

18th International Conference on POLYSACCHARIDES-GLYCOSCIENCE

Programme



9–11 November, 2022



Novotného lávka 5, Prague,
Czech Republic



9th November, 2022

18:00 **Glass of wine**

ArtCafe
Karlova (Street) 2
Prague 1

10th November, 2022

8:00 - 9:00 **Registration**

9:00 - 9:10 **Opening ceremony**

Novotného Lávka 5
Prague 1

- Keynote lecture: 40+10 min. discussion
- Oral presentation: 15+5 min. discussion

9:00 WELCOME

JANA ČOPIKOVÁ and MONIKA TOMANIOVÁ, UNIVERSITY OF CHEMISTRY AND TECHNOLOGY, PRAGUE

ORAL SESSION

	Oral session 1
9:10 – 12:10	“Physiological effects of natural polysaccharides and Chemically modified polysaccharides” Chair-woman: Jana Čopíková

9:10 - 10:00 G. Lewandowicz*
Keynote lecture: Potato juice – a raw material with unique potential for food industry and medicine

10:00 - 10:20 B. Hajdari*, S. Henke, S. Gillarová, T. Svoboda, V. Pour, Z. Bubník
Pectin depolymerization by UV/TiO₂ under different conditions

10:20 - 11:00 **Coffee break/Poster Section**

11:00 - 11:20 J. Lewandowicz*, J. Le Thanh-Blicharz
The effect of chemical modification of starch on rheological properties and texture of tomato ketchup

11:20 - 12:10 Y. N. Georgiev*
Keynote lecture: Immunomodulating polysaccharides and their residual adsorbed smaller bioactive molecules

12:30 - 13:30 **Lunch break**

13:30 – 17:40	Oral session 2 “Polysaccharide nanoparticles and drug delivery systems and Biodegradable plastics and other materials based on polysaccharides” Chair-man: Jacek Lewandowicz
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- 13:30 - 14:20 P. Matricardi*
Keynote lecture: Polysaccharide nanohydrogels and drug delivery: an effective combination
- 14:20 - 15:10 A. Dufresne*
Keynote lecture: Cellulose nanomaterials and advanced materials
- 15:10 - 15:30 M. Tsirigotis-Maniecka*
Polysaccharide-based floating microparticles for intragastric delivery of curcumin
- 15:30 - 15:50 F. Zavřel, R. Bleha, G. Ruphuy, F. Štěpánek*
Optimization of the yeast-glucan particles preparation process

15:50 - 16:30 ***Coffee break/Poster Section***

- 16:30 - 16:50 H. Eslami, T. H. Mekonnen*
Flexible and green multilayer paper coating for barrier enhancement of paper packaging
- 16:50 - 17:40 Y. Ai*
Keynote lecture: Gelation mechanisms of starches varying in molecular structures under different processing conditions

18:00 - 24:00 ***Conference dinner***

18:15 Departure from Novotného lávka

19:00 Arrival to Steiner&Kovarik company

19:30 Welcome and start of a dinner

21:00 Guided tour of the production with the possibility of making your own chocolate

24:00 Expected end and transport to Anděl station (tram, bus, metro) by bus

We would like to invite you to the heart of the Steiner&Kovarik company, where you will have the opportunity to learn about the technology of chocolate production and also to try the production itself. You will get to know the individual steps of chocolate production and how to make it to order. The company Pražská čokoláda Steiner&Kovarik focuses on the production of premium chocolate directly from the bean, i.e., bean to bar. We import beans from Colombia, from a specific farmer, which allows us to monitor and maintain the highest quality products. Our products have been awarded at the Great Taste or International Chocolate Awards, which we see as confirmation of the quality of our products.

