile compounds, grape quality.

References;

- [1] Dinis, L-T.; Bernardo, S.; Luzio, A.; Pinto, G.; Meijón, M.; Pintó-Marijuan, M.; Cotado, A.; Correia, C.; Moutinho-Pereira, J. *Journal of Plant Physiology* 2018, 220, 181.
 [2] Glenn, D.M.; Cooley, N. M.; Walker, R. R.; Clingeleffer, P. R.; Shellie, K. C. *Hortscience* 2010, 45, 1178–1187.
 [3] Glenn, D. M.; Puterka, G. J.. *Horticultural Reviews*, 2005, 31, 1–44.

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CP074

ISOLATION OF PHENOLIC COMPOUNDS FROM TEAS USING μ SPEed AS INNOVATIVE MICROEXTRACTION APPROACH

Priscilla Porto-Figueira¹, José A. Figueira¹, Jorge Pereira¹ and José S. Câmara^{1,2,*}

¹ CQM - Centro de Química da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal

² Faculdade de Ciências Exatas e da Engenharia da Universidade da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal;
*email: jsc@staff.uma.pt (José S. Câmara)

Phenolic compounds are secondary metabolites produced by plants. They are constituents of several food matrices, including fruits, juices and beverages such as coffee and wine. Despite their wide distribution, the health effects of dietary phenolic compounds have come to the attention of nutritionists particularly in recent years. This interest was driven by epidemiologic data as well as in vitro and in vivo studies, suggesting that compounds have a preventive effect in cancer and cardiovascular diseases.

The objective of this study was to evaluate the performance of an innovative and promising analytical strategy based on microextraction technique, μ SPEed, combined with ultrahigh performance liquid chromatography for quantification of phenolic compounds in different teas. The selection of the proper analytical strategy for phenolic characterization of food matrices depends on the purpose of the study as well the nature of the sample and the target analyte. Therefore, some key parameters influencing the extraction efficiency were tested, namely the nature of sorbent, elution solvent, the volume of loading sample and number of cycles.

The performance of the analytical approach was assessed in terms of limits of detection (LOD) and quantification (LOQ), linear dynamic range (LDR), precision and matrix effect. The results obtained are very interesting and the newly proposed strategy, μ SPEed/UHPLC-PDA, gives good analytical performance with very satisfactory results for recovery (> 96%) and precision (% RSD < 7%). Moreover, the developed methodology is ultrafast, semi-automatic, involving minimal sample pre-treatment and solvent usage, in comparison with conventional techniques, allowing a rapid and simultaneous determination of different phenolic compounds in food matrices with high sensitivity

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CP075

USAMET, AN IMPROVED TECHNIQUE FOR THE ISOLATION OF BIOGENIC AMINES FROM TUNA FISH

Joanna Pataca ¹, Priscilla Porto-Figueira ¹, Jorge Pereira ¹ and José S. Câmara ^{1, 2,*}

¹ CQM - Centro de Química da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal

² Faculdade de Ciências Exatas e da Engenharia da Universidade da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal;
*email: jsc@staff.uma.pt (José S. Câmara)

Biogenic amines (BAs) are nitrogen compounds that can be naturally present in animal and vegetable cells, being important for their metabolism and viability. However, under certain conditions, particularly in fermented foods and beverages and when food spoilage starts occurring, exogenous BAs can be generated by different microorganisms, creating several food safety concerns. This is mainly due to the interference that high levels of certain BAs may cause at different cell functions, as cell cycle or signalling. Therefore, BAs levels must be closely monitored to protect human health. However, the extraction and quantification of such compounds is challenging because foodstuffs are complex matrices and furthermore these compounds don't have fluorescence. In this work, we aimed to improve the experimental layout commonly used in BAs extraction and analysis, optimizing the BAs extraction from food matrices, the derivatization procedure and the chromatographic separation through an ultrasound assisted microextraction technique (USAMET). The methodology developed was optimized at different levels, namely the extraction, dansyl derivatization and the ultrahigh pressure liquid chromatographic (UHPLC) separation, and applied to the extraction of BAs from tuna fish samples. Overall, the methodology developed is faster, simpler and cheaper than most methodologies reported so far and was used to quantify the BAs most often reported in foodstuffs, namely histamine, putrescine, cadaverine, spermine, spermidine, tyramine and tryptamine with good analytical performance.

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CP076

Optimization of ergosterol extraction from *Agaricus blazei* Murrill using response surface methodology (RSM)

Oludemi Taofiq^{a,b,d}, Rúbia C.G. Corrêa^{a,c}, Lillian Barros^a, M.A. Prieto^a, Adelar Bracht^c, Rosane M. Peralta^c, Ana M. González-Paramás^d, Maria F. Barreiro^{a,b}, Isabel C.F.R. Ferreira^a

^a*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal*

^b*Laboratory of Separation and Reaction Engineering - Laboratory of Catalysis and Materials (LSRE-LCM), Bragança Polytechnic Institute, 5301-857 Bragança, Portugal;*

^c*Department of Biochemistry, State University of Maringá, Paraná, Brazil.*

^d*GIP- USAL, Unidad de Nutrición y Bromatología, Faculty of Pharmacy, University of Salamanca, Campus Miguel de Unamuno, 37007 Salamanca, Spain*

Different approaches have been utilized to lower environmental impacts of by-products from industrial processes and this involves conversion of biological wastes, agricultural residues and waste streams into high value-added products, thereby delivering positive economic, environmental and scientific impact [1]. Mushroom production has increased recently due to their use as ingredients in preparation of nutraceutical, pharmaceutical and cosmeceutical formulations. During mushrooms sorting, an expressive volume is discarded because they do not fit into commercial standard even though their content in biomolecules is not compromised. RSM was applied to optimize the recovery of ergosterol from the fruiting bodies of *Agaricus blazei* Murrill by comparing conventional (heat-assisted extraction, HAE) and non-conventional techniques (ultrasound and microwave-assisted extractions, UAE and MAE, respectively). The used response criteria were the quantification of ergosterol by HPLC-UV and the extraction yield (%). The optimum conditions were predicted as 150 min, 81.6 °C for HAE, 30 min, 400W for UAE, and 25 min, 134.6 °C, for the MAE system. Considering both responses, MAE (25.44 mg/100 g dw, 21 %); UAE (21.49 mg/100 g dw, 11.03 %) and HAE (18.84 mg/100 g dw, 17.05 %), the MAE system was identified as the best technique followed by UAE and HAE. The values predicted by the model are in close agreement with the experimental observations, proving the validity of the model and the usefulness of the predictions for future scale up. The obtained ergosterol-rich extracts can be applied as bioactive ingredients for pharmaceutical, cosmeceutical and nutraceutical purposes.

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[1] Heleno, S.A.; Prieto, M.A.; Barros, L.; Rodrigues, A.A.; Barreiro, M.F.; Ferreira, I.C.F.R. *Food Chemistry* **2016**, *197*, 1054-1063.

CP077

EFFECT OF HYPERBARIC STORAGE AT ROOM TEMPERATURE IN *BACILLUS SUBTILIS* ENDOSPORE GERMINATION CONTROL COMPARED WITH THE CONVENTIONAL REFRIGERATION

Carlos A. Pinto¹, Mauro D. Santos¹, Liliana G. Fidalgo¹, Ivonne Delgadillo¹, Jorge A. Saraiva¹

¹Research Unit of Organic Chemistry, Natural and Agro-food Products, Chemistry Department, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal.

carlospinto@ua.pt

Food preservation still relies on the conventional cold storage procedures, such as refrigeration (RF), which are energetically expensive and environmental harmful.

A new food preservation methodology has been investigated as a potential replacement of RF processes. Hyperbaric storage at room temperature states pressure control, inasmuch temperature control, to hinder both microbial and physicochemical degradation of foods. When performed at uncontrolled room temperature (HS/RT), it allows considerable energetic savings, as energy is only needed during the compression/decompression phases of the pressure vessel, and not to keep it along storage [1]. Several studies confirmed the feasibility of HS/RT, mainly on highly perishable food products, such as watermelon juice [2], raw bovine meat [3], whey cheese [4], among others, with HS/RT performing better than RF on the microbiological stability, allowing considerable shelf-life extensions.

As low acidic pasteurized food products are shelf-life limited by the presence of endospores, whose development is temporarily hindered by low temperatures, it is of utmost importance to evaluate the performance of HS/RT regarding this field. For so, HS/RT of highly perishable carrot juice (pH 6.00 and $a_w \approx 0.98$) was inoculated with *Bacillus subtilis* endospores, and stored under pressure at 25, 50 and 100 MPa, up to 60 days, and compared to RF storage (≈ 4 °C). The results showed that the juice kept at atmospheric pressure (AP) and RT conditions quickly spoiled in 9 days, similarly to RF, and HS/RT at 25 MPa, whose endospores germinated and outgrew ≈ 1 log unit after 60 and 2 days of storage, respectively. HS/RT at 50/100 MPa, resulted in endospore inactivation along storage, being more pronounced at 100 MPa, wherein the quantification limit (of 2.00 log CFU/mL) was reached, by the 30th day of experiments, resulting in a shelf-life extension.

In conclusion, HS/RT performed better than RF to avoid endospore germination and outgrowth, yielding microbiological shelf-life extension of carrot juice. These results point towards the possibility to enhance the preservation of low acidic pasteurized food products by HS/RT.

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- [1] Fernandes P. A. R. et al. *Food Engineering Reviews* **2014**, 7, 1–10.
- [2] Lemos Á. T., et al. *Food Chemistry* **2017**, 231, 61–9.
- [3] Freitas P., et al. *Meat Science* **2016**, 121, 64–72.
- [4] Duarte R. V., et al. *CyTA – Journal of Food* **2015**, 13, 321–328.

CP078

GROWTH INHIBITION AND INACTIVATION OF *ALICYCLOBACILLUS ACIDOTERRESTRIS* ENDOSPORE IN APPLE JUICE BY HYPERBARIC STORAGE AT ROOM-LIKE TEMPERATURE

Jorge A. Saraiva¹, Carlos A. Pinto¹, Ana P. Martins¹, Liliana G. Fidalgo¹, Mauro D. Santos¹, Ivonne Delgadillo¹

¹Research Unit of Organic Chemistry, Natural and Agro-food Products, Chemistry Department, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal
jorgesaraiva@ua.pt

Pasteurized acidic fruit juices (pH<3.7) normally evidence longer shelf-lives than non-acidic juices (pH>4.5). In fact, pasteurized acidic food products, generally, are suitable to be kept at ambient temperature, as endospores development is inhibited by the low pH. Nevertheless, there are a few atypical cases of endospores able to germinate and outgrowth in acidic food products, as it is the case of *Alicyclobacillus acidoterrestris* endospores. This acidophilic bacterium was firstly discovered in Germany, in 1984, in acidic pasteurized apple juice, leading to the re-design of pasteurization procedures, as both the vegetative and endospore forms are quite resistant.

A new preservation methodology is being widely and increasingly investigated as a *quasi*-energetically costless alternative of the conventional refrigeration (RF). Hyperbaric storage (HS) states pressure control, contrarily to temperature control, as a hurdle to slowdown microbial development. It also allows considerable energetic savings, due to the needless temperature control, and the energy input is only required during the compression/decompression phases of the pressure vessel, and not to keep it along storage, contrarily to conventional RF, which needs almost constant power supply.

In order to infer the feasibility of HS on the development of *A. acidoterrestris* in apple juice (pH 3.4), juice samples were inoculated with *A. acidoterrestris* under pressure (25,50 and 100 MPa), and compared with atmospheric pressure storage, at both room (18 to 23 °C) and RF (4 °C) temperatures for up to 30 days.

The results showed that, after 5 days, samples kept at atmospheric pressure and room temperature spoiled due to endospore development (increase of about 1 log unit), with acidity unable to hurdle microbial development, while spores in refrigerated samples remained unchanged for 30 days. Contrarily, at 50 and 100 MPa, it was observed a significant endospore inactivation of about 5 log units, being reached the detection limit (1.0 log CFU/mL), while at 25 MPa a less pronounced endospore reduction was observed (about 2 log units).

These results suggest that HS at uncontrolled room temperature might be a reliable alternative to control endospore germination and outgrowth in acidic apple juice.

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CP079

EFFECT OF HIGH PRESSURE EXTRACTION ON THE CITOTOXICITY AND GENOTOXICITY OF HERBAL EXTRACTS: A CASE STUDY ON STINGING NETTLE

Silvia A. Moreira^{1,2}, Manuela Pintado², Jorge A. Saraiva¹

¹Research Unit of Organic Chemistry, Natural and Agro-food Products (QOPNA), Chemistry Department, Aveiro University, Aveiro, Portugal. silvia.moreira@ua.pt

²Center of Biotechnology and Fine Chemistry (CBQF), School of Biotechnology of Portuguese Catholic University, Porto, Portugal

Stinging nettle grows wildly in the fields and is often seen as an undesirable weed. Nevertheless, its use in folk medicine for centuries is due to its biological effects, due to the rich content in bioactive compounds, that have already been proven by modern research [1,2]. Extraction is the first step to obtain natural components from herbal material, being conventional processes, such as Soxhlet, traditionally used. However, these methods have several disadvantages, such as high operation time and high temperature of extraction, causing structural and chemical alterations of the compounds. For so, it is of interest to develop new methods, such as high pressure assisted extraction (HPE) [3]. HPE can operate at room temperature, avoiding compound denaturation during extraction, enabling the recovering of heat-sensitive compounds, without major damage and denaturation, and has been recognized as an environmentally-friendly technology by the FDA [3].

The aim of this work was to study HPE as a new extraction method to obtain bioactive components from nettle leaves, avoiding high temperatures. After the optimization of the extraction conditions, by response surface methodology, the extracts were characterized on several biological activities, as antioxidant activity. Nevertheless, one of the most common problems of *in vitro* assays (such as ABTS^{•+} and DPPH^{•+} scavenging assays, that are easier and faster to use when screening for antioxidant properties) is their relative lack of biological context, since they typically disregard the molecules that the antioxidants could be protecting, such as the DNA, and the equilibria between antioxidant, pro-oxidant and the body's natural coping mechanisms. For so, in this work the antioxidant and pro-oxidant activities of the optimized extracts in the presence/absence of Fe³⁺ or hydrogen peroxide, as well as its cytotoxicity were studied. The results indicate that aqueous extracts show not only the ability to protect the DNA from degradation (high antioxidant activity) through hydrogen peroxide radicals, as also shows negative results for pro-oxidant activity, indicating that the extracts itself did not affect the DNA molecule. Relatively to the cytotoxicity, the extracts at 1.0 mg DW/mL of concentration did not present any concern towards the metabolism on Caco-2 cell culture.

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[1] D. Orcic, et al, *Food Chem* **2014**, *143*, 48-53.

[2] S. Otles, B. Yalcin, *Scientific World J* **2012**, 1-12.

[3] H. Huang, et al, Trends. *Food Sci Technol* **2013**, *33* (1), 54-62.

CP080
TANINOS PARA A PRODUÇÃO DE COAGULANTES NATURAIS A PARTIR DE ACÁCIA (ACACIA DEALBATA) E PINHEIRO (PINUS PINASTER)

Lopes, C., Rodrigues, A., Fernandes, E., Vaz Velho, M., Pires, P.

Instituto Politécnico de Viana do Castelo, Avenida do Atlântico 644, 4900-348 Viana do Castelo, Portugal. ppires@estg.ipvvc.pt

A coagulação é um processo fundamental no tratamento da água para consumo humano. É durante a primeira etapa deste tratamento que ocorre a adição de um coagulante químico, mais concretamente sais metálicos, como o sulfato de alumínio, que permite neutralizar as cargas elétricas das partículas suspensas na água e posteriormente a sua aglomeração. No entanto devido às desvantagens dos coagulantes químicos, nomeadamente as lamas geradas pela ligação destes sais inorgânicos às partículas coloidais e em suspensão, existe uma preocupação com a carga poluente. Além desta, a água tratada contém parte das substâncias adicionadas. Esta é outra desvantagem dos coagulantes químicos, nomeadamente uma potencial causa de problemas de saúde pública, como a doença de Alzheimer e a demência pré-senil, quando esta água é consumida. Estas preocupações conduziram à procura de alternativas mais seguras e naturais [1]. Os primeiros estudos sobre coagulantes naturais recaíram nos polifenóis, em particular os derivados de taninos condensados provenientes de biomassa vegetal. Este tipo de coagulantes, além de possuírem um mecanismo de ação semelhante ao dos coagulantes químicos, ainda permite que os flocos resultantes do processo possam ser utilizados como condicionadores/fertilizantes orgânicos de solos [2]. O presente trabalho teve como principal objetivo estudar as condições de extração para a fração polifenólica a partir da casca de pinheiro (*Pinus pinaster*) e da casca e madeira da acácia (*Acacia dealbata*) e quantificar os taninos nestes extratos para posterior produção de coagulantes naturais para o tratamento de águas. Nos extratos obtidos verificou-se que a casca de pinheiro possui um rendimento de extração e uma atividade antioxidante mais elevada comparativamente à madeira e casca de acácia. Verificou-se que o extrato da amostra de madeira de acácia com partículas de menor dimensão possui um teor de taninos condensados ($125,95 \pm 0,95$ mg/g de matéria seca) mais elevado que a casca da mesma espécie ($56,48 \pm 25,18$ mg/g de matéria seca). Através destes resultados, observa-se que a madeira de acácia possui maior potencial para produção de coagulantes, uma vez que possui maior teor de taninos. Os coagulantes naturais já são produzidos por algumas empresas, a BWE- Brazilian Wattle Extract e TANAC, estando a sua aplicação condicionada devido aos baixos custos e elevado desempenho dos coagulantes químicos.

Palavras chave: Coagulação, extração, atividade antioxidante, taninos.

[1] Kristianto, H., 2017. The potency of Indonesia native plants as natural coagulant: a mini review. *Water Science and Engineering*, 2, 51-60. [2] Mangrich, A. S., Doumer, M. E., Mallmann, A. S. e Wolf, C. R., 2014. Química verde no tratamento de águas: uso de coagulante derivado de tanino de *acacia mearnsii*. *Revista Virtual de Química*, 6, 1, 12-15.

CP081

SEMENTES DE MELÃO: POTENCIAL COMO INGREDIENTE ALIMENTAR

Mafalda Alexandra Silva^{1,2}, Tânia Gonçalves Albuquerque^{1,2}, Rita C. Alves², M. Beatriz P.P. Oliveira², Helena S. Costa^{1,2*}

¹ Departamento de Alimentação e Nutrição, Instituto Nacional de Saúde Doutor Ricardo Jorge, I.P., Lisboa, Portugal

² REQUIMTE, LAQV/Faculdade de Farmácia da Universidade do Porto, Portugal
*helena.costa@insa.min-saude.pt

O desperdício alimentar é uma preocupação crescente em todo o mundo, sendo considerado um problema com impacto direto na economia, sociedade e ambiente. A sua gestão torna-se, portanto, uma questão crucial para a disponibilidade alimentar [1]. O interesse na utilização dos subprodutos da indústria agroalimentar para a formulação e/ou enriquecimento de novos produtos alimentares tem vindo a aumentar, e parece ser uma solução sustentável, permitindo ir ao encontro das necessidades dos consumidores [2].

Este estudo tem como objetivo fornecer uma visão geral da composição nutricional de um subproduto do melão, de modo a avaliar o seu potencial como ingrediente alimentar.

As sementes do melão são uma boa fonte de lípidos (13 - 37%), proteína (15 - 36%), fibra alimentar (7 - 44%), minerais (potássio, magnésio e cálcio) e aminoácidos (ácido glutâmico, arginina e ácido aspártico) [3-8]. Constituem um potencial ingrediente alimentar que pode ser utilizado para enriquecer alimentos e conferir-lhes propriedades benéficas, com vista à promoção da saúde e bem-estar dos seus consumidores. Para além disso, a sua utilização pode ser um aspeto muito importante para a gestão dos resíduos alimentares e contribuir para uma produção mais sustentável, diminuindo o impacto social, económico e ambiental.

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[1] Comissão Europeia. Relatório da Comissão ao Parlamento Europeu, ao Conselho, ao Comité Económico e Social Europeu e ao Comité das Regiões sobre a implementação do plano de ação para a economia circular **2017**, 1–14.

[2] Silva, M. A.; Albuquerque, T. G.; Alves, R. C.; Oliveira, M. B. P. P.; Costa, H. S. *Trends in Food Science & Technology* **2018**, *In press*, <https://doi.org/10.1016/j.tifs.2018.07.005>

[3] Mello, M. L. S.; Bora, P. S.; Narain, N. *Journal of Food Composition and Analysis* **2001**, *14*, 69–74.

[4] Melo, M. L. S.; Narain, N.; Bora, P. S. *Food Chemistry* **2000**, *68*, 411–414.

[5] Petkova, Z.; Antova, G. *Cogent Food & Agriculture* **2015**, *1*.

[6] Mehra, M.; Pasricha, V.; Gupta, R. K. *Journal of Pharmacognosy and Phytochemistry* **2015**, *3*, 98–102.

[7] Morais, D. R.; Rotta, E. M.; Visentainer, J. V. (2017). *Journal of the Brazilian Chemical Society* **2017**, *28*, 308–318.

[8] Mallek-Ayadi, S.; Bahloul, N.; Kechaou, N. *Food Chemistry* **2017**, *221*, 1691–1697.

CP082

TEORES DE VITAMINA C DO FIGO-DA-ÍNDIA E DA ANONA: COMPARAÇÃO ENTRE POLPA E SUB-PRODUTOS

Mafalda Alexandra Silva^{1,2}, Tânia Gonçalves Albuquerque^{1,2}, M. Beatriz P.P. Oliveira², Paula Pereira^{3,4,5}, Renata Ramalho^{3,4,5}, Helena S. Costa^{1,2*}

¹ Departamento de Alimentação e Nutrição, Instituto Nacional de Saúde Doutor Ricardo Jorge, I.P., Lisboa, Portugal

² REQUIMTE, LAQV/Faculdade de Farmácia da Universidade do Porto, Portugal

³ Instituto Superior de Ciências da Saúde Egas Moniz, Caparica, Portugal;

⁴ CiiEM - Centro de Investigação Interdisciplinar Egas Moniz, Caparica, Portugal;

⁵ GENA - Grupo de Estudos de Nutrição Aplicada, Caparica, Portugal

*helenacosta@insa.min-saude.pt

A vitamina C não é sintetizada pelos seres humanos, tendo por isso de ser obtida pela alimentação. É crucial para a saúde e bem-estar do indivíduo assegurar um aporte adequado desta vitamina (1). O figo-da-Índia e a anona são dois frutos exóticos muito apreciados devido às suas propriedades sensoriais diferenciadas. Do seu consumo resultam grandes quantidades de subprodutos que são descartadas, mas que podem ser fonte de compostos bioativos, com propriedades benéficas para a saúde.

Este trabalho teve como objetivo a comparação dos teores dos ácidos L-ascórbico e desidroascórbico e da vitamina C total, determinados na polpa e em subprodutos dos referidos frutos, com o intuito de avaliar o potencial dos seus extratos como ingredientes de novos produtos alimentares. As amostras de anona foram fornecidas por uma empresa da Madeira (Portugal) e as amostras de figo-da-Índia foram obtidas na Herdade de Peliteiros (Silveiras, Montemor-o-Novo, Évora, Portugal). A quantificação da vitamina C foi realizada por cromatografia líquida acoplada à deteção por díodos (2). As amostras de figo-da-Índia apresentaram teores mais elevados de vitamina C tanto para a polpa (35 mg/100 g de amostra) como para o subproduto (132 mg/100g) (3). Pelo contrário na anona obteve-se um teor mais elevado de ácido desidroascórbico (6 mg/100 g de parte edível) na polpa (3).

Pelos resultados parece possível concluir que o figo-da-Índia é uma boa fonte de vitamina C, especialmente o subproduto. Este trabalho poderá promover uma nova abordagem de valorização destes frutos, contribuindo para a sustentabilidade ambiental e económica

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[1] Silva, M.A.; Albuquerque, T.G.;Oliveira, M.B.P.P.;Costa H.S. *Food Chemistry* **2018**, 267, 83-90.

[2] Valente, A.; Sanches-Silva, A.; Albuquerque, T.G.; Costa H.S. *Food Chemistry* **2014**, 154, 71-77.

[3] Albuquerque, T.G.; Santos, F.; Sanches-Silva, A.; Oliveira, M.B.; Bento, A.C; Costa, H.S. *Food Chemistry* **2016**, 193, 187-95.

CP083

BIOACTIVE COMPOUNDS EXTRACTED FROM INDUSTRIAL FRUIT JUICES BY-PRODUCTS

Vasco Lima¹, Mariana A. Andrade^{1,2}, Ana Sanches Silva^{3,4}, Fernanda Vilarinho^{2,5}, Maria Conceição Castilho¹, Khaoula Khwaldia⁶, Fernando Ramos^{1,7}

¹Faculty of Pharmacy, University of Coimbra, Pólo III - Pólo das Ciências da Saúde, Azinhaga de Santa Comba, 3000-354 Coimbra, Portugal. vasco.jose.lima@gmail.com

²Department of Food and Nutrition, National Institute of Health Doutor Ricardo Jorge (INSA), I.P., Av. Padre Cruz, 1649-016, Lisboa, Portugal

³National Institute for Agricultural and Veterinary Research (INIAV), I.P., Rua dos Lagidos, Lugar da Madalena, 4485-655, Vairão, Vila do Conde, Portugal

⁴Center for Study in Animal Science (CECA), ICETA, University of Porto, Porto, Portugal;

⁵IDMEC, Departamento de Engenharia Mecânica, Instituto Superior Técnico, University of Lisboa, Lisboa, Portugal

⁶Institut National de Recherche et d'Analyse Physico-chimique, INRAP, Pôle Technologique de Sidi Thabet, 2020 Tunis

⁷REQUIMTE/LAQV, Faculty of Pharmacy, University of Coimbra, Coimbra, Azinhaga de Santa Comba, 3000-548 Coimbra, Portugal

Fruits are very popular around the world due to their diversity, flavour, availability and healthy properties. Juices are one of the most popular ways to consume them and there is a great demand of fruits to satisfy the needs of the market. Consequently, tonnes of by-products are generated every year and they become an economical and environmental problem that needs to be addressed. Although some of them may be used through composting or for animal feed, the volumes generated in short periods of time and the fact that they are still good sources of bioactive compounds for the food, cosmetic and pharmaceutical industries, represent an opportunity to develop or advance valorisation methods for these low cost materials. Fruits are rich in vitamins, dietary fibre and bioactive compounds like phenolic compounds or terpenoids that are known for showing health-promoting properties, like antioxidant or antimicrobial activities. These compounds can be recovered, since a lot of the bioactive content remains on the by-product after processing, because many of these compounds are concentrated on the outer or least palatable parts of the fruit [1].

Extracting bioactive compounds from the waste of fruit juice processing is one way to valorise it so the objectives of this study were to analyse the phenolic content and antioxidant activity of extracts made from mixtures of by-products recovered from a fruit juice-producing company.

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[1] Renard, C.M.G.C *LWT- Food Science and Technology* **2018**, 93, 390-395

CP084

USE OF BREWERS' SPENT GRAIN IN THE PRODUCTION OF SNACKS

Anna Wieczorek¹, Anabela Amaral¹, Olga Amaral¹ and João Dias^{1,2}

joao.dias@ipbeja.pt

¹ESA-Instituto Politécnico de Beja, Rua Pedro Soares, 7800-295 Beja, Portugal

²GeoBioTec, Un. Nova de Lisboa, Campus da Caparica, 2829-516 Caparica, Portugal

Brewery Spent Grain (BSG) is an interesting raw material for food ingredients. This residue left after separation of the wort during the brewing is considered as a ligno-cellulosic material rich in protein and fiber, presenting about 17% cellulose, 28% non-cellulosic polysaccharides, mostly arabinoxylans, and 28% lignin. Proteins in BSG are rich in glutamine, which has been reported to promote the recovery and preservation of intestinal mucosa and to prevent bacterial translocation from the gastrointestinal tract. The purpose of this study was to develop energy bars using by-products from beer production with the incorporation of dried fruits, honey (as a substitute for sugar) and flax seed. Together, were also tested different formulas for salty crackers using mostly brewers' spent grain, flour and spices (curry and paprika). Samples were submitted to physicochemical, rheological and sensorial analysis. The results of energy bars presented an average moisture value of 15%, Aw around 0.72 and force to fracture of 15.93N. The results of crackers presented also low moisture (less than 1%), low Aw (less than 0,65) but high force to fracture (higher than 28N). The results of sensory analysis presented a good acceptance of all tested products. The overall acceptance was higher for paprika crackers rather than curry crackers.



Figure 1: Energy bar with brewers' spent grain



Figure 2: Salty snack with brewers' spent grain

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CP085

ISOLATION AND CHEMICAL CHARACTERIZATION OF
MELANOIDINS FROM CHIPS INDUSTRY BY-PRODUCTS

Sílvia Petronilho^{1,2,3}, Manuel A. Coimbra^{2,3}, M. Rosário Domingues^{2,4}, Fernando Nunes¹

¹Chemistry Research Centre-Vila Real, Chemistry Department, UTAD, Portugal.

²QOPNA, Chemistry Department, University of Aveiro, Portugal

³LAQV-REQUIMTE, Chemistry Department, University of Aveiro, Portugal

⁴CESAM, Chemistry Department, University of Aveiro, Portugal

silviapetronilho@ua.pt

Potato chips are consumed worldwide, so their industrial processing creates huge amounts of disposable by-products, including burned chips residues, a putative source of melanoidins. These are high molecular weight nitrogenous brown-colored compounds formed during food heat treatments, containing reducing sugars and proteins/amino acids. Melanoidins have been related with several beneficial health effects as antioxidant, anti-microbial, and anti-inflammatory properties [1].

Frying oil fatty acids residues may suffer transesterification and may be incorporated into burned chips residues-melanoidins, as observed for organic acids in coffee melanoidins [2]. Thus, the aim of the present study was to characterize melanoidins structure in burned chips residues. Taking advantage of melanoidins high molecular weight structure (HMW), they were isolated from the supernatant of burned chips residue by ultrafiltration using a set of 6 membranes. Because >100 kDa fraction was quantitatively dominant, an additional purification procedure, using a batch of C₁₈ resin suspension for adsorption of hydrophobic material, was performed, allowing to obtain two fractions: AqHMW (material not sorbed to the C₁₈ resin, which remained in the water solution), and MeHMW (material retained in the C₁₈ resin and recovered with acidic methanol). Both fractions were submitted to structural characterization by using sugar (determined by GC-FID as alditol acetates, after hydrolysis), methylation (identified by GC-MS after methylation, hydrolysis and acetylation), and fatty acids analysis (identified by GC-FID as fatty acid methyl esters, after transesterification), and complemented with other analytical tools. The AqHMW fraction is composed by 87% (w/w) of sugars and the MeHMW fraction is composed by 1% (w/w) of sugars (t-Glcp, 4-Glcp, and 4,6-Glcp are the most abundant linkages) and 0.2% (w/w) of fatty acids, allowing to conclude that potato chips melanoidins are composed by short chain oligosaccharides derived from starch esterified with fatty acids.

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[1] Hodge, J. E. *Journal of Agriculture and Food Chemistry*, **1953**, 1, 928-943.

[2] Moreira, A. S. P.; Coimbra, M. A.; Nunes, F. M.; Passos, C. P., Santos, S. A. O.; Silvestre, A. J. D.; Silva, A. M. N.; Rangel, M.; Domingues, M. R. M. *Food Chemistry* **2015**, 185, 135-144.

CP086

RECUPERAÇÃO DA CAFEÍNA A PARTIR DE UM SUBPRODUTO DE CAFÉ

Rita C. Alves^{1*}, Hélder Puga², Anabela S. Costa¹, Sílvia Bessada¹,
M. Beatriz P.P. Oliveira¹

¹ REQUIMTE/LAQV, Departamento de Ciências Químicas, Faculdade de Farmácia da
Universidade do Porto, Portugal

² CMEMS, Centre for Microelectromechanical Systems, Minho, Campus Azurem, 4800-058
Guimarães, Portugal

*rcalves@ff.up.pt

A pele de prata é o principal subproduto da torrefação do café. Há estudos que sugerem a sua potencial utilização como fonte de nutrientes e compostos bioativos devido à sua riqueza em fibra, compostos fenólicos e cafeína [1,2].

O objetivo deste trabalho consistiu na obtenção de um pó rico em cafeína preparado a partir de pele de prata do café. Para tal, utilizou-se um método de ultrassons baseado numa tecnologia de Multifrequência, Multimodo, Modelada (MMM). Esta tecnologia permite, através de um processamento avançado de sinal, sincronizar modos de vibração, promovendo uma distribuição de energia acústica uniforme e homogénea, de elevada intensidade, contribuindo para uma otimização da extração dos compostos químicos. O sistema de ultrassons usado consistiu num gerador de ultrassons (baseado na tecnologia MMM), um transdutor de 20 kHz, um precursor de ondas e um radiador acústico otimizado para o efeito. O dispositivo de ultrassons foi otimizado especificamente para aumentar o desempenho da extração em meio líquido, considerando a influência das condições na resposta dinâmica do transdutor. O tempo de sonicação, a amplitude de vibração, a temperatura alcançada e a necessidade de moagem prévia foram as variáveis estudadas. Os resultados foram comparados com uma extração sólido-líquido convencional, previamente otimizada para o efeito. A extração por ultrassons permitiu obter uma maior recuperação da cafeína (+23%), sem qualquer necessidade de preparação prévia da amostra e utilizando apenas água como solvente de extração. Após liofilização, obteve-se um pó concentrado com um teor de cafeína aproximadamente 10 vezes superior ao da matriz original, passível de ser utilizado para outros fins.

Estes resultados mostram que este tipo de tecnologia pode ser de grande interesse para recuperar compostos bioativos a partir de matrizes naturais, de uma forma eficiente e limpa.

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[1] Costa, A. S. G.; Alves, R. C.; Vinha, A. F.; Costa, E.; Costa, C.; Nunes, M. A.; Almeida, A. A.; Santos-Silva, A.; Oliveira, M. B. P. P. *Food Chemistry*, **2018**, 267, 28-35.

[2] Bessada, S. M. F., Alves, R. C.; Costa, A. S. G.; Nunes, M. A.; Oliveira, M. B. P. P. *Science of the Total Environment*, **2018**, 645, 1021–1028.