11th November, 2022

Novotného Lávká 5

Prague 1

ORAL SESSION

Oral session 3
“Characterization and analyses of polysaccharides from natural sources and Production of polysaccharides and agricultural sources”
Chair-men: Roman Bleha and Yordan Georgiev

9:00 - 9:50

J. M. De Bruijn*

Keynote lecture: The role of polysaccharides in sugar beet processing

9:50 - 10:10

P. A. R. Fernandes*, B. Antunes, S. S. Ferreira, C. Nunes, E. Coelho,
M. A. Coimbra

Inulin as a source of sweet tasting carbohydrates on demand for *clean label* sugar reduction

10:10 - 10:30

S. S. Ferreira*, C. Nunes, M. A. Coimbra

Isolation and characterization of marine sulfated polysaccharides concentrated in salt pan waters

10:30 - 11:00

Coffee break/Poster Section

11:00 - 11:20

M. Havrlentová*, V. Gregusová, P. Hozlár, J. Gubiš

What is the potential for (1-3)(1-4)- β -D-glucans to be beneficial in a plant source?

11:20 - 11:40

I. Pawlaczyk-Graja*

Environment-friendly techniques in isolation of pectin conjugates from *Fragaria vesca* L. leaf

11:40 - 12:00

P. Smrčková*, E. Šárka, R. Bleha, V. Pour

Characterization of sugar beet pectin in diffuse and thin juice

12:00 - 13:00

Coffee break/Poster Section

13:00 - 13:20

L. Kalitukha*, J. Kraska, M. Sari

Gel-forming extracts from the fruiting bodies of the *Auricularia* mushrooms

13:20 - 13:40

R. Kao, P. Ekambaranellore*

Isolation and Characterization of Acemannan a Natural Polysaccharide from *Aloe vera*

13:40 - 14:00

T. Svoboda*, A. Svoboda, S. Henke, S. Gillarova, D. Růžička, P. Krčová

Development of software tool for estimation of equilibrium dispersive model parameters chromatography separation of saccharides and mannitol

14:00 - 14:20	<u>D. Harkavchenko</u> , I. Shakirzianova, A. Macůrková, J. Štětina, L. Čurda* Preparation of galactooligosaccharides form whey using novel commercially available β -galactosidases
14:20 – 14:40	<u>Š. Králová</u> , R. Bleha*, T. Babayeva, J. Čopíková, T. Brányik, A. Sinica Polysaccharides microalgae “ <i>Chlorella vulgaris</i> G10”: Structural analysis
14:40 - 15:00	Young scientific award
15:00	ICPG closing

POSTERS

1. L. Masewicz, K. Walkowiak, H. M. Baranowska*
Water binding in tomato ketchups stabilized with modified potato starches
2. Z. Černý*, M. Čihák, J. Jílková, S. Chatzigeorgiou, M. Janata, V. Velebný
Host strain Streptococcus zooepidemicus affects the impact of genetic mutations in carbohydrate metabolism
3. N. Dolejšová*, R. Bleha, A. Sinica, J. Čopíková
Reformulation of fondant with *Hericium erinaceum* extract
4. V. Dvořáček*, L. Jurkaninová, I. Hartman, M. Jágr, A. Kotrbová Kozak
Rheological parameters of oat flour and bran with an emphasis on the properties of the starch complex before and after controlled malting
5. S. Gillarová*, S. Henke, D. Růžička, T. Svoboda, Z. Bubník
Measurements and simulation of chromatography of mannitol and other saccharides solution
6. E. Górska*, A. Mazurek, I. Pawlaczyk-Graja
Natural deep eutectic solvents in pectins extraction from black currant pomace
7. O. Jirsa*, M. Blandino, I. Polišenská, P. Podloucká, I. Sedláčková, P. Martinek
The influence of nitrogen fertilization on the content of starch, protein and gluten in perspective genotypes of coloured wheat
8. H. Kalas*, K. Obleser, V. Scheibelreiter, B. Seidl, M. Kozich, Ch. Stanetty*, M. D. Mihovilovi
Facile quantification of aldehyde starch in a photometric assay based on 2-aminobenzamide oxime
9. R. Köpük*, T. M. Ferreira Maia De Andrade E Castro, M. Slukova, M. J. Monteiro
Development and evaluation of flours from cereal and legume flours for biscuits making
10. J. Le Thanh-Blicharz*, M. Stangierski, Z. Małyszek, J. Lewandowicz
The effect botanical origin of starch on mechanical properties of solvent casted films
11. A. Mazurek*, W. Różycka, E. Górska, I. Pawlaczyk-Graja
Polysaccharides from flaxseed – isolation by natural deep eutectic solvents