CP087

VALORIZAÇÃO NUTRICIONAL DE SUBPRODUTOS DA INDÚSTRIA VINÍCOLA

Anabela S.G. Costa, Rita C. Alves*, Liliana Espírito Santo, M. Antónia Nunes, M. Beatriz P. P. Oliveira

REQUIMTE/LAQV, Departamento de Ciências Químicas, Faculdade de Farmácia da Universidade do Porto, Portugal

*rcalves@ff.up.pt

A indústria vinícola produz milhões de toneladas de resíduos (bagaço de uva), que necessitam de uma gestão adequada, tanto ecológica quanto económica, para responder a questões sustentáveis [1]. O bagaço de uva é composto principalmente por cascas de uva e sementes, e pode ser usado para extração de ácido tartárico ou produção de etanol. Devido à sua riqueza em compostos fenólicos, se for aplicado diretamente no solo pode inibir o crescimento das plantas (fitotoxicidade) [2]. As grainhas de uva podem ser usadas para extrair o óleo de grainha de uva, que é conhecido por seu valor nutricional (72% de ácido linoleico e um ponto de fumo muito alto, sendo adequado para fritar) e propriedades hidratantes (com interesse para a indústria da cosmética) [3]. Após a extração do óleo, é obtido um resíduo - a farinha de grainha de uva - que é uma boa fonte de polifenóis, incluindo proantocianidinas, e fibras alimentares [4]. A fim de caracterizar estes produtos derivados de bagaço de uva e avaliar o seu potencial para aplicações na alimentação humana e animal, foi efetuada a análise nutricional de acordo com os métodos oficiais [5].

Os resultados mostram diferenças significativas ($p < 0,05$) entre as amostras, com a farinha de semente de uva a apresentar um teor de fibra total superior às restantes amostras (82%) e menores quantidades de hidratos de carbono disponíveis (3%) e gordura total (<1%). Por sua vez, as cascas de uva apresentam níveis significativamente mais altos ($p < 0,05$) de minerais (9%) e hidratos de carbono disponíveis (12%), enquanto as sementes de uva são as mais ricas em gordura total (9%). Como esperado, a mistura de casca de uva e farinha de sementes apresentou um perfil intermédio em relação às matrizes originais, apresentando alto teor de fibra alimentar (71%), proteína (12%) e minerais (6%). Em geral, todos estes produtos derivados de bagaço de uva podem ser vistos como fontes interessantes de proteína e fibra.

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[1] F.M. Zhu et al., *Food Chem.*, **2015**, 186, 207.

[2] A.R.. Fontana et al., *J Agric Food Chem.*, **2013**, 61,8987

[3] C. Da Porto et al., *Ultrason Sonochem.*, **2013**, 20,1076

[4] E.N Ozvural & H. Vural, *Meat Sci.* **2011**, 88, 179

[5] AOAC. Official Methods of Analysis of AOAC International, 19th Edition AOAC International **2012**: Maryland, EUA.

CP088

EXTRACTION OF OLIVE POMACE ANTIOXIDANT COMPOUNDS: SUSTAINABILITY *VERSUS* YIELD

M. Antónia Nunes*, Anabela S.G. Costa, Joana Santos, Rita C. Alves,
M. Beatriz P. P. Oliveira

LAQV-REQUIMTE, Faculty of Pharmacy, Universidade do Porto, 4050-313 Porto, Portugal
*antonianunes.maria@gmail.com

The selection of the process for antioxidant compounds extraction is based on different factors, such as the polarity of the compounds of interest; quantification purposes; compounds application; extracts safety; cost-effectiveness; and environmental concerns. Currently, it is strongly advisable to use green extraction methods, focusing on the minimal use of organic solvents [1]. Olive pomace (OP) is a major by-product of olive oil processing and a great source of antioxidant compounds [2].

This work aimed to evaluate the extraction yield of OP antioxidants using two different procedures: i) a patented eco-friendly extraction (Patent WO/2017/212450) using water as solvent (PE), and ii) a methanolic-based extraction (ME). The studied samples were OP from different cultivars (Arbequina, Oliana, and Koroneiki), all collected in Alentejo, Portugal. The extraction yield was assessed by analyzing the total phenolics (TPC) and flavonoids (TFC) contents of the extracts, as well as their antioxidant activity by the FRAP and DPPH[•] inhibition assays [2].

The compounds extraction was, as expected, higher in the ME. In this case, the TPC were 11.8, 13.8 and 21.7 g of gallic acid equivalents/kg, for Oliana, Arbequina, and Koroneiki pomaces, respectively. The PE achieved only 50, 39, and 43%, correspondingly, of the TPC extracted by ME. Regarding the TFC, the extraction yields were similar for both methods. The antioxidant activity of extracts was alike higher using the methanolic solution. Koroneiki OP presented the highest antioxidant activity by either ME or PE, followed by Oliana and Arbequina samples. However, considering the DPPH[•] inhibition in ME, Arbequina OP presented higher values than Oliana OP.

The extraction yields varied among the different OP, pointing out the presence of different profiles of antioxidant compounds. Although the methanolic solution provided higher yields of antioxidants recovery, it is worth to highlight the use of the solvent, costs and time consumption of this procedure. Indeed, even considering extraction yields of ≈50%, the proposed green method is strongly advisable when foreseen further applications (e.g. food/cosmetics).

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[1] Chemat, F., Vian M.A., Cravotto, G. *Int. J. Mol. Sci.* **2012**, *13*, 8615-8627.

[2] Nunes, M.A., Costa, A.S.G., Bessada, S., Santos, J., Puga, H., Alves, R.C., Freitas, V., Oliveira, M.B.P.P. *Sci. Total Environ.* **2018**, *644*, 229-236.

CP089

SUSTAINABLE RECOVERY OF ANTIOXIDANT COMPOUNDS FROM OLIVE POMACE VIA A MEMBRANE-ASSISTED PROCESSING

M. Antónia Nunes^{1,*}, Sylwin Pawlowski², Anabela S.G. Costa¹, Rita C. Alves², Svetlozar Velizarov², M. Beatriz P. P. Oliveira¹

¹LAQV-REQUIMTE, Faculty of Pharmacy, Universidade do Porto, 4050-313 Porto, Portugal

²LAQV-REQUIMTE, Faculty of Science and Technology, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal.

*antonianunes.maria@gmail.com

The recovery of bioactive compounds from agro-industrial by-products and further application in innovative products is a key issue of the circular economy concept. Olive pomace (OP) is the major olive oil processing by-product [1]. After the characterization and quantification of OP bioactive compounds by several research works, it is now mandatory to study effective ways to recover those compounds. Membrane separation processes are considered clean and economically feasible for concentration and purification of such compounds from by-products [2].

The presented study aimed to recover the OP hydrophilic antioxidant compounds by a sustainable way. Firstly, a patented eco-friendly treatment was applied for compounds extraction [3] and obtained the initial aqueous extracts (IAE). Then, IAE were submitted to three different membranes: BW30, NF270, and NF90. The composition of the resulting streams was evaluated by total phenolics (TP) and flavonoids (TF) contents, and antioxidant activity (ferric reducing antioxidant power (FRAP) and 2,2-diphenyl-1-picrylhydrazyl (DPPH[•]) scavenging ability) assays [1].

IAE showed a ferric reducing power of 845 μmol ferrous sulfate equivalents (FSE)/L and a DPPH[•] scavenging ability of 42 mg trolox equivalents (TE)/L. TP and TF attained 110 mg gallic acid equivalents (GAE)/L and 50 mg epicatechin equivalents (EE)/L in the extract, respectively. The antioxidant activity of the concentrate streams was significantly higher ($p < 0.05$) (≈ 10 times) than the initial IAE. Also, significant differences ($p < 0.05$) among the three concentrates (from the three membranes) were observed. TP and TF contents of the BW30 concentrate was significantly higher ($p < 0.05$) (1234 GAE/L and 464 EE/L, respectively) and presented the highest FRAP value (9183 μmol FSE/L). No significant differences ($p > 0.05$) were observed among the DPPH[•] scavenging ability of the three concentrates.

A membrane-assisted process, using a BW30 membrane, is a highly recommendable solution to concentrate antioxidant compounds from OP extracts.

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[1] Nunes, M.A., Costa, A.S.G., Bessada, S., Santos, J., Puga, H., Alves, R.C., Freitas, V., Oliveira, M.B.P.P. *Sci. Total Environ.* **2018**, *644*, 229-236.

[2] Sosa, P.A., Roca, C., Velizarov, S. *J. Membr. Sci.* **2016**, *501*, 236-247.

[3] International Patent WO/2017/212450 – Olive products, method of production and their uses. University of Porto, **2017**.

CP090

FERMENTED GREEN TOMATO: A VALUABLE APPROACH TO CONVERT NON-USABLE TOMATOES INTO A BENEFICIAL FOOD ADDITIVE

**Rafaela Santos¹, Isabel Sousa¹, Anabela Raymundo¹, João Santos Silva²,
Catarina Prista¹, Mariana Mota¹**

¹LEAF, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda 1349-017 Lisboa, Portugal.

²Centro de Competências para o Tomate Industria (CCTI), Quinta das Pratas 2070-158 Cartaxo, Portugal. Email of author for contact: rscantos@isa.ulisboa.pt

The Competence Center for Tomato Industry (CCTI) estimates that in Portugal large quantities of immature (green) tomatoes are rejected every year, once tomato industry is focused on a single high value product – tomato paste, produced only from completely red tomato. The rejection of green tomatoes represents a huge loss of energy, water and food besides the cost of the removal and destruction.

Fermentation is a time-honoured method of food processing resulting in food products with more desirable nutritional properties such as extended shelf-life and good sensorial properties^[1,2]. Among fermentation, lactic acid fermentation is considered a potentially beneficial technology to improve added value of green tomatoes, since it will contribute to decrease toxic and anti-nutritional compounds, such as α -tomatine and dihydrotomatine, natural compounds found in higher amounts in green tomatoes^[3,4].

The aim of this work was to promote the use of immature industrial tomatoes as a source of new functional food based on lactic acid fermentation.

Tomatoes from the industry were classified in three groups based on their external colour (green, yellow-orange and red) and physico-chemically characterized.

Chemical composition did not reveal any relevant significant differences among the three groups. Brix^o slightly increased and titratable acidity slightly decreased from green tomatoes (4.7°Brix and 8.01g/L) to red tomatoes (5.3 Brix and 4.7g/L), whereas the pH increased slightly. However, these differences were not substantial, suggesting that the three groups have similar substrate potential to be fermented.

Twelve Lactic Acid Bacteria strains were screened for their ability to grow under potential conditions usual in vegetable fermentations. Growth/fermentative performance on pasteurized tomato paste of each ripening class was also tested. Based on these results, two *Lactobacillus plantarum* strains and one *Pediococcus pentosaceus*, *Leuconostoc mesenteroides* and *Lactobacillus brevis* strains were selected as potential starters for not fully ripe tomato fermentation.

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[1] Granato, D.; Branco, G. F.; Nazzaro, F.; Cruz, A. G.; Faria, J. A. F. *Comprehensive Reviews in Food Science and Food Safety* **2010**, *9*, 292-302.

[2] Nehir, El S.; Simsek, S. *Comprehensive Reviews in Food Science and Food Safety* **2012**, *11*, 2-12.

[3] Kozukue, N.; Han, J. S.; Lee, K. R.; Friedman, M. *Journal of Agricultural and Food Chemistry* **2004**, *52*, 2079–2083.

[4] Gupta, S.; Abu-Ghannam, N. *Critical Reviews in Food Science and Nutrition* **2012**, *52*, 183-199.

CP091
INTEGRATION OF MEMBRANE PROCESSES IN VALORIZATION OF
GOAT CHEESE WHEY

David Azedo¹, Antónia Macedo¹, Teresa Santos¹, C. Pereira², M. Henriques², D. Gomes², R. Borges²

¹*Politechnic Institute of Beja, Rua Pedro Soares, 7800 -295 Beja, Portugal*

²*Politechnic Institute of Coimbra, Bencanta, 3045-601 Coimbra. atmacedo@ipbeja.pt*

The interest in the study of goat milk and their products has been increasing a lot due to its nutritional, biological and functional properties, as well as to the attributed health effects. In this work, in order to valorize goat cheese whey, our proposal is to study the efficiency of a sequence of membrane processes, for the separation of different valuable fractions. After a pretreatment, goat cheese whey is subjected to the following membrane processes: ultrafiltration/diafiltration and after nanofiltration/diafiltration of the permeates of first processes. All the membrane processes were performed in a plane-and-frame module and the total membrane area used was 0.072 m². The ultrafiltration/diafiltration experiments were carried out using organic ultrafiltration membranes of a molecular weight cut-off of 10 kDa and led to the production of a purified protein concentrate, with a protein concentration of about 80%. In the process of nanofiltration/diafiltration of the permeates, were also used organic membranes and it was possible to recover almost all the lactose in the concentrate and to obtain a final permeate with a very low organic load. The application of all the fractions separated for development of new products will be further studied.

CP092

AGROINDUSTRIAL BYPRODUCTS AS POSSIBLE ANTIMICROBIAL INGREDIENTS IN ANIMAL FEED

Elisabete Coelho¹, Jéssica Santos¹, Ana M. Brenha¹, Soraia P. Silva¹, Cláudia P. Passos¹, Isabel Henriques², Manuel A. Coimbra¹

¹QOPNA, Departamento de Química, Universidade de Aveiro, 3810-193 Aveiro, Portugal

²Department of Biology and CESAM, University of Aveiro, Campus Universitário Santiago, Aveiro, 3810-193, Portugal. ecoelho@ua.pt

A wide range of antibiotics are used worldwide within the poultry industry for therapeutic, prophylactic, and as growth promoters [1]. However, as bacteria resistance to the most widely used antimicrobials is a concern [2], to develop alternative substances and strategies for animal growth promotion and disease prevention is a requirement. Phytobiotics and prebiotics are natural alternatives to antibiotic growth promoters in poultry industry [3]. In the present work, the antimicrobial activity of agro-industrial byproducts are evaluated as possible ingredients in broiler diets.

Essential oils (EOs) were obtained from stems from thyme “Bela-luz” (*Thymus mastichina*), oregano (*Origanum vulgare*), and winter savory (*Satureja montana*) by hydrodistillation (≈ 120 min) with convective heating, and by microwave assisted hydrodistillation (16 ± 1 min) of rehydrated and drained material. The EOs yields were comparable for the two methodologies and three samples used (0.01-0.03%), as well as their chemical composition. A total of 13 compounds were identified in winter savory, where the monoterpenoids accounted for 84.4–97.6% and sesquiterpenoids accounted for 0.3–0.5%. Carvacrol was the component present in higher amount (825–950 $\mu\text{g}/\text{mg}$). A total of 37 compounds were identified in thyme and oregano EOs, composed mainly by monoterpenoids and sesquiterpenoids, and where carvacrol (17%) and thymol (1% and 11% in thyme and oregano, respectively) were the most abundant compounds on both sample species.

The antimicrobial activity of essential oils was individually evaluated against *Escherichia coli* ATCC 25922, *Salmonella enterica* sv Anatum SF2 and *Staphylococcus aureus* ATCC 6538 using an agar disc diffusion method and broth microdilution assay. All tested microorganisms were inhibited by EOs obtained from the byproducts under study. The winter savory showed the highest antimicrobial activity that can be probably related with the higher carvacrol concentration.

As the winter savory, thyme, and oregano byproducts revealed antimicrobial activity against the main poultry’s infectious species, it can be concluded that they have potential to be incorporated in animal feed formulations.

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[1] Barton, M. D. *Nutr Res Rev* **2000**, *13*, 279.

[2] EFSA; ECDC. *EFSA Journal* **2016**, *14*, 4380.

[3] Yadav A. S.; Kolluri G.; Gopi M.; Karthik K.; Malik Y. S.; Dhama K. *J Exp Biol Agric Sci* **2016**, *4*, 368.

CP093 CHARACTERIZATION OF A CONCENTRATED SECOND CHEESE WHEY

Margarida Faustino¹, Ana Sofia Salsinha¹, Lígia Pimentel¹, Luís Alcalá¹, Ana Cristina Freitas¹, Ana Maria Gomes¹, Carlos Dias Pereira², Manuela Pintado^{1*}

¹ Universidade Católica Portuguesa, CBQF – Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Arquiteto Lobão Vital 172, 4200-374 Porto, Portugal. *mpintado@porto.ucp.pt

²IPC/Escola Superior Agrária, Departamento de Ciência e Tecnologia Alimentar, Bencanta, 3045-601 Coimbra, Portugal

An emergent trend in the food industry sector is to search for added-value innovations, in particular, the production of new highly sustainable food products of high nutritional value [1]. Whey cheese “Requeijão” is obtained by heating the whey between 90 and 100 °C for 15 to 30 min, with or without the addition of 10–20% (v/v) of ovine/caprine/bovine milk. The residual deproteinized whey known as second cheese whey or “Sorelho”, which is obtained from whey cheese manufacture, contains approximately 60% (w/w) of the original whey dry matter. Deproteinized whey is a common by-product of small/medium scale cheese plants and, although it has little to no commercial value, it is produced in relatively high volumes implying a complex processing before its disposal [2]. Therefore, the objective of this work was to characterize the nutritional composition of two concentrated deproteinized wheys (sheep and goat), obtained after the treatment of deproteinized wheys by ultrafiltration/diafiltration with a 10 kDa membrane followed by freeze drying, in an attempt to provide some insights into their potential use as food ingredients. Nutritional composition was determined according to AOAC methods for protein, lactose and ash contents. Fatty acid qualitative and quantitative profiles were determined according to Pimentel et al. [3]. From the nutritional characterization, it was possible to observe that the deproteinized wheys, upon ultrafiltration, were mostly comprised of protein 77-99% (w/w) and 3.5-4.0% (w/w) mineral contents (total ash). The samples also exhibited a low lactose content (0.59-0.81 mg/mg). The fatty acid composition profile was predominantly composed of short- and medium chain fatty acids including butyric, caproic and caprylic acids, and long chain fatty acids, such as palmitoleic, rumenic and trans vaccenic acid along with low concentrations of docosapentaenoic acid and docosahexaenoic acid. Aspartic acid, glutamic acid, alanine and tyrosine were the most predominant amino acids found in the sheep concentrated deproteinized whey while in the goat concentrated deproteinized whey aspartic acid, glutamic acid, asparagine, threonine and valine were prevalent. Taking into account the nutritional profile of these concentrated deproteinized wheys, new innovative products may be sought through their incorporation in different matrices such as whey cheese.

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[1] Santeramo, F. G.; Carlucci, D.; De Devitiis, B.; Seccia, A.; Stasi, A.; Viseccchia, R.; Nardone, G. *Food Research International* 2017, 104, 39-47.

[2] Pereira, C. D.; Díaz, O.; Cobos, A. *Food Technology and Biotechnology* 2007, 45, 32-37.

[3] Pimentel, L.; Fontes, A.; Gomes, A.; Alcalá, L. *MethodsX* 2015, 475-484.

CP094
ESTRATÉGIA SUSTENTÁVEL PARA A VALORIZAÇÃO DO SORO DE LEITE NO DESENVOLVIMENTO DE PÃO COM PROPRIEDADES ANTICANCERÍGENAS

Christine Macedo¹, Cláudia Feiteira¹, Cristiana Nunes¹, Ana Lima¹, Ricardo Ferreira¹, Isabel Sousa¹, Anabela Raymundo¹

¹Universidade de Lisboa, Instituto Superior de Agronomia, LEAF Research Center (Linking Landscape Environment Agriculture and Food), Tapada da Ajuda, 1349-017 Lisboa, Portugal

Corresponding author: csmacedo@isa.ulisboa.pt

O soro de leite é um subproduto da indústria dos laticínios, obtido em grande quantidade durante a produção de queijo. Trata-se de um subproduto com elevado valor nutricional, que apresenta propriedades bioativas e a sua aplicação como ingrediente na produção de alimentos contribuirá para a obtenção de produtos com valor nutricional acrescentado e com propriedades funcionais e aromáticas, traduzindo-se numa boa alternativa para o seu aproveitamento. O processo de fermentação do soro permite a remoção da lactose e proteínas alergénicas que o constituem, além de aumentar a disponibilização de compostos bioativos. O pão é um dos alimentos mais consumidos em todo o mundo e uma boa estratégia para o enriquecimento de pão é a utilização de soro de leite como ingrediente na sua elaboração. O presente trabalho teve como objetivo produzir pão utilizando soro de leite fermentado em substituição total da água, de modo a obter pão nutricionalmente mais rico e com propriedades bioativas, criando em simultâneo uma alternativa para o aproveitamento do soro de leite. O soro foi fermentado sob condições controladas e caracterizado em termos de composição centesimal. A sua bioatividade como inibidor anticancerígeno, foi demonstrada através de ensaios bioquímicos e *in vitro*. A partir de uma formulação padrão de pão desenvolvida anteriormente, a água foi completamente substituída por soro líquido fermentado. Testaram-se três tempos de fermentação da massa: 1, 2 e 3 horas. As massas foram caracterizadas em termos de pH, extensibilidade, textura (TPA) e espectro mecânico (SAOS), antes e após as fermentações. Nos pães subsequentes, foram realizadas análises de pH, cor e textura (crosta e miolo), volume, rendimento, atividade de água, composição nutricional (lípidos, proteínas, minerais e hidratos de carbono): Efetuou-se ainda a avaliação sensorial dos pães. Verificou-se que o soro apresenta alta bioatividade após a fermentação e afeta a reologia e a textura do pão. O pão elaborado com soro de leite fermentado apresentou atividade anticancerígena. Deste modo, é possível otimizar uma formulação com propriedades sensoriais semelhantes ao pão tradicional, mas com uma bioatividade aumentada, com grande potencial para expansão, transferência de tecnologia e lançamento no mercado.

CP095
**LIGNIN NANOPARTICLES LOADED WITH BLUIISH
PYRANOANTHOCYANIN PIGMENTS. INCREASED STABILITY IN
AQUEOUS SYSTEMS.**

Paula Araújo¹, Ana Costa^{2,3}, Iva Fernandes¹, Nuno Mateus¹, Victor de Freitas¹,
Bruno Sarmento^{2,3,4}, Joana Oliveira¹

¹ ICETA/REQUIMTE – Laboratório Associado para a Química Verde, Departamento de Química e Bioquímica, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre, 687, 4169-007 Porto, Portugal, paula.araujo@fc.up.pt

² Instituto de Investigação e Inovação em Saúde (i3S), Universidade do Porto, Rua Alfredo Allen 208, 4200-135 Porto, Portugal

³ Instituto de Engenharia Biomédica (INEB), Universidade do Porto, Rua Alfredo Allen 208, 4200-135 Porto, Portugal.

⁴ CESPU, Instituto de Investigação e Formação Avançada em Ciências e Tecnologias da Saúde & Instituto Universitário de Ciências da Saúde, Rua Central de Gandra 1317, 4585-116 Gandra, Portugal

The search of natural blue pigments as an alternative to the synthetic colorants aroused the interest of the research community.

Pyranoanthocyanin dimers and Portisins that present a blue colour were found to occur in aged Port wines. However, these compounds demonstrated a lack of solubility in aqueous and lipophilic systems, hindering their application in food and cosmetic matrices [1].

In order to improve the water solubility of these pigments, lignin nanoparticles were produced using dialysis (LNP_D). Particles around 200 nm were obtained with a stability of at least one month at room temperature. The stability of the particles at different pH values from 1 to 8 was evaluated during 7 days by the determination of the average particle size (Z-average), the polydispersity index (PDI) and the average zeta potential (ξ) by dynamic light scattering (DLS) and electrophoretic light scattering (ELS). The morphology of lignin nanoparticles (LNPs) was determined by TEM, STEM and SEM analysis and the images obtained are in accordance with reported by *Figueiredo, et al.* 2017 showing a symmetric and uniformly spherical shape with a compact structure [2]. In addition, the effect of pH on the color stability of free pigments and encapsulated was also studied and it was demonstrated that encapsulated pigments present a higher chromatic stability when compared to the free pigments.

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[1] Oliveira, J., Mateus N., de Freitas, V. *Dyes and Pigments*, **2014**, 100, 190-200.

[2] Figueiredo, P., Lintinen, K., Kiriazis, A., Hynninen, V., Liu, Z., Bauleth-Ramos, T., Rahikkala, A., Correia, A., Kohout, T., Sarmento, B., Yli-Kauhaluoma, J., Hirvonen, J., Ikkala, O., Kostianen, M., Santos, H. *In vitro* evaluation of biodegradable lignin-based nanoparticles for drug delivery and enhanced antiproliferation effect in cancer cells. *Biomaterials*, **2017**, 121, 97-108.

CP096

AGARICUS BLAZEI MURRIL- A POTENTIAL INGREDIENT FOR NUTRACEUTICAL OUTCOMES

Oludemi Taofiq^{1,2,3}, Francisca Rodrigues⁴, Lillian Barros¹, Ricardo C. Calhella¹, Ana M. González-Paramás³, Maria F. Barreiro^{1,2}, M. Beatriz P.P. Oliveira⁴, Isabel C.F.R. Ferreira¹

¹*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal*

²*Laboratory of Separation and Reaction Engineering (LSRE), Associate Laboratory LSRE/LCM, Polytechnic Institute of Bragança, Bragança, Portugal*

³*GIP- USAL, Unidad de Nutrición y Bromatología, Faculty of Pharmacy, University of Salamanca, Salamanca, Spain*

⁴*REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Porto, Portugal*

The concept of bio-economy has emerged to overcome some sustainability challenges, and this involves conversion of agricultural residues and waste streams into high value-added products that can be utilized as ingredients for several bio-based industrial processes, delivering both economic growth, scientific interest and a better environment. The present work was carried out to re-utilize discarded *Agaricus blazei* Murill. Its nutritional composition was evaluated and ethanolic extracts were prepared by Soxhlet extraction to be further evaluated for their anti-inflammatory, anti-tyrosinase and cytotoxic properties against different tumor cell lines (SRB assay). MTT and LDH assays were also used to determine cell viability and cell death respectively in Caco-2 and HT29 cells lines. Essential nutrients such as carbohydrates, proteins and fat, were found; twenty fatty acids were detected, sugars (mannitol and trehalose), α -tocopherol and oxalic acid were also present. The extracts, up to 100 $\mu\text{g/mL}$, were able to maintain viability of Caco-2 and HT29 cells. The extracts also presented anti-tyrosinase activity (EC_{50} 1.33 \pm 0.02 mg/mL) and with no toxicity in tumor cells. The results obtained suggested that the extracts obtained from *Agaricus blazei* Murill residues can be utilized as an inexpensive and sustainable source of nutraceutical and functional food ingredients.

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[1] Heleno, S.A.; Prieto, M.A.; Barros, L.; Rodrigues, A.A.; Barreiro, M.F.; Ferreira, I.C.F.R. *Food Chemistry* **2016**, *197*, 1054-1063.

CP097

ASSESSING THE NUTRITIONAL PROFILE AND ANTIOXIDANT ACTIVITY OF RED SEAWEEDS SPECIES PRODUCED IN INTEGRATED MULTI-TROPHIC AQUACULTURE SYSTEM

Filipa B. Pimentel^{1*}, Vasco D. Teixeira¹, Anabela S.G. Costa¹, Rita C. Alves¹,
M. Beatriz P.P. Oliveira¹

¹REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy,
 University of Porto, Rua de Jorge Viterbo Ferreira nr. 228, 4050-313 Porto, Portugal

*filipabpimentel@gmail.com

Integrated Multi-Trophic Aquaculture (IMTA) systems are an example of ecological engineering tools used to increase the production sustainably, while modifying the chemical composition, and attenuating environmental problems caused by several forms of fed aquaculture [1]. The aim of this work was to study the nutritional composition and antioxidant activity of two species of red seaweeds produced in an IMTA system, in Portugal: *Porphyra dioica* and *Gracilaria vermiculophylla*.

Nutritional analyses of samples were performed according to official methods [2,3]. The amount of antioxidant compounds was estimated based on the total phenolic compounds (Folin-Ciocalteu method) and total flavonoids. Antioxidant activity was determined using FRAP and DPPH• inhibition assays. These parameters were determined in extracts obtained by different protocols, using different combinations of solvents - water, ethanol and an hidroethanolic mixture (1:1); sample:volume ratios (1:30; 1:40 and 1:50, w/v), and time (60'; 30' + 30'; and 30') at room temperature.

Both species presented significant amounts of protein, especially *P. dioica* (256 ± 3 vs 145 ± 5 kg/ton dry weight (dw)), and minerals, which represented up to 30% of dw in *G. vermiculophylla* (293 ± 4 vs 186 ± 6 kg/ton dw). Carbohydrates, essentially fibre, accounted for more than 50% of dw (557 and 559 kg/ton for *P. dioica* and *G. vermiculophylla*, respectively). Lipid content was very low in both cases, especially in *P. dioica* (0.7 ± 0.2 vs 3.0 ± 0.3 kg/ton dw). Both species have a considerable content of phenolic compounds. Extracts contained up to 2.9 kg gallic acid equivalents (GAE)/ton for *P. dioica* and 1.6 ± 0.1 kg GAE/ton for *G. vermiculophylla*. Hydroethanolic (*G. vermiculophylla*) and aqueous (*P. dioica*) extracts, for 30 or 60', respectively, presented a remarkable antioxidant capacity using the FRAP assay, however, none of the extracts showed DPPH• inhibition. In conclusion, these type of red algae have noteworthy contents of proteins and dietary fibre. Furthermore, by using a simple and short time-consuming extraction procedure and non-toxic solvents, it was possible to obtain extracts rich in bioactive compounds.

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[1] Abreu, M. H.; Pereira, R.; Yarish, C.; Buschmann, A. H.; Sousa-Pinto, I. *Aquaculture* **2011**, 312, 77-87.

[2] AOAC. Official Methods of Analysis of AOAC International, 19th Edition AOAC International 2012: Maryland, EUA.

[3] Angell, A. R.; Mata, L.; de Nys, R.; Paul, N. A. *Journal of Applied Phycology* **2016**, 28, 511-524.

CP098

BIOMONITORING OF ORGANOCHLORINE PESTICIDES IN PORTUGUESE COAST SHRIMP

Maria Luz Maia¹, Conceição Calhau^{2,3}, Cristina Delerue-Matos¹, Valentina F. Domingues¹

¹REQUIMTE-LAQV, Rua Dr. António Bernardino de Almeida, 431, 4200-072 Porto, Portugal.

² Center for Research in Health Technologies and Information Systems (Centro de Investigação em Tecnologias e Serviços de Saúde –CINTESIS), Porto, Portugal

³ Nutrition and Metabolism, NOVA Medical School, Universidade Nova de Lisboa, Campo dos Mártires da Pátria, 130, 1169-056 Lisbon, Portugal

cmm@isep.ipp.pt

Organochlorine pesticides (OCPs) are pesticides widespread used around the world and very persistent in the environment. OCPs are chemical persistent, lipophilic, and hydrophobic compounds that can accumulate in biota, become biomagnified through the food chain, meaning that the concentrations in biota increase as the trophic level increases [1]. Despite several OCPs have been banned, they can still be detected in sediments, plants, animals and humans.

Shrimps are rich in proteins and omega-3 fatty acids. This shellfish is also a good source of phosphorus, choline, copper, selenium, zinc, iodine, carotenoid astaxanthin, as well as B-complex vitamins (B12, B3, B6), vitamin A and E [2]. However they can also accumulate environmental contaminants with impact in human health, namely OCPs. The shrimp specie *Palaemon serratus* is widely distributed in Portugal coastal areas, estuaries and rivers and is the subject of small-scale fisheries. This species are widely consumed in seafood restaurants along the Portuguese Coast, and for that reason is important to verify that they are safe for human consumption.

With this in mind, sampling of the *P. serratus* shrimp was performed up to two miles of the west Portuguese coast, in Vila do Conde during autumn 2017. After the arrival at the laboratory, the shrimp head, the shell and the edible portion were separated and storage separately at -20°C. The edible portion were homogenised and 5 g were used to test the presence of OCPs.

Briefly, the OCP residues were extracted by Quick, Easy, Cheap, Effective, Rugged and Safe (QuEChERS) methodology. A clean-up sorbent (mix of anhydrous magnesium sulphate, primary secondary amine, C18 and graphitized carbon black) were used after extraction. The extent of the contamination was reached through the quantification of fourteen OCPs using gas chromatography (GC) coupled with electron-capture detector. The pesticides γ -HCH (γ -hexachlorocyclohexane), *p,p'*-DDD (dichlodiphenyldichloro-ethane) and methoxychlor were detected. The confirmation will be performed using GC coupled with mass spectrometry.

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- [1] Maia ML, Correia-Sá L,. J Environ Sci Heal - Part B Pestic Food Contam Agric Wastes 2015;50:338–45.
- [2] Akonor PT, Ofori H,. Int J Food Sci 2016;2016:1–5.

CP099 ANALYSIS OF BIOGENIC AMINES IN FISH BY HPLC-FLD

Servaas de Cock¹, João Teixeira¹, Maria João Ramalhosa¹, César Oliveira¹, Cristina Delerue-Matos¹

¹REQUIMTE–LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, R. Dr. António Bernardino de Almeida 431, 4249-015 Porto, Portugal. cmm@isep.ipp.pt

The presence of biogenic amines in food is a public health concern as they are within the most notorious food-borne intoxications [1]. They can occur in raw and processed food and result in strong allergic reactions. They are formed by the microbial decarboxylation of amino acids, as the fish is normally contaminated with bacteria during storage and processing [2]. Therefore, the detection of biogenic amines in food is crucial, as they are indicators of food quality and safety. Histamine is considered by European and international standards as the most dangerous and relevant biogenic amine, with a food safety limit of 50 mg of ingested amine per meal. In the European Union, the maximum level of histamine allowed in fish or fish products is 200 mg histamine kg⁻¹ of fish [3] while the recommended value by the Food and Drug Administration (FDA) is 50 mg kg⁻¹ [4].

The objective of this work was the development of an analytical methodology to quantify biogenic amines (histamine, putrescine, cadaverine, tyramine, tryptamine, β -phenylethylamine, spermidine and spermine) in fish using relatively inexpensive analytical apparatus and following simple protocols. Briefly, the analytical procedure consisted on sampling and homogenizing fish samples, the extraction of the solid matrices with an acid, their subsequent derivatization with dansyl chloride and the analysis of the organic extracts by liquid chromatography with fluorescence detection. The developed methodology was employed on the analysis of samples of tuna and sardine. The impact of the fish matrix on quality control parameters was also evaluated.

The results obtained suggest that the adopted methodology has the potentiality to be implemented in routine analysis of fish samples, helping to comply with the exigent European and international standards regarding the levels of biogenic amines in fish.

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[1] Papageorgiou, M.; Lambrapoulou, D.; Morrison, C.; Klodzinska, E.; Namiesnik, J; Plotka-Wasyłka, J. *Trends in Analytical Chemistry* **2017**, 98, 128-142.

[2] Tahmouzi, S.; Khaskar, R.; Ghasemlou, M. *Food Chemistry* **2010**, 126, 756-761.

[3] European Union, “Eur-lex,” 23 October 2013. Available:

<https://eur-lex.europa.eu/eli/reg/2013/1019/oj>. [Accessed 3 September 2018].

[4] Herrero, A.; Sanllorente, S.; Reguera, C.; Ortiz, M.; Sarabia, L. *Analytica Chimica Acta* **2016**, 945, 31-38

CP100

AVALIAÇÃO DO pH NA TRANSFORMAÇÃO DO MÚSCULO EM CARNE BOVINA

Landum L.¹; Fernandes, I²; Ferro Palma, S¹.