12. P. Podloucká*, K. Vaculová,
I. Polišínská* The influence of cooking on the content of β -glucans and polyphenols in six Barley varieties
13. M. N. Rapin*, L. Murray,
I. H. Sadler, J. H. Bothwell,
S. C. Fry Chemical structure and cellulose affinity of seaweed cell-wall polysaccharides
14. J. Sita*, M. Čepa,
V. Velebný, F. Ondreáš Oleyl-hyaluronan self-assembly and its interactions with bovine serum albumin
15. M. Sluková*, Š. Horáčková,
P. Skřivan, I. Švec, D. Koval Characterization of buckwheat sourdoughs and evaluation of their functionality
16. R. Arabadzhieva, I. Ivanov,
D. Vassilev*, N. Petkova,
R. Mihov, I. Petrova Microwave-assisted synthesis of lactose octaacetates and their application in a cosmetic hand gel
17. E. Bernáš*, K. Venugopal The influence of pretreatment and lactic acid fermentation on dietary fibre and beta-glucans in *Neoboletus erythropus* mushroom
18. M. Yanat*, I. Colijn,
K. Schroën The antioxidant activity of chitin nanocrystals in polylactic acid films
19. I. Švec*, P. Smrčková,
L. Marešová, M. Sluková Identification of polysaccharides and proteins in the rva profile "wheat flour ethanol method"
20. Ch. Jaffali*, R. Bleha,
A. Khadri, S. Aschi-Smitt,
P. Klouček, I. Jablonský,
A. Sinica Mid-Infrared spectroscopic evaluation of cultivated oyster mushroom *Pleurotus eryngii* as the source of medicinal polysaccharides
21. R. Bleha, T. Babayeva,
J. Copikova, M. Jozífek,
P. Klouček, I. Jablonsky,
A. Sinica* Isolation and characterisation of polysaccharides from fruiting bodies of medicinal fungus *Hericium erinaceus* strain KZ-120
22. T. Babayeva*, A. Sinica,
F. Kvasnička, R. Bleha,
K. Demnerová Characteristics of industrial poultry waste as a source of glycoaminoglycans
23. J. Martínéz-Martí*,
R. Bleha, A. Quiles,
I. Hernando Structural characterization of polysaccharides from Clementine by-products

Poster size is recommended max. width 90 cm and max. height 110 cm.

GELATION MECHANISMS OF STARCHES VARYING IN MOLECULAR STRUCTURES UNDER DIFFERENT PROCESSING CONDITIONS

Invited lecture

YONGFENG AI*

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Starch is a versatile gelling agent that is broadly utilized in foods, bioplastics, pharmaceutical products, and biomedical materials. The gelation behavior of starch depends on the structures at both granular and molecular levels and the processing conditions. This presentation will concentrate on our most recent research of employing rheological testing, scanning electron microscopy, and synchrotron-based X-ray computed tomography to elucidate gelation mechanisms of starches of various botanical origins. The advanced knowledge will be meaningful for using starch-based biogels in diverse industrial products.

We thank NSERC, Saskatchewan Ministry of Agriculture, Agriculture and Agri-Food Canada, Canada Foundation for Innovation, Saskatchewan Pulse Growers, Pulse Canada, NRC Canada and Mitacs for the financial support.

CHARACTERISTICS OF INDUSTRIAL POULTRY WASTE AS A SOURCE OF GLYCOSAMINOGLYCANS

**TAMILLA BABAYEVA^a, ANDREJ SINICA^a,
FRANTIŠEK KVASNIČKA^b, ROMAN BLEHA^a,
KATEŘINA DEMNEROVÁ^c**

*^a Department of Carbohydrates and Cereals, ^b Department of Food Preservation, ^c Department of Biochemistry and Microbiology, Faculty of Food and Biochemical Technology, University of Chemistry and Technology Prague, Czech Republic
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Glycosaminoglycans were obtained from hydrolysate of industrial poultry waste by dialysis using cut off 100,000 Da. The high molecular fraction was lyophilised and weighted, and its purity and composition were analysed by organic elemental analysis, spectroscopic (FTIR, NMR) and separation (capillary ITP) methods. It was identified mainly as chondroitin 4-*O*-sulphate. Small amount of hyaluronic acid was also detected by ITP, but this did not confirmed by correlation NMR. The presence of chondroitin sulphate makes poultry waste interesting as a raw material for production of food and feed supplements.