¹DTCA, Escola Superior Agrária, Instituto Politécnico de Beja, Portugal

²Matadouro da SAPJU CARNES, S.A, Beja, Portugal

sfpalma@ipbeja.pt

A qualidade da carne é influenciada por vários factores, nomeadamente, a raça do animal, sexo, alimentação e sobretudo o maneio do animal. No maneio estão implícitas as condições a que o animal está sujeito. Por isso, o bem-estar animal influencia de modo fulcral a qualidade da carne. Animais sujeitos a stresse originam carne de pior qualidade e com valores de pH anómalos [1].

O bem-estar animal nos matadouros é um tema recente [2], o seu controlo constitui um factor essencial nas características finais da carne, com tradução na transformação do músculo em carne.

A ocorrência de uma rigidez cadavérica adequada e uma queda notória do pH são factores benéficos para a carne, pois o pH dito baixo (5,4-5,5) promove a inibição do crescimento microbiano e o ácido láctico formado potencia uma textura macia, em virtude da conversão do colagénio em gelatina [3].

O pH é influência a conservação da carne, pelo facto de interferir com a capacidade de retenção de água e com o desenvolvimento microbiano. Por outro lado, o pH tem um papel decisivo na qualidade da carne, pois influencia características como cor, textura e suculência às quais os consumidores dão elevado ênfase

O trabalho foi desenvolvido no matadouro da SAPJU CARNES, S.A. As raças avaliadas foram vacas, Alentejana, Cruzado de carne, Turino Frísia e Limousine.

As medições de pH aos 0 dias e 2 dias de abate, com o intuito de avaliar o pH na transformação do músculo em carne bovina.

A medição do pH foi realizada com um medidor de pH portátil (método potenciométrico) e efectuada na vazia e no acém.

Com os resultados obtidos concluímos que nas raças Cruzado de Carne, Turino Frísia e Limousine existem carnes que poderíamos considerar DFD, segundo [4]. Na raça Cruzado de Carne, 6,4%, e na raça Limousine 5,5%. A variação de pH ao longo das primeiras 48 horas é similar nas quatro raças.

A raça Turino Frísia destacou-se em relação às outras raças por apresentar valores de pH, tanto no acém como na vazia, mais baixos.

[1] Arantes, S.2014. *Importância do pH na carne*. Mestrado Integrado em Engenharia Biológica - Ramo Tecnologia Química e Alimentar. Minho: Universidade do Minho-Escola de Engenharia.

[2] Regulamento (CE) nº 1099/2009 do Parlamento Europeu e do Conselho de 22 de Setembro de 2009. Protecção dos animais no momento da occisão, Jornal Oficial da União Europeia, L303. Bruxelas.

[3] Barbalho, P. C. (2007). *Avaliação de programas de treinamento em manejo racional de bovinos em frigoríficos para melhoria do bem-estar animal*. Dissertação de mestrado, Faculdade de Ciências Agrárias e Veterinária, Universidade Estadual Paulista, Jaboticabal, SP.

[4] López, N. et al. (2001). Tecnologia de elaboración de produtos cozido. In Martín Bejarano, S. (2001). *Enciclopedia de la carne y de los productos cárnicos* (Vol. II, Cap. 4). Plasencia (Cáceres): Martin & Macias.

CP101

Assessment of functional properties and determination of pharmaceuticals in subcritical water extracts from seaweeds

Ana P. Carvalho¹, Paula Paíga¹, Inês Ribeiro¹, Bruno Pedras², Rita Craveiro², Francisca Mano², Pedro Simões², Cristina Delerue-Matos¹, Clara Grosso¹

¹ REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida, 431, 4249-015 Porto, Portugal. Email: ana.carvalho@graq.isep.ipp.pt

² REQUIMTE/LAQV, Departamento de Química, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal

Seaweeds are interesting marine organisms due to their nutritional, commercial and ecological importance. Apart from their nutritional importance, as sources of minerals, proteins and omega-3 fatty acids (among others), they are also interesting sources of functional compounds such as metabolites with antioxidant, antimicrobial or neuroprotective activities. These elements can exist at very different levels depending on the studied species, site of collection and season. Additionally, the extraction process and its conditions are also of utmost importance.

The main objective of this work was to characterize some functional properties (antioxidant capacity and anticholinesterase activity), from two edible seaweeds from the Portuguese coast, *Fucus vesiculosus* L. and *Codium tomentosum* Stackhouse, in order to assess some of their potential health benefits. Subcritical water extraction was performed with these seaweeds, using 3 steps of temperature: 20-130°C (condition 1); 130-190°C (condition 2); and 190-240 °C (condition 3).

Antioxidant capacity tests performed were ABTS and ORAC, whereas the neuroprotective properties were assessed by the ability of the extracts to inhibit two enzymes, acetylcholinesterase and butyrylcholinesterase. Extracts obtained using condition 3 were the most promising ones.

In recent years, the presence and impact of pharmaceutical products detected in water environment has been a subject of concern. In order to guarantee that extracts obtained with condition 3 were free of contaminants, the presence of pharmaceuticals belonging to different therapeutic classes were assessed by LC-MS/MS.

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CP102
DETERMINAÇÃO DE SELÊNIO TOTAL EM SUPLEMENTOS
ALIMENTARES EMPREGANDO QUANTUM DOTS COMO SONDAS
FLUORESCENTES

Leandro G. Benzi¹, Maria das Graças A. Korn¹, Rodolfo M. M. Santana¹

¹Universidade Federal da Bahia, Departamento de Química Analítica, Rua Barão de Jeremoabo CEP 41170290, Salvador-BA, Brasil. Email: leo-benzi@hotmail.com

A complementação alimentar pelo uso de suplementos alimentares tornou-se prática recorrente nos dias atuais. Nesse contexto, destacam-se os suplementos de selênio, que face aos efeitos benéficos desse micronutriente¹, têm sido amplamente comercializados empregando diferentes compostos, como quelatos ou leveduras de selênio, isolados ou associados a outros nutrientes. Apesar dos benéficos efeitos do Se, sua ingestão de altos teores pode causar intoxicação severa levando a queda de cabelo, edemas pulmonares e outras complicações. Assim, o presente trabalho tem por objetivo o desenvolvimento de um novo método para determinação de Se empregando pontos quânticos (QD) de CdTe revestidos com ácido tioglicólico para controle de qualidade de suplementos com composição distintas. A avaliação da interação do QD com selênio foi realizada de modo a investigar os efeitos do tamanho do QD (2,5 e 3,2 nm), pH (5 - 9), composição do tampão (citrato, acetato, amoniacal e TRIS) e ordem de adição dos reagentes sobre a emissão fluorescente. Para a validação foram determinadas a faixa linear de trabalho, limite de detecção e quantificação, precisão. Duas amostras de suplemento compostas por diferentes espécies de Se (levedura selenizada, 34 µg/comprimido, e selênio quelado, 100 µg/comprimido) foram adquiridas e analisadas pelo método proposto. Para a avaliação da exatidão do método proposto, as amostras foram analisadas segundo método de referência da agência americana de alimentos (FDA)². O efeito de aumento da intensidade fluorescente dos QD foi observado para espécie iônica Se(IV) com acentuada dependência do tamanho do nanocristal empregado ($\Delta F_{2,5nm} > 40\%$ e $\Delta F_{3,2nm} < 7\%$). Adicionalmente, foi constatado ganho expressivo na sensibilidade analítica ($\Delta F > 90\%$) em condições ótimas com tampão amoniacal (5 µM) a pH=8,4, seguindo a ordem de adição: (i) amostra, (ii) tampão e (iii) QD. O LOD e LOQ do método foram iguais a 87 e 290 µg L⁻¹, respectivamente, a faixa linear de trabalho apresenta limite superior igual 450 µg L⁻¹ com boa linearidade ($R^2 = 0,9956$, $n = 6$) e precisão ($RSD \leq 4\%$, $n=8$). Foram determinados nas amostras analisadas teores de Se igual a 41,94±3,88 e 128,41±5,67 µg/comprimido, não sendo observadas diferenças significativas em relação ao método de referência (35,42±1,33 e 131,64±4,79 µg/comprimido). Porém, foi verificado maior teor de Se em relação aos valores declarados na segunda amostra sendo observada diferença significativa para 95% de confiança entre esses valores. O método proposto apresentou boa precisão e exatidão, bem como limites de quantificação adequados para controle de qualidade em amostras de suplemento sendo uma alternativa simples e de menor custo frente aos métodos já estabelecidos.

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[1] Bunch DR, Cielask W, Wang S, *Clinical Biochemistry*, **2017**, 50, 710-713

[2] FDA U.S., *Elemental Analysis Manual for Food and Related Products*, **2015**, v. 1.1

CP103

USE OF DIGITAL IMAGE ANALYSIS FOR MONITORING THE RIPENING OF PDO SERPA CHEESE

João Dias^{1,4}, Nuno B. Alvarenga^{2,5}, Maria João Carvalho¹, Olga Amaral¹, A. Pedro Louro Martins^{2,5}, Cristina Pinheiro⁶, Ana Garrido⁶, Eliana Machado⁶, Patrícia Lage¹ and Maria F. Duarte^{3,6}

joao.dias@ipbeja.pt

¹ESA-Instituto Politécnico de Beja (IPBeja), Rua Pedro Soares, 7800-295 Beja, Portugal

²UTI-INIAV, Quinta do Marquês, Oeiras, Portugal

³CEBAL/IPBeja, Rua Pedro Soares, s.n, Ap 6158, 7801-908 Beja, Portugal

⁴GeoBioTec, Un. Nova de Lisboa, Campus da Caparica, 2829-516 Caparica, Portugal

⁵LEAF-ISA, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisbon, Portugal

⁶ICAAM, ECT, U. Evora, Ap. 94, 7006-554 Evora

Serpa cheese is a Portuguese PDO cheese, with a semi-hard or hard consistency, light yellow color, few or no holes and intense flavour. It is obtained by slowly draining the curd, after coagulation of raw ewe's milk, with a vegetable coagulant infusion of *Cynara cardunculus* L. The aim of this work was to analyze the evolution of the color in the interior of Serpa cheese and the area of gas holes during the ripening process, using different coagulants. The experimental design included three flower extracts from different *C. cardunculus* (C1, C2 and C3), and one commercial animal coagulant (AC). For each coagulant, groups of four cheeses were picked after 0, 14 and 35d of ripening dates. Samples were analyzed considering color (CIE L* a* b* and RGB), digital image and structural parameters (viscoelastic measurement and texture analysis) in the interior of cheese, together with chemical parameters (moisture, pH, acidity). The results evidenced an increase of the area occupied by the holes until 14d, followed by a decrease until the end of ripening time. Pearson correlation coefficients between structural indicators, image parameters (ratio of gas holes) and chemical parameters were calculated. The obtained results indicate considerable physical changes during ripening, reflecting the biochemical reactions which occur inside Serpa cheese and how these changes affect the area occupied by the gas during the fermentation.

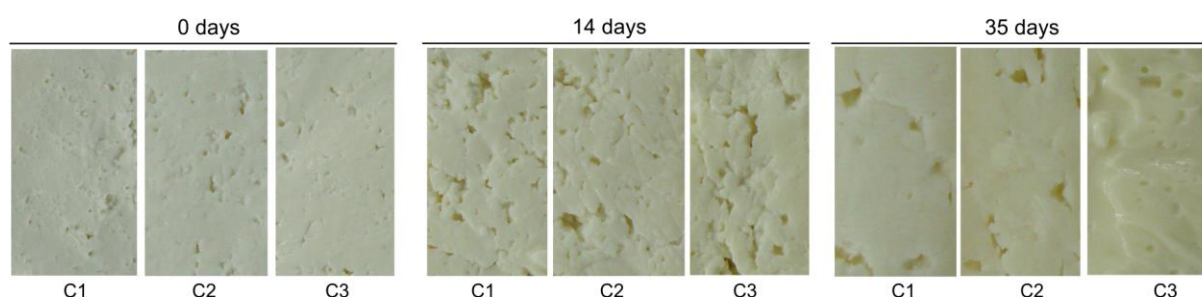


Figure 1: Evolution of Serpa cheese during ripening

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CP104
OPTIMIZATION AND DEVELOPMENT OF ANALYTICAL METHODS
FOR THE DETERMINATION OF NEW BROMINATED FLAME
RETARDANTS AND POLYBROMINATED DIPHENYL ETHERS IN
CHILI PEPPERS

Virgínia C. Fernandes^{1*}, Ward Luts^{2*}, Cristina Delerue-Matos¹, Valentina F. Domingues¹

¹ *REQUIMTE/LAQV, Instituto Superior de Engenharia, Instituto Politécnico do Porto, Rua Dr^o António Bernardino de Almeida, 431, 4200-072 Porto, Portugal.*

² *Faculty of Engineering Technology, Hasselt University, KU Leuven, Belgium
vircru@gmail.com*

**contributed equally to this study*

Food safety has become a constant concern all over the world, leading healthcare institutions and governments of several countries to find ways to monitor production chains. Brominated flame retardants (BFRs) are mixtures of man-made chemicals that are added to a wide variety of products to make them less flammable. BFRs have raised great concerns for their persistence, bioaccumulation, and harm to human health. Consequently, the attention in monitoring BFRs is growing and the European Commission has adopted a recommendation (118/2014/EU). The contamination of BFRs in food samples results not only from the environment, but also during food processing or storage. For the first time, a simple, fast and cost-effective sample preparation method is proposed as extraction technique to determine 12 BFRs in Chili peppers samples. Different QuEChERS, and dispersive solid phase extract sorbent compositions were evaluated in terms of recovery and matrix effects. Gas chromatography (GC) coupled with an electron capture detector was used for the detection and the quantification of the BFRs. Matrix effects were studied and the LODs obtained were between 4.52-13.57 µg/Kg and recoveries were calculated and varied between 21-149%, The repeatability is lower than 20%. To confirm the presence of the BFRs a GC coupled with a mass spectrometer was used. No traces of BFRs were found.

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CP105

SELECTION OF MITOCHONDRIAL DNA MARKERS FOR COW'S MILK ALLERGEN DETECTION

Caterina Villa, Joana Costa, M. Beatriz P. P. Oliveira and Isabel Mafra

REQUIMTE-LAQV, Faculty of Pharmacy, University of Porto, Porto, Portugal.
Email: caterinavilla@hotmail.com; isabel.mafra@ff.up.pt

Cow's milk allergy is one of the most common food allergies in early childhood, which can persist through adult life. The current effective treatment for milk allergy is the adoption of an elimination diet. However, accidental exposure to cow's milk proteins is recurrent since they are present in uncounted food products, as ingredients (cheeses, yogurts) or as technological aids (sausages, cooked hams), exposing allergic individuals to a constant threat, even with the ingestion of trace amounts [1]. The aim of this work was to screen different genes of cow mitochondrial genome in order to develop a specific, sensitive and accurate method to detect trace quantities of cow DNA in complex and processed foods.

Model mixtures containing known quantities (10-0.00001%) of cow's milk protein concentrate (technological aid) in turkey meat were prepared and submitted to two processing methods, simulating the production of cooked ham (67°C, 5 h) and sausages (121°C, 15 min). Sequences of mitochondrial genes from cow and other relevant animal species were retrieved from NCBI database. Specific primers and TaqMan probes were designed and tested in model mixtures by qualitative PCR and real-time PCR. Sequencing of the same genes of different animal species were also performed for cross-reactivity study. Most of the tested PCR assays presented absolute limit of detection (LOD) between 10 pg and 1 pg of cow DNA and relative LOD of 0.01% and 0.1% of cow's milk protein concentrate in raw meat and cooked ham, respectively. However, the specificity study revealed cross-reactivity with some meat species, including turkey, pork, goat and chicken. The cow amplicons from the assays that presented less cross-reactivity and the respective regions in the reactive animal species were sequenced in order to identify the nucleotide differences for primer and probe design, increasing the specificity by real-time PCR. Until now, real-time PCR targeting the *cyt b* gene showed a LOD of 0.01% with adequate performance parameters in the range 10-0.01% of cow milk protein concentrate in raw meat, but still with a background signal of some cross-reaction with turkey meat. Currently, other mitochondrial genes are under evaluation and will be tested by real-time PCR with specific probes in order to improve the sensitivity and specificity of the method.

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[1] Villa, C., Costa, J., Oliveira, M. B. P. P., Mafra, I. (2018). Comprehensive Reviews in Food Science and Food Safety, 17:137-164.

CP106
DNA-BASED STRATEGIES TO DETECT AND QUANTIFY SHRIMP
CRUSTACEANS AS POTENTIAL ALLERGENS

Telmo J. R. Fernandes, Joana Costa, M. Beatriz P. P. Oliveira, Isabel Mafra
REQUIMTE-LAQV, Faculty of Pharmacy, University of Porto, Porto, Portugal.
Email: isabel.mafra@ff.up.pt; jbcosta@ff.up.pt

Currently, crustacean allergy is faced as a very relevant issue of food safety. Crustaceans, such as shrimps, crabs and lobsters represent a major food resource, which is highly appreciated by general population. However, they are also responsible for eliciting the majority of the shellfish-allergic reactions [1], representing a concrete health risk for a significant portion of the global population. Therefore, to safeguard people from suffering adverse allergic reactions, adequate analytical methodologies are necessary to verify the labelling of processed seafood. This work intended to develop a new quantitative real-time PCR system specific for a wide range of shrimp species.

The mitochondrial 16S rRNA gene was selected from the available NCBI database for 17 distinct crustacean species, whose sequences were aligned to identify common regions for primers and probe design, as a universal marker for shrimp crustaceans. Crustacean specimens from different species ($n=18$) were acquired, together with 62 non-crustacean species, including fish, mollusks, meats and plants. Several seafood products ($n=18$), including shrimp patties, seafood broth/soups, surimi and pre-cooked dishes, were also acquired at local markets for assay applicability. A set of model mixtures was prepared to simulate a processed shrimp stuffing/filling, containing 50-0.0001% of shrimp in béchamel. DNA was extracted using the SureFood® Prep advanced kit, according to the manufacturer instruction of Protocol 1. Two methods targeting the 16S rRNA gene were developed to detect crustaceans in foods: (i) a qualitative PCR assay (shrimps, lobsters and crabs) and (ii) a quantitative real-time PCR assay [2]. The real-time PCR system allowed the detection and quantification down to 0.1 pg and 0.0001% (w/w) of shrimp DNA and shrimp in model mixtures, respectively, being effectively validated with blind mixtures and applied to commercial samples. The qualitative PCR assay represents a simple and fast toll to detect crustaceans in processed foods, while the proposed real-time PCR method enables the accurate detection/ quantification of shrimp in foods.

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[1] Pascoal, A., Barros-Velazquez, J., Cepeda, A., Gallardo, J.M., Calo-Mata, P. (2008). Food Chemistry, 109:638-646.

[2] Fernandes, T.J.R., Costa, J., Oliveira, M.B.P.P., Mafra, I. (2018). Journal of Food Composition and Analysis, 72, 7-14

CP107
DETERMINATION OF BENZOIC ACID AND SORBIC ACID IN
FOODSTUFFS BY HIGH PERFORMANCE LIQUID
CHROMATOGRAPHY WITH UV DETECTION

João Costa¹, Celeste Serra¹, Elsa Vasco²

¹*Chemical Engineering Department, High Institute of Engineering of Lisbon, Portugal*

²*Food and nutrition Department, National Health Institute Dr. Ricardo Jorge, Portugal.*

Elsa.vasco@insa.min-saude.pt

In recent decades, there has been a change in the dietary pattern of the population towards an increase in consumption of more industrialized foods, with distinguishing flavor, high energy density and usually at a low cost [1].

Food industry has overcome the challenge of maintaining the quality and nutritional value of the products by using a wide range of Food Additives. Sorbic and benzoic acids, and its salts, are the most used food preservatives, being present in a wide variety of foodstuffs such as dairy products, soft drinks, jams, sauces, cake and bakery products. These substances are responsible for inhibit the growth of microorganisms, thus preserving and prolonging the product shelf-life.

Although these preservatives are recognized by the EFSA and FDA as being safe, there are concerns arising from their wide occurrence in food, cosmetics and pharmaceutical products, that can lead to an increase of the daily intake and possible risks of exceeding the acceptable daily intake (ADI) of 5 and 25 mg/kg body weight/day for benzoic and sorbic acids respectively [2]. Therefore, occurrence data are essential to ensure consumer safety through exposure assessment studies.

In this study, 23 food products (soft drinks, fruit juices, quince jams, yogurts, sauces, and bakery and cake products) commercially available in the market, were evaluated using a validated HPLC method with UV detection based on European Standard 12856 in order to compare their levels with respective allowable limits.

Both benzoic and sorbic acids were separated and quantified on a Prevail™ C18 column (250x4.6 mm, 5 µm) using phosphate buffer (0.0125M, pH 3.5) and acetonitrile as mobile phase, in gradient elution, at flow rate of 1 mL/min. The detection was performed at 220 nm.

All samples were within the limits permitted by the legislation. Benzoic and sorbic acids were found in concentrations ranging from 94 mg/L to 824 mg/kg and 91 mg/L to 1298 mg/kg, respectively. Comparing the results, both preservatives were present in samples of soft drinks, jam, cake products and non-emulsified sauces at concentrations below the limits of 250+150 mg/L, 1500 mg/kg, 300 mg/kg and 1000 mg/kg, of sorbic and benzoic acid, respectively. As specified in the legislation, only sorbic acid was found in samples of bakery products and emulsified sauces at concentrations below 2000 mg/kg.

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[1] Linke, B. G.; Casagrande, T. A.; Cardoso, L. A.. *African Journal of Biotechnology* **2018**, *17*, 306-310.

[2] Chen, Q.C. and Wang, J. *Journal of Chromatography A* **2001**, *937*, 57-64.

CP108
**EVALUATION OF A MODIFIED QUECHERS METHOD FOR THE
EXTRACTION OF BROMINATED FLAME RETARDANTS FROM RED
FRUITS BY GC-MS**

V. C Fernandes, M. Freitas, J G. Pacheco, V. F. Domingues, C. Delerue-Matos
*REQUIMTE/LAQV, Instituto Superior de Engenharia, Instituto Politécnico do Porto, Rua Dr^o
António Bernardino de Almeida, 431, 4200-072 Porto, Portugal.*
vireru@gmail.com

Brominated flame retardants (BFRs), such as polybrominated diphenyl ethers (PBDEs) and others emerging brominated flame retardants (EBFRs), have been used as additives in furniture, electronics, foams, building materials and textiles to reduce the risk of fire spreading. They are usually added to plastics at concentrations between 5 and 30% by weight as additives not chemically bonded to the polymer. Because they are not covalently bound to materials to which they are added, BFRs freely liberate and make their way into the environment and foods. In the past decade, the widely used PBDEs were gradually banned worldwide, due to increasing evidence of their toxicity, persistency and other health and environment concerns. As a result, many EBFRs are used in commercial formulations as a PBDE replacement to comply with fire safety regulations in commercial products. A few studies have reported the presence of BFRs also in fresh food. The development of simple, rapid, selective and sensitive methodologies that allow the BFRs determination at very low levels constitutes a special challenge. In addition, modified magnetic nanoparticles, a novel and interesting material, have attracted scientific attentions. They have become a magnetic sorbent and have been successfully applied in separation of contaminants in different samples. The goal of this study was to evaluate a simple, rapid, and cost-effective sample preparation method, previously developed and validated for the analysis of pesticides in strawberries using gas chromatography (GC) [1], for the analysis of PBDEs and NBFRs by GC-MS in red fruits samples. The sample preparation methodology was based on the quick, easy, rugged, effective, and safe approach and magnetic microdispersive solid-phase extraction cleanup technique. The optimization of the methodology was carried out for the extraction and cleanup step by testing the effects of the different solvents and sorbents, and extraction times. The optimized methodology achieves an efficient removal of interferences, reaching a good sensitivity and selectivity. The method proved to be simple and gave quantitative results for the assayed analytes, providing good validation parameters, such as recoveries, linearity, limits of detection and quantification and precision. The discovery of nanomaterials has bestowed a great impact in the improvement and development of Analytical and Food Chemistry, because of their particular properties that result highly adequate for a variety of applications. The present work is an example of an application for food chemistry namely food safety analysis.

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1. Fernandes, V. C., Freitas, M., Pacheco, J. P. G., Oliveira, J. M., Domingues, V. F. & Delerue-Matos, C. (2018), *J Chromatogr A*. **1566**, 1-12.

CP109
VOLATOMIC PROFILE COMBINED WITH CHEMOMETRIC
ANALYSIS. A POWERFUL TOOL TO DISCRIMINATE CITRUS
SPECIES

José A. Figueira¹, Priscilla Porto-Figueira¹ and José S. Câmara^{1,2*}

¹ CQM - Centro de Química da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal

² Faculdade de Ciências Exatas e da Engenharia da Universidade da Madeira, Campus Universitário da Penteada, 9020-105 Funchal, Portugal;

*email: jsc@staff.uma.pt (José S. Câmara)

Lemon (*Citrus limonum*) and tangerine (*Citrus reticulata*) are representative and well-known examples of citrus fruits widely consumed throughout the world. Constitute an important source of secondary metabolites including vitamin C, folate, flavonoids, limonoids, coumarins, terpenoids and carotenoids. Present a high economic and medicinal value expressed on its industrial applications including food industry, cosmetics and medicine.

Citrus from different varieties and/or growing in different geographic regions will present distinctive characteristics. In this context, in the present study were analyzed lemon and tangerine samples from two different regions of Portugal (mainland and Madeira Island) in order to gain deeper insights on the volatile composition of lemon (*Eureka* variety) and tangerine (*Murcott* variety from Portugal mainland and *Setubalense* variety from Madeira Island) as well as identify putative variety and geographical molecular biomarkers.

A total of 108 different volatile organic metabolites (VOMs), belonging to different chemical groups, namely terpenes, sesquiterpenes, alcohols and carbonyl compounds, were identified in the juice of targeted citrus fruits by using headspace solid-phase microextraction (HS-SPME) combined with GC-MS. The most dominant volatiles, identified in both citrus fruits, were D-limonene, γ -terpinene, β -pinene, β -myrcene, o-cymene, terpinolene and α -pinene. Since some of these volatiles exert effective health benefits (e.g. chemotherapeutic and chemopreventive effects of D-limonene), the investigated fruits can be used as source of bioactive compounds in addition to its use on cosmetic and food industry. The data matrices, submitted to principal component analysis (PCA) revealed that the VOMs were able to differentiate citrus fruits according to type, variety and geographic origin.

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CP110
ESTUDO DOS EFEITOS DA DIGESTÃO GASTROINTESTINAL *IN VITRO* E FERMENTAÇÃO COLÓNICA EM EXTRATOS FENÓLICOS E BIOATIVIDADES DE *ROSMARINUS OFFICINALIS* L.

Rúbia C.G. Corrêa^{1,2}, Geferson A. Gonçalves^{2,3}, Lillian Barros¹, Maria Inês Dias¹, Ricardo C. Calhêla¹, Vanesa G. Correa², Adelar Bracht², Rosane M. Peralta², Isabel C.F.R. Ferreira¹

¹ Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

² Departamento de Bioquímica, Universidade Estadual de Maringá, Paraná, Brasil

³ Graduação em Ciência Alimentar, Universidade Estadual de Maringá, Paraná, Brasil, iferreira@ipb.pt

Rosmarinus officinalis L., alecrim, pertence à família das Lamiaceae e encontra-se amplamente disseminado em vários países da região do Mediterrâneo [1]. É usado sobretudo como condimento, mas os seus extratos aquosos ricos em compostos fenólicos, maioritariamente ácido rosmarínico, têm um grande potencial para ser usados como conservantes e/ou ingredientes funcionais [2]. É, no entanto, necessário perceber a estabilidade e biodisponibilidade destes extratos aquosos e dos seus compostos bioativos após a digestão gastrointestinal e processos de fermentação colónica, de modo a não perder a funcionalidade dos mesmos. No presente trabalho, o extrato inicial e os extratos digeridos e fermentados de alecrim foram caracterizados em termos de compostos fenólicos por HPLC-DAD/ESI-MS e, posteriormente, estudados os seus potenciais antioxidante, antibacteriano e antiproliferativo. Foram identificados 16 compostos fenólicos, entre eles 10 ácidos fenólicos e 6 flavonoides, sendo o ácido rosmarínico o composto maioritário, como era expectável. Foi também este composto que mais sofreu os efeitos da digestão e fermentação representando um total de 60%, em comparação com os 26% dos compostos fenólicos totais. No geral, a digestão gastrointestinal *in vitro* diminuiu a atividade antioxidante obtida pelos métodos de DPPH, ABTS, FRAP, ORAC e TBARS. Tanto o extrato inicial como o digerido não apresentaram qualquer atividade antiproliferativa, no entanto, o extrato fermentado exibiu um ótima atividade antiproliferativa na linha celular HeLa (carcinoma cervical, GI₅₀ = 116 µg/mL). Relativamente à atividade antibacteriana, o extrato inicial e o extrato digerido revelaram-se moderadamente eficazes contra o crescimento de *Staphylococcus aureus*, *S. aureus* resistente à meticilina (MRSA) e sensível à meticilina (MSSA) e também contra a *Listeria monocytogenes*. O extrato fermentado revelou-se também moderadamente eficaz contra o crescimento de MRSA e MSSA. Os resultados aqui obtidos revelam a importância dos extratos ricos em ácido rosmarínico como potenciais conservantes e ingredientes funcionais, no entanto, o uso de técnicas de estabilização/microencapsulação seria importante para assegurar uma adequada ação destes compostos após digestão e fermentação.

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[1] Andrade, J. M., Faustino, C., Garcia, et al., *Future Science*, **2018**, FSO283.

[2] Gonçalves, G. A., de Sá-Nakanishi, A. B., Comar, et al., *Food & Function*, **2018**, 1465–1474

CP111
PRESERVATION OF FRESH ATLANTIC SALMON (*SALMO SALAR*)
UNDER HYPERBARIC STORAGE AT REFRIGERATED
TEMPERATURE: MICROBIAL AND PHYSICOCHEMICAL
INDICATORS RELATED TO QUALITY

Liliana G. Fidalgo¹, Rodolfo Castro¹, Marcos Trigo², Mónica Carrera², Santiago Aubourg², Ivonne Delgadillo¹, Jorge A. Saraiva¹

¹Research Unit of Organic Chemistry, Natural and Agro-food Products (QOPNA), Chemistry Department, Aveiro University, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal

²Department of Food Technology, Marine Research Institute (CSIC), c/ Eduardo Cabello 6, Vigo, Spain.

lilianafidalgo@ua.pt

Hyperbaric storage (HS) has attracted great interest for fish preservation, since it has shown a microbial stability improvement compared to traditional refrigeration (RF, 5 °C) [1, 2, 3]. However, knowledge about other physicochemical reactions is very scarce. So, hyperbaric preservation (60 MPa) of Atlantic salmon (*Salmo salar*) using low temperatures (10 °C) over 50 days was studied, by evaluation of microbial and physicochemical quality-indicators. Contrarily observed in atmospheric pressure (AP) samples, HS samples showed high microbial stability and no changes on pH and colour during the 50 days. Concerning chemical indicators, after only 30 days, HS samples showed an increase on total volatile base-nitrogen to values higher than the established limit, being this value exceeded on AP/10 °C samples after 6 days of storage. These samples also showed trimethylamine (TMA) values higher than the established limit, which is well correlated to the higher microbial growth, while this indicator did not changed on HS and RF samples. Compared to fresh salmon, formaldehyde and dimethylamine content increased in HS samples, increasing the formaldehyde content during along storage. Furthermore, an advanced lipid oxidation stated was observed on AP samples, with high tertiary lipid oxidation (fluorescent compounds) values after 6 days of storage, whereas HS samples only showed a high content of secondary products.

HS may represent an interesting methodology for quality extension of fresh salmon to a minimum of 15 and a maximum of 30 days (limited by the chemical indicators), considerably higher than the those obtained by traditional RF (a maximum of 6 days of shelf-life).

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[1] Ko, W. C.; Hsu, K. C. *Journal Food Protection* **2001**, 64, 94.

[2] Fidalgo, L. G.; Lemos, Á. T.; Delgadillo, I.; Saraiva, J. A. *Innovative Food Science & Emerging Technologies* **2018**, 45, 264–272.

[3] Otero, L.; Pérez-Mateos, M.; López-Caballero, M. E. *Innovative Food Science and Emerging Technologies* **2017**, 41, 19–25.

CP112

ESTUDO DO EFEITO DA LUMINOSIDADE E DO TEMPO DE GERMINAÇÃO NO PERFIL SENSORIAL DOS GERMINADOS DE BRÁSSICAS: COUVE PENCA, GALEGA E BRÓCOLO

Ana Paula Vale¹, Natalina Carvalho¹, Júlio César Lopes¹, Isabel M. Afonso¹

¹*Escola Superior Agrária do Instituto Politécnico de Viana do Castelo, Rua D. Mendo Afonso 147, Refoios do Lima, 4990-706 Ponte de Lima, Portugal*

Atualmente existe uma procura e um consumo crescente de alimentos funcionais, nomeadamente de alimentos enriquecidos com fitoquímicos devido às suas propriedades antioxidantes e anticancerígenas. Muitos destes compostos encontram-se presentes nos alimentos em natureza como é o caso das brássicas e dos seus germinados, que apresentam uma composição rica em compostos bioativos. Os germinados são considerados alimentos funcionais pelo que uma dieta rica em germinados de brássicas que contêm níveis elevados de vitamina C, sais minerais e outros compostos bioativos, contribuirá para a saúde e bem-estar do ser humano, diminuindo o risco de desenvolvimento de várias doenças, nomeadamente de doenças do foro oncológico [1,2].

Com este trabalho pretendeu-se estudar o efeito de algumas condições de germinação, como a luminosidade e o tempo de germinação, no perfil sensorial de germinados de brássicas. Para tal procedeu-se à germinação de três variedades regionais de brássicas (couve galega, penca e brócolo) que foram selecionadas não só pelo seu potencial nutricional e funcional mas também pelo seu impacto económico na região do Entre Douro e Minho.

O estudo contemplou a avaliação dos fatores que influenciam as propriedades dos germinados das brássicas selecionadas, tendo sido testados a luminosidade (com e sem luz) e o tempo de germinação (7,9 e 12 dias), com um painel treinados de 11 provadores, que através da análise descritiva quantitativa (QDA) permitiu obter os perfis sensoriais de produtos testados.

Os resultados obtidos indicaram que o fator luminosidade na produção dos germinados, em geral, apresenta uma contribuição significativa nos atributos sensoriais nos germinados com luz para todas as variedades estudadas. Na comparação do tempo de germinação e o efeito luminosidade, o brócolo sem luz apresentou diferenças significativas entre os 7 e 9 dias de germinação nos parâmetros sensoriais estudados. Na penca verificou-se que no germinado sem luz as diferenças significativas são notórias entre os 7 e 9 dias. Já na couve penca com luz observaram-se diferenças entre os 9 e 12 dias de germinação. A couve-galega, tanto nos germinados com e sem luz, apresentou diferenças significativas nos atributos sensoriais nos 7,9 e 12 dias de germinação.