This work was supported from the Technology Agency of the Czech Republic (project No. 512 9251) and the grant of Specific university research – grant No A1_FPBT_2022_008.

WATER BINDING IN TOMATO KETCHUPS STABILIZED WITH MODIFIED POTATO STARCHES

**ŁUKASZ MASEWICZ, KATARZYNA WALKOWIAK,
HANNA MARIA BARANOWSKA**

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Starch is a biopolymer used as an additive that determines the mechanical and rheological properties of food products. Research shows that chemical modifications of starch significantly improve its affinity for water. The aim of this study was to investigate how different modified starches change the molecular dynamics of water in tomato ketchups. The analysis of the results obtained from low-field nuclear magnetic resonance (LF NMR) and the result of water activity measurements showed that starch octyl succinate (E1450) binds water in the analyzed system most effectively compared to native starch.

POLYSACCHARIDES MICROALGAE “*CHLORELLA VULGARIS* G10”: STRUCTURAL ANALYSIS

**ŠTĚPÁNKA KRÁLOVÁ, ROMAN BLEHA*, TAMILLA
BABAYEVA, JANA ČOPIKOVÁ, TOMÁŠ BRÁNYIK,
ANDREJ SINICA**

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This work focused on the isolation and structural characterization of polysaccharides from *Chlorella vulgaris* strain G10. Hot water extraction was followed by alkali and DMSO extraction steps. The crude polysaccharides were purified by the combination of enzymes pepsine/pronase to remove proteins and amylase/pullulanase to remove starch-like polysaccharides. All fractions were analysed by FTIR, GC/FID, and NMR to identify the structure. The main polysaccharide in the hot water fraction was (1→6)-linked β-D-galactopyranosyl fragments and in DMSO (1→4)-α-D-glucan and α-D-glucopyranoses.

This work was supported by the Ministry of Agriculture of the Czech Republic (project QK1910300) and of Specific university research – grant No A1_FPBT_2022_008 of UCT Prague, are greatly acknowledged.

HOST STRAIN *STREPTOCOCCUS ZOOEPIDEMICUS* AFFECTS THE IMPACT OF GENETIC MUTATIONS IN CARBOHYDRATE METABOLISM

ZBYNĚK ČERNÝ, MATOUŠ ČIHÁK, JANA JÍLKOVÁ, SOFIA CHATZIGEORGIOU, MARTIN JANATA, VLADIMÍR VELEBNÝ

*Contipro a.s., Dolní Dobrouč 401, 561 02 Dolní Dobrouč, Czech Republic
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Hyaluronic acid (HA) is produced by the fermentation of *Streptococcus zooepidemicus*. Various mutations can lead to streptococcal strains with increased HA yield. Therefore, we constructed a *fruK* deficient strain to increase HA production. However, the HA yield decreased. We hypothesized that the host strain influences the the mutation effect. This was tested in strains with reduced expression of *pfkA* or *ldh*, with the expected increase in HA yield. Only one of nine recombinant strains produced more HA than its parental strain. We concluded that each host strain has a defined genetic background and responds in a specific way to the introduced mutations.

REFORMULATION OF FONDANT WITH *HERICIUM ERINACEUS* EXTRACT

NATÁLIE DOLEJŠOVÁ, ROMAN BLEHA, ANDREJ SINICA, JANA ČOPIKOVÁ

Department of Carbohydrates and Cereals, the University of Chemistry and Technology in Prague, copikovj@vscht.cz

The using of polysaccharide rich medicinal mushrooms in reformulation of foods has grown during last years. The formulation of fondant was modified with water extract of the fungi *Hericium erinaceus*. FTIR spectroscopy and sensory analysis were applied to monitor the product features. The content of β -glucan in *Hericium erinaceus* was determined by enzymatic method β -Glucan Assay Kit K-YBGL (Neogen/Megazyme) and the molar ratio of monosaccharides in isolated polysaccharides was determined by GC. This work is consistent with the current effort to produce sweets with a new benefit.

This work was supported by MZ – ZEMĚ (project – QK1910209).