Assim, o estudo permitiu concluir que os fatores luminosidade e o tempo de germinação influenciam os perfis sensoriais dos germinados de todas as variedades regionais.

[1] Jacob, J. A.; Mahal, H. S.; Mukherjee. T.; Kapoor. S., *Food Chemistry* **2011**, 129, 1132-1138.

[2] Herr, I.; Buchler, M., *Cancer Treatment Reviews* **2010**, 36, 377-383.

CP113
DEFEITOS EM QUEIJO DE OVELHA COM LEITE CRU
ESTUDO PRÁTICO DE UM CASO

Maria Teresa G. Santos¹, Elsa Caetano¹, Paulo Serol¹, Célia Lampreia¹, João Dias¹,
Manuela Costa¹, Maria João Carvalho¹, António Miguel Floro¹, Olga Amaral¹, Antónia
Macedo¹ e Nuno B. Alvarenga^{2,3}

¹ESA – Instituto Politécnico de Beja, Beja; ²UTI – Instituto Nacional de
Investigação Agrária e Veterinária, Oeiras; ³LEAF, ISA – Universidade de
Lisboa, Lisboa.

Neste estudo efectuou-se a caracterização físico-química e microbiológica quantitativa e qualitativa de queijos com defeito obtidos numa queijaria produtora de queijo de ovelha fabricado com leite cru, numa tentativa de diagnóstico do caso. O defeito em causa tem vindo a manifestar-se de forma persistente afectando a qualidade de alguns queijos, e constituindo assim um grave prejuízo para a queijaria em causa. Este trabalho foi efectuado no âmbito da fase 1 do projecto GO SerpaFlora, já que se considera que os resultados podem ser esclarecedores relativamente à diferenciação entre flora autóctone e contaminante.

O estudo microbiológico do queijo incluiu a caracterização da flora autóctone e contaminante, que pode ser fundamental no diagnóstico do problema. Para auxiliar este diagnóstico foi ainda feito o levantamento de resultados de análises microbiológicas do leite cru e da água usados na queijaria. Em cada uma das doze unidades de queijo foi efetuada a contagem total de microrganismos a 30°C, de enterobactérias, de *Escherichia coli*, de bactérias lácticas totais, de estreptococos, de clostrídios sulfito redutores, de estafilococos totais e coagulase positiva e ainda de fungos.

Os resultados sugerem o leite e a água como potenciais contaminantes no processo. Na flora dos queijos com defeito, estreptococos e leveduras revelam-se em concentrações superiores às observadas em trabalhos com queijos do mesmo tipo [1, 2, 3], podendo estar na origem das alterações observadas. No entanto a identificação das estirpes prevalentes em cada um dos grupos microbianos parece essencial para o diagnóstico do caso.

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[1] Gonçalves dos Santos, M. T. P.; Benito, M. J.; Córdoba, M. G.; Alvarenga, N.; Ruiz-Moyano, S., *International Journal of Food Microbiology* **2017**, 262, 63-70

[2] Gonçalves dos Santos, M. T. P.; Benito, M. J.; Córdoba, M. G.; Egas, C.; Merchán, A. V.; Galván, A. I.; Ruiz-Moyano, S., *Journal of Food Science* **2018**, 83 (5), 1333-1341.

[3] Ordiales, E., Martín, A., Benito, M.J., Hernández, A., Ruiz-Moyano, S., Córdoba, M. G., *Journal of Dairy Science*, **2013**, vol. 96, pp. 5477–5486.

CP114

VALORIZAÇÃO DA MICROFLORA DO QUEIJO SERPA

ESTUDO BASE PARA O DESENHO DE INÓCULOS AUTÓCTONES

Maria Teresa G. Santos¹, Paulo Serol¹, Célia Lampreia¹, João Dias¹, Manuela Costa¹, Maria João Carvalho¹, António Miguel Floro¹, Olga Amaral¹, Antónia Macedo¹ e Nuno B. Alvarenga^{2,3}

¹ESA – Instituto Politécnico de Beja, Beja; ²UTI – Instituto Nacional de Investigação Agrária e Veterinária, Oeiras; ³LEAF, ISA – Universidade de Lisboa, Lisboa.

A produção de queijos artesanais com leite cru e sem adição de inóculo determina uma grande dependência da microflora presente. Esta condição, dificilmente controlada pelo produtor de queijo, constitui um dos factores determinantes na especificidade e estabilidade do queijo, podendo por em causa a sua qualidade e segurança e dificultando a sua aceitação em alguns mercados. Conhecimentos sobre a microflora deste tipo de produtos, podem facilitar o diagnóstico/resolução destes problemas e sobretudo a sua prevenção, nomeadamente através da sua utilização no desenho de inóculos autóctones bem adaptados à tecnologia de produção, que ofereçam vantagens tecnológicas, de qualidade e segurança, nutricionais, probióticas ou mesmo que realcem determinadas características sensoriais [1,2]. Desta forma pode-se contribuir de forma decisiva para a rentabilização de matérias primas e para a inovação no sector [2].

Neste estudo base para o desenho de inóculos autóctones, inserido na fase 1 do projecto GO SerpaFlora, efectuou-se a caracterização sensorial, microbiológica quantitativa e físico química de 56 unidades de amostra de queijo Serpa e de queijo de leite cru de ovelha não certificado, finalizados, de forma a correlacionar o perfil microbiano com os atributos positivos característicos estabelecidos para a certificação deste tipo de queijo, e seleccionar amostras/produtores para as fases de caracterização microbiológica qualitativa.

A avaliação sensorial efectuada com base na ficha de certificação do queijo Serpa, permitiu classificar as unidades de queijo em Aprovadas e Reprovadas, distinguindo-se as mesmas sobretudo pela forma, cheiro, sabor e textura. A caracterização microbiológica dos dois tipos de amostra, comparável com valores obtidos noutros trabalhos [3, 4], aponta no entanto para diferenças na quantificação de indicadores de higiene e flora láctica. Em termos físico-químicos parecem evidenciar-se diferenças na cor da casca e acidez, em média mais elevada nos queijos reprovados.

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[1] Montel, M.C.; Buchin, S.; Mallet, A.; Delbes-Paus, C.; Vuitton, D. A.; Desmasures, N.; Berthier, F., *International Journal of Food Microbiology* **2014**, *177*, 136-154.

[2] Johnson, M. E., *Journal of Dairy Science* **2017**, *100* (12), 9952-9952 - 9965.

[3] Gonçalves dos Santos, M. T. P.; Benito, M. J.; Córdoba, M. G.; Alvarenga, N.; Ruiz-Moyano, S., *International Journal of Food Microbiology* **2017**, *262*, 63-70.

[4] Gonçalves dos Santos, M. T. P.; Benito, M. J.; Córdoba, M. G.; Egas, C.; Merchán, A. V.; Galván, A. I.; Ruiz-Moyano, S., *Journal of Food Science* **2018**, *83* (5), 1333-1341.

CP115**Análise de componentes principais aplicada ao estudo do comportamento reológico: o caso do queijo fundido**Carla Barbosa^{1,2}, Susana Rocha¹, M. Rui Alves¹¹IPVC- Instituto Politécnico de Viana do Castelo²LAQV-REQUIMTE

A viscosidade é definida na reologia como a resistência ao escoamento de fluidos. O estudo da viscosidade acompanhado pela modelização matemática das cinéticas do escoamento, permite perceber diferentes variáveis e características do movimento, dos materiais, forças e resistências. Os modelos usados neste estudo foram: Oswald-de-Waelle (Lei de Potência), Bingham, Casson, Power Law, Herschel-Bulkley, Cross e Carreau-Yasuda. O objetivo foi tentar observar diferentes comportamentos de escoamento em amostras de queijo fundido com adição de hidrocolóides (gomas guar, alfarroba e carragenato K) e a influência destas na estabilidade da matriz com recurso a uma análise multivariada, a análise de componentes principais (ACP). Para tal, foram produzidas amostras de queijo fundido tipo *petit suisse* e ainda uma amostra comercial, analisada a viscosidade aparente (5 réplicas) e ajustados os diferentes modelos reológicos. A fusão do queijo foi conseguida à custa da adição de sais de fusão e a matriz estabilizada com os hidrocolóides, nas percentagens de 0,1%; 0,25% e 0,5%. Após a obtenção das amostras e avaliada a viscosidade aparente foi realizado o ajuste dos dados aos modelos reológicos referidos cujo coeficiente de correlação permitiu avaliar a adequação destes na previsão do comportamento do escoamento das matrizes em estudo. A ACP permitiu verificar como as amostras tendem a agrupar-se segundo os parâmetros característicos desses modelos. O índice de comportamento de fluxo da Lei da Potência, variou entre 0,25 e 0,67 ($n < 1$), destacando-se assim um comportamento pseudoplástico das diferentes amostras, sendo que todas elas apresentam maior fluidificação do que o controlo e a amostra comercial. A ACP aplicada aos parâmetros reológicos dos modelos revelou que as amostras são muito semelhantes, apenas as gomas Guar (0,50%) e Alfarroba (0,50%) e comercial a destacar alguma diferença. Mais, as amostras podem ser agrupadas segundo os índices de comportamento de fluxo dos modelos reológicos de Ostwald-de-Waelle (η_{ow}), Herschel-Bulkley (η_{hb}) e Carreau Yasuda (η_{cy}), quando assumem valores mais elevados e agrupadas segundo o índice de consistência de Herschel-Bulkley (k_{hb}), viscosidade e viscosidade máxima de Carreau Yasuda (η_{0c} e η_{0cy}) e tensão residual de Bingham (τ_0), projetando-as para um lado oposto, assumindo valores mais elevados nestes parâmetros. Neste estudo verificou-se que o comportamento do queijo fundido é essencialmente viscoso, as amostras produzidas no laboratório mais fluidas, menos resistentes à força de atrito do que o queijo fundido comercial.

Bibliografia

Joyner, H.S., Damiano, H. (2015). International Dairy Journal, 51, 24-33.

Francis, F. J., Encyclopedia of Food Science and Technology, 2th Ed., Wiley-Interscience Publication, USA, 2000.

Sahin, S., Sumnu, S. G., Physical Properties of Foods. Springer Science+Business Media, LLC, USA, 2006.

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Qualidade nutricional e sensorial de cenouras minimamente processadas e cozidas embaladas em atmosfera de alto teor de CO₂

Carla Barbosa ^{1,2}, M.R. Alves ^{1,2}, M.B.P.P. Oliveira ²

¹ Instituto Politécnico de Viana do Castelo (IPVC-ESTG), Viana do Castelo, Portugal,

² LAQV- REQUIMTE – Faculdade de Farmácia da Universidade do Porto, Porto, Portugal

A disponibilidade de alimento e sustentabilidade das operações de logística em termos de diminuição de desperdício alimentar é um tema da máxima importância para a indústria. Seguindo esta tendência, o objetivo deste trabalho foi o prolongamento do tempo de vida útil de cenouras prontas a consumir, quer minimamente processadas (MP) quer cozidas (PC). As amostras adquiridas num produtor local, foram processadas imediatamente e embaladas com uma atmosfera modificada, rica em CO₂: 10%O₂+45%CO₂+45%N₂ no caso das cenouras MP e 0%O₂+40%CO₂+60%N₂ no caso das PC. A qualidade sensorial e nutricional das amostras foi monitorizada ao longo do tempo de armazenamento (em triplicado), respetivamente: 28 e 17 dias para as cenouras PC e MP. A avaliação das propriedades organoléticas consistiu numa análise descritiva quantitativa (ADQ) e correlacionada com a estabilidade parâmetros nutricionais tais como: atividade antioxidante e compostos bioativos (fenóis totais, flavonoides, carotenoides e antocianinas) e, também, a da cor e firmeza ao longo do armazenamento. A análise exploratória dos dados recorrendo a uma análise de componentes principais com Autobiplots permitiu verificar que pequenas alterações são percebidas ao longo do tempo, apenas na atividade antioxidante, apesar de não se ter verificado nenhuma tendência na evolução dos compostos bioativos, (Fig. 1). Esta perda de atividade antioxidante (alto EC50), pode ser devida à fragilidade dos carotenoides cuja própria metodologia de análise pode promover perdas e consequentemente a sua expressão ser traduzida por defeito. A ADQ apresentou as mesmas tendências, considerando-se que o painel teve grande dificuldade em discriminar amostras ao longo do tempo (Fig. 2). Pode assim concluir-se que este método de conservação com alto teor de CO₂ é adequado para o período em estudo, permitindo um aumento de quase 50% do tempo de vida útil das cenouras, o que ao nível industrial pode ser extremamente útil para otimização das operações de logística.

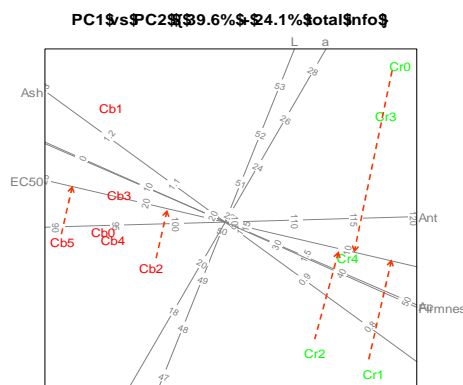


Fig. 1 – PCA with physicochemical quality parameters (EC50 – Antioxidant activity; ANT – Anthocyanins; Ash – Ash; firmness)

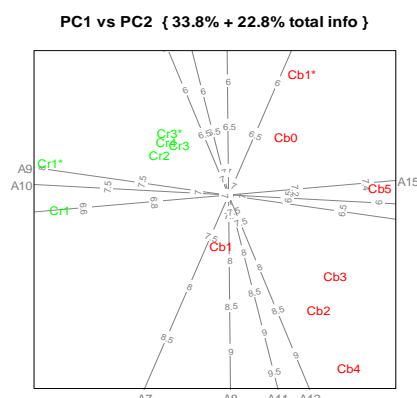


Fig. 2 - PCA with sensory quality parameters. A1 to A17 sensory attributes related to aroma and flavour tipicity, texture and mouthfeel.

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Interação de uma mistura de procianidinas com saliva humana de diferentes indivíduos

Carlos Guerreiro^{1,*}, Elsa Brandão¹, Nuno Mateus¹, Victor de Freitas¹, Susana Soares¹

¹REQUIMTE/LAQV, Departamento de Química e Bioquímica, Faculdade de Ciências da Universidade do Porto, Rua do Campo Alegre, 689, Porto, Portugal

*carloseyguerreiro02@gmail.com

Os polifenóis estão inseridos na dieta humana devido ao alargado consumo de alimentos de origem vegetal. Estes compostos e mais concretamente, as procianidinas, têm variados benefícios para a saúde nomeadamente, atividade anti-cancerígena, anti-oxidante e proteção cardiovascular e neurodegenerativa [1]. Além destas propriedades, estes compostos desempenham um papel importante nas propriedades organolépticas dos alimentos, nomeadamente no sabor e cor. Porém, em quantidades elevadas, as procianidinas podem provocar a sensação de adstringência e amargor, podendo reduzir a sua ingestão e assim comprometer os seus benefícios para a saúde [2]. O principal mecanismo para a perceção da adstringência assenta na interação destes compostos com as proteínas salivares (PS) da cavidade oral, levando à formação e/ou precipitação de complexos (in)solúveis [3].

Neste trabalho, foi realizado um estudo de interação por HPLC de uma mistura de procianidinas (0.8 e 1.3 g.L⁻¹) com saliva de cinco indivíduos. Observou-se que, na concentração de 1.3 g.L⁻¹, os dímeros B6 e B2-galhato, um trimero e a epigalocatequina, atingiram uma precipitação máxima de 50 %. O dímero B7 apresentou maior interação a 0.8 g.L⁻¹ levando a uma precipitação de 31 %. Relativamente às famílias de PS, observou-se uma precipitação de diferentes famílias de PS, diretamente proporcional à concentração de procianidinas. Foi observada uma depleção quase total de estaterina e péptido P-B em todos os indivíduos. Dentro das proteínas ricas em prolina (PRPs), as acídicas parecem ser as mais afetadas com o aumento gradual da concentração de procianidinas, levando a precipitações até 80 %. As cistatinas, não sofreram qualquer diminuição, exceto no indivíduo com maior teor nesta família de PS, que sofreu uma precipitação até 24%.

Adicionalmente, neste estudo foram analisadas por HPLC as variações dos perfis das PS mais relevantes para a perceção da adstringência de dezassete indivíduos ao longo de um ano. Foi observado um aumento no teor total de proteínas entre os meses de março e maio (Primavera). Por oposição, foi observada uma diminuição deste teor entre os meses de junho e agosto (Verão). Esta tendência foi observada também individualmente para as famílias de PRPs básicas e glicosiladas de todos os indivíduos. Relativamente às três classes de PRPs, as acídicas são as que apresentam menor variabilidade anual comparativamente ao teor total de PS.

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- [1] S. Quideau, D. Deffieux, C. Douat-Casassus, and L. Pouységú, *Angewandte Chemie - International Edition*. 2011.
- [2] S. Soares, E. Brandão, N. Mateus, and V. de Freitas, *Crit. Rev. Food Sci. Nutr.*, 2017.
- [3] E. C. Bate-Smith, *J. Linn. Soc., Bot.*, 1962.

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SENSORY ANALYSIS OF PDO SERPA CHEESE PRODUCED WITH DIFFERENT ECOTYPES *CYNARA CARDUNCULUS* L.

M.J. Carvalho¹; N.B. Alvarenga^{1,2,3*}, J. Dias¹, O. Amaral¹, P. Lage¹, A.M. Floro¹, M. Costa¹ and M.F. Duarte^{4,5}

¹ESA – IPBeja, Portugal, ²INIAV, Portugal; ³LEAF – ISA, U.Lisboa, Portugal; ⁴ICAM – U.Évora, Portugal; ⁵CEBAL, Portugal

Serpa is an artisanal ripened Portuguese cheese granted the Protected Designation of Origin (PDO) label (Council Regulation (EEC) No 2081/92, 2017), and it is produced within the Alentejo province from raw ewes' milk, using an aqueous infusion of the dried flowers from *Cynara cardunculus* L. as the coagulant agent. The aim of this work was to study the influence of flower extracts from different *C. cardunculus* ecotypes on the sensory properties of PDO Serpa cheese, using three ecotypes of vegetable coagulant (C1, C2 and C3), and one commercial animal coagulant (AC). Sensory analysis was performed at ripening days legally allowed, by a panel of experts. Sensory analysis was carried out using either the four sensory parameters well defined and accredited (ISO/IEC 17025:2005) by IPAC, as well as a sensory assessment in a 9-point scale: shape, rind colour, paste colour, eyes, ammoniac odor, grainy and buttery texture, salty, sour, spicy and bitter taste. The cheeses with the different *C. cardunculus* ecotypes were different from the commercial animal coagulant cheese (AC-486), namely on colour, texture and taste characteristics. In relation to texture, it was less buttery in the commercial animal coagulant sample, as it had less yellowish colour and the panel rejected it in taste and smell. Thus sensory parameters such as texture and taste can be used as authentication markers for the cheese *Cynara* ecotypes.

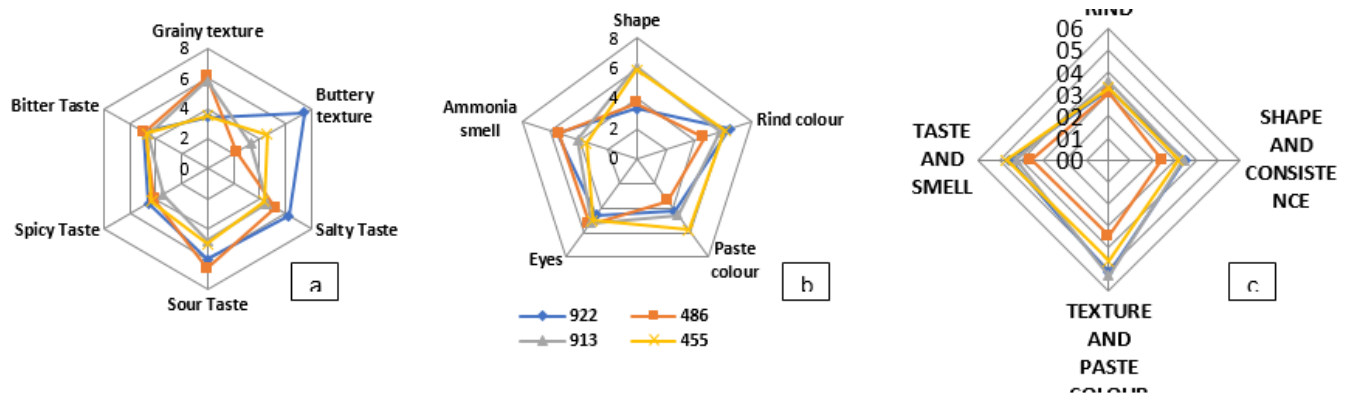


Figure 1 – Sensory parameters by the sensory assessment (a, b) and by the panel (c)

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Lista de Participantes

Nome	Email	Instituição
Maria do Carmo Serrano	carmo.serrano@iniav.pt	INIAV
Maria Inês Moreira Figueiredo Dias	maria.ines@ipb.pt	Centro de Investigação de Montanha
WATERS TECHNOLOGIES LC-MS PORTUGAL, UNIPESSOAL LDA	portugal@waters.com	Waters Technologies LC-MS Portugal
Aida Maria Gonçalves Moreira da Silva	aidams@esac.pt	Escola Superior Agrária de Coimbra
João Pedro Marques Lima	joao.lima@estescoimbra.pt	Escola Superior de Tecnologia da Saúde de Coimbra
Joana Filipa Brígida Duarte	jfbduarte@hotmail.com	Instituto Superior de Agronomia
Rita de Oliveira Soares	ritinha_gemea@hotmail.com	Instituto Superior de Agronomia
Paulo César Lopes Serol	paulo_serol@outlook.pt	Instituto Politécnico de Beja
Cláudia Alexandra Colaço Lourenço Viegas	claudia.viegas@esht.pt	Escola Superior de Hotelaria e Turismo do Estoril
Hugo Filipe Felix Antunes da Silva	hsilva@deq.isel.ipl.pt	ISEL
Antónia Teresa Zorro Nobre Macedo	atmacedo@ipbeja.pt	Instituto Politécnico de Beja
David José Chaveiro da Silva Azedo	david.azedo@ipbeja.pt	Instituto Politécnico de Beja
Isabel Maria Rôla Coelho	imrc@fct.unl.pt	FCT- Universidade Nova de Lisboa
Carolina Santos Pereira	pereiracarolina03@gmail.com	CALSEG / LAQV-Requimte, Laboratório de Bromatologia e Hidrologia
Susana Andreia Alves da Rocha	srocha@estg.ipvc.pt	ESTG/IPVC
Telmo José Anselmo Francisco	tjfrancisco@gmail.com	LAQV-REQUINTE
Ricardo Jorge Correia Dias	rj.correia.dias@gmail.com	Faculdade de Ciências da Universidade do Porto
Isabel Maria Barreira Afonso Paula	iafonso@esa.ipvc.pt	Instituto Politécnico de Viana do Castelo
Ana Rita Cardoso Borges	ritaborges_17@Hotmail.com	Instituto Politécnico de Bragança
Ana Cristina Mendes Ferreira da Vinha	anafvinha@gmail.com	REQUIMTE/LAQV
Elsa Judite Ferreira Azevedo Brandão	elsajudite@gmail.com	Faculdade de Ciências da Universidade do Porto
Carlos Guerreiro	carloseyguerreiro02@gmail.com	Faculdade de Ciências da Universidade do Porto
Preciosa de Jesus da Costa Pires	ppires@estg.ipvc.pt	Instituto Politécnico de Viana do Castelo
Ana Luísa Leite Fernandes Amaro	aamaro@porto.ucp.pt	Escola Superior de Biotecnologia da Universidade Católica Portuguesa

João Pedro Trigo	joao-trigo@hotmail.com	Universidade de Aveiro
Soudabeh Ghalamara	s.ghalamara85@gmail.com	Universidade Católica Portuguesa - Porto
Behnam Taghizadeh	b.taghizadeh84@gmail.com	catolica university
Soudabeh Ghalamara	sghalamara@ucpcrp.pt	Universidade Católica Portuguesa
Célia Ferreira Rocha	celiaferreirarocho@gmail.com	FCNAUP
Cristina Maria Santos Conceição Pinheiro	ccp@uevora.pt	Universidade de Évora
Margarida Pina	margaridafpina@gmail.com	Instituto Superior de Agronomia
Christine da Silva Macedo	chmacedo1309@gmail.com	Universidade de Lisboa
Bruno Miguel Fernandes Campos	bm.campos@campus.fct.unl.pt	Faculdade de Ciências e Tecnologia
Bruno Miguel Fernandes Campos	bmcamos@campus.fct.unl.pt	Faculdade de Ciências e Tecnologia
Sheyma KHEMIRI	khemirisheyma@gmail.com	National Institute of Applied Sciences and Technology
Carla Alexandra Lopes Graça	lopesgraca.carla@gmail.com	Instituto Superior de agronomia - Universidade de Lisboa
Rafaela do Couto Santos	rcsantos@isa.ulisboa.pt	Instituto Superior de Agronomia / LEAF
Maria Beatriz Prior Pinto Oliveira	beatoliv@ff.up.pt	REQUIMTE/LAQV Faculdade de Farmácia da Universidade do Porto
Maria Celeste de Carvalho N. P. Morais Serra	mcserra@deq.isel.ipl.pt	instituto Superior de Engenharia de Lisboa
Ricardo Miguel Pereira Pinto	pintoricardo@ipvc.pt	Instituto Politécnico de Viana do Castelo
Núria Leandra Nascimento Reis	nurialeandrareis@gmail.com	Instituto Politécnico de Viana do Castelo
Maria Alberta Pereira das Neves da Fonseca Araújo	alberta@estg.ipvc.pt	ESTG-IPVC
Maria Cristiana Henriques Nunes	crnunes@gmail.com	Instituto Superior de Agronomia
Diana Brito de Barros	dib@ipvc.pt	Instituto Politécnico de Viana do Castelo
Hélder Oliveira	hjoliv@gmail.com	Faculdade de Ciências Universidade do Porto
Anabela Cristina da Silva Naret Moreira Raymundo	anabraymundo@isa.ulisboa.pt	Instituto Superior de Agronomia
Isabel Nunes de Sousa	isabelsousa@isa.ulisboa.pt	Instituto Superior de Agronomia
Catarina da silva Vieito	catarina.sv@hotmail.com	Instituto Politécnico de Viana do Castelo
Manuela Vaz Velho	mvazvelho@estg.ipvc.pt	Instituto Politécnico de Viana do Castelo
Paula Araújo	prauinha_araujo@hotmail.com	FCUP

Liliana Gonçalves Fidalgo	lilianafidalgo@ua.pt	Universidade de Aveiro
Silvia Alexandra Monteiro Moreira	silvia.moreira@ua.pt	Universidade de Aveiro
Joana Sofia Barros da Costa	joanabcosta@gmail.com	REQUIMTE-LAQV/FFUP
Sónia Rocha Neves Pereira de Oliveira	soniarochaneves@gmail.com	ISA
Jorge Manuel Alexandre Saraiva	jorgesaraiva@ua.pt	Universidade de Aveiro
Ana Rita Santos Inácio	ritainacio@ua.pt	Universidade de Aveiro
Mauro Diogo Batista dos Santos	mdbs@ua.pt	Universidade de Aveiro
Rui Pedro Figueiredo Neto Queirós	rui.queiros@ua.pt	Universidade de Aveiro
Ana Cristina Sobrosa Rodrigues Duarte	duartede@ipvc.pt	Instituto Politécnico de Viana do Castelo
Ana Patricia Sousa	apatriciasousa@estg.ipvc.pt	IPVC
Maria João Conceição Candeias Alegria Timóteo Rodrigues	Maria.Alegria@sumolcompal.pt	SUMOL+COMPAL Marcas
Carlos Alberto Cruz Pinto	carlospinto@ua.pt	Universidade de Aveiro
Leandro Jorge Guimarães de Oliveira	loliveira@porto.ucp.pt	Universidade Católica Portuguesa
Ana Carolina Ervilha Paletta de Cerqueira Amaral	carol.ervilha@gmail.com	Faculdade de Farmácia Universidade do Porto
Rita Isabel Couto Pinheiro	ritapinheiro@estg.ipvc.pt	Instituto Politécnico de Viana do Castelo
Carla Barbosa	cbarbosa@estg.ipvc.pt	Instituto Politécnico de Viana do Castelo
Taofiq Ayodele Oludemi	mesutforward@gmail.com	Instituto Politecnico de Braganca
José Carlos Reis Ribeiro	jose.ribeiro@sensetel.pt	Faculdade de Ciências da Universidade do Porto
ELSA VIEIRA	elsavieiraf@gmail.com	requimte/LAQV
José Aldónio Oliveira Figueira	krudstar@gmail.com	Universidade da Madeira
Ana Clara F M T Grosso	aclaragrosso@gmail.com	REQUIMTE/LAQV
Rita Carneiro Alves	rita.c.alves@gmail.com	REQUIMTE, LAQV/ FFUP
Ana Soraia Pires Silva	soraiapiressilva@ua.pt	Universidade de Aveiro
Cátia Sofia Faria Martins	catia.martins19@gmail.com	Universidade de Aveiro
Gonçalo Vieira Saraiva de Oliveira	gvso@ua.pt	Universidade de Aveiro
Tânia Cristina de São Pedro Pires	tania.pires@ipb.pt	Centro de Investigação de Montanha
Sílvia Lancha Petronilho	silviapetronilho@ua.pt	Universidade de Aveiro
Cláudia Sofia Cordeiro Nunes	claudianunes@ua.pt	Universidade de Aveiro
Ana Paula Taboada da Costa Santos Carvalho	ana.p.santos.carvalho@gmail.com	REQUIMTE/LAQV
Elisabete Verde Martins Coelho	ecoelho@ua.pt	Universidade de Aveiro
Mariana Alvoco Andrade	malvoco92@gmail.com	Instituto Nacional de Saúde Doutor Ricardo Jorge

Leandro Gonçalves Benzi	leo-benzi@hotmail.com	Universidade Federal da Bahia (UFBA)
Bernardo Artur Fernandes Lopes	mcarocho@ipb.pt	Instituto Politécnico de Bragança
Joana Andréa Soares Amaral	jamaral@ipb.pt	Instituto Politécnico de Bragança
Sandra Fernandes Gomes	sfgomes86@gmail.com	INIAV
Lillian Bouçada de Barros	lillian@ipb.pt	Instituto Politécnico de Bragança
Maria de Sousa Silva Lopes	mlopes108@gmail.com	Faculdade de Farmácia da Universidade de Coimbra
Vasco José Costa de Lima	vasco.jose.lima@gmail.com	Faculdade de Farmácia da Universidade de Coimbra
Inês Filipa Mourão Ferreira	ines.filipa.mourao.ferreira@gmail.com	Faculdade Ciências Universidade do Porto
Silvina dos Anjos Pimenta M. Maia Ferro Palma	sfpalma@ipbeja.pt	Instituto Politécnico de Beja
Maria Antónia da Mota Nunes	antonianunes.maria@gmail.com	Faculdade de Farmácia REQUIMTE/LAQV
Cristina Maria Fernandes Delerue Alvim Matos	cmm@isep.ipp.pt	REQUIMTE, Instituto Superior de Engenharia do Porto
Maria Filomena de Jesus Raposo	fraposo@ua.pt	Universidade de Aveiro
Zélia Ribeiro Alves	zeliaralves@ua.pt	Universidade de Aveiro
Filipa Sofia Dinis Reis	freis@ipb.pt	Centro de Investigação de Montanha (CIMO)
Mafalda Alexandra Marinho Machado da Silva	mafaldasilva135@hotmail.com	Instituto Nacional de Saúde Doutor Ricardo Jorge, I.P.
Eliana Andreia Pires Castilho Pereira	eliana@ipb.pt	Instituto Politécnico de Bragança
Thelma de Barros Machado	thel34@gmail.com	Universidade do Porto
RICARDA DANIELA VALENTIM DA TORRE	rdvdt@isep.ipp.pt	INSTITUTO SUPERIOR DE ENGENHARIA DO PORTO
Ana Filipa Mandim Pires	filipamandim@ipb.pt	Instituto Politécnico de Bragança
Tânia Gonçalves Albuquerque	tania.g.alb@gmail.com	REQUIMTE-LAQV/FFUP
Susana Margarida Leite Machado	su_tche@hotmail.com	REQUIMTE/LAQV
Virgínia Maria Monteiro da Cruz Fernandes	vir cru@gmail.com	REQUIMTE/LAQV - ISEP
José Sousa Câmara	jsc@uma.pt	Universidade da Madeira
Rúbia Corrêa	rubia_engalim@hotmail.com	Centro de Investigação de Montanha
RUPESH KUMAR SINGH	rupeshbio702@gmail.com	Centro de Química de Vila Real (CQ-VR)
Joana Filipa Martinho Lopes	lopesjoana@ua.pt	Universidade de Aveiro
Priscilla Felício Porto Figueira	priscillaportofigueira@gmail.com	Universidade da Madeira
Ana Margarida Massa Faustino	afaustino@porto.ucp.pt	Escola Superior de Biotecnologia, Universidade Católica Portuguesa
Manuela de Fátima Ferraz Machado	mmachado@porto.ucp.pt	Escola Superior de Biotecnologia, Universidade Católica Portuguesa

Liliana João Gatões da Silva	ljgsilva@hotmail.com	Faculdade de Farmácia, Universidade de Coimbra
Helena Maria Araújo Rodrigues	helenamarodrigues94@gmail.com	Escola Superior de Biotecnologia, Universidade Católica Portuguesa
Lisete Sousa Paiva	lisetepaiva@gmail.com	Plantações de Chá Gorreana/Universidade dos Açores
Victor Gomes Lauriano de Souza	v.souza@campus.fct.unl.pt	Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa
José António Bettencourt Baptista	jose.ab.baptista@uac.pt	Universidade dos Açores/Plantações de Chá Gorreana
Carolina Pereira Rodrigues	cpe.rodrigues@campus.fct.unl.pt	Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa
Elisabete Maria de Castro Lima	elisabete.mc.lima@uac.pt	Universidade dos Açores
Olga Maria Reis Pacheco de Amaral	olga.amaral@ipbeja.pt	Instituto Politécnico de Beja
Nuno Bartolomeu Mendes Godinho de Alvarenga	nuno.alvarenga@iniva.pt	IPBeja
Maria João Barata de Carvalho	joaobcarvalho@ipbeja.pt	Instituto Politécnico de Beja
Patrícia Coelho Lage	patricialage_@hotmail.com	Instituto Politécnico de Beja
João Jorge Mestre Dias	joao.dias@ipbeja.pt	Instituto Politécnico de Beja