REFERENCES

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2. Thongbai B., et al.: *Mycol Progress*. 14, 91 (2015).

THE ROLE OF POLYSACCHARIDES IN SUGAR BEET PROCESSING

Invited lecture

JAN MAARTEN DE BRUIJN

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The processing of sugar beet, in particularly the purification of the extracted raw juice, can be significantly hindered by the presence of polysaccharides like pectin and dextran in the extracted juice. The origin of these polysaccharides in beet processing, as well as how their presence in the raw juice affects processing will be explained. Preventive and process control measures are available in order to largely limit the risk that the concentration of these polysaccharides gets at a level where they adversely affect beet processing.

RHEOLOGICAL PARAMETERS OF OAT FLOUR AND BRAN WITH AN EMPHASIS ON THE PROPERTIES OF THE STARCH COMPLEX BEFORE AND AFTER CONTROLLED MALTING

VÁCLAV DVOŘÁČEK^{a*}, LUCIE JURKANINOVÁ^b, IVO HARTMAN^c, MICHAL JÁGR^a, ANNA KOTRBOVÁ KOZAK^a

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The subject of our study was the rheological analysis of processed oat flour and bran using the Mixolab system. These were obtained by combining 2 oat varieties from malted and unmalted grain. The results confirmed a significant degradation of the starch-amylase complex by the malting of the products. At the same time, the varietal quality of the oat grain also manifested itself in unmalted products. An obvious relationship was detected between the low value of the flour falling number and the loss of the rheological resistance of the dough during its controlled heating.

This work was supported by Ministry of Agriculture of the Czech Republic (project QK1810102 and projects RO0418 and RO1920).

ISOLATION AND CHARACTERIZATION OF ACEMANNAN A NATURAL POLYSACCHARIDE FROM ALOE VERA

RICHARD KAO, PRAKASH EKAMBARANELLORE*

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Natural polysaccharides play important functional roles in human health and personal care. We have developed an efficient method to isolate Acemannan from A.vera, which showed high percentage of acetylation. The purified Acemannan was characterized using HPLC, spectrophotometry, NMR, and FTIR. Preliminary *in vitro* experiments with Acemannan using rat gastric mucosa cell line, mouse and human fibroblasts and macrophage cell line showed improved cell integrity and immune cell activation, in a dose dependent manner.

INULIN AS A SOURCE OF SWEET TASTING CARBOHYDRATES ON DEMAND FOR CLEAN LABEL SUGAR REDUCTION

PEDRO A. R. FERNANDES^{a,b,*}, BRUNA ANTUNES^a, SÓNIA S. FERREIRA^b, CLÁUDIA NUNES^c, ELISABETE COELHO^a, MANUEL A. COIMBRA^a

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Inulins are polysaccharides of high-water retention capacity, attributed to its long 1)→Fru₂-(β2→ chains. This structure also renders inulin a sweet taste, but 10-fold less intense than that provided by sucrose.¹ However, inulin can be depolymerized to fructooligosaccharides (FOS), carbohydrates that still present much of inulin properties but with a higher sweetening power.² In this context, inulin was isolated from yacon, a tuberous root characteristic of the Andean region but efficiently cropped in Portugal, and subjected to acid depolymerization (0.1–0.5% citric acid) while performing yacon juice concentration to yield a sweet tasting hydrolysate.

Inulin was the most abundant carbohydrate in yacon, accounting 311 g/kg_{dry weight} and presenting a degree of polymerization (DP) up to 50. Inulin hydrolysis, at the highest initial citric acid concentration (0.5%; w/v), resulted on the decrease of inulin detected maximum DP to 27 and of the inulin/FOS proportion, from the initial 1.8:1, to 0.5:1. Newly FOS structures were found to be formed, differing on their DP (2–9) and sugar composition, potentiating the hydrolysate sweetness to 0.6. Texture analysis also showed that as inulin is depolymerized, the hydrolysates become less sticky and stringier. In this context, inulin can be valuable in sugar reduction strategies as a raw material to produce sweet tasting

carbohydrates able to provide different sweetness and texture sensations following a clean label approach.

Thanks are due to LAQV/REQUIMTE (UIDB/50006/2020 & UIDP/50006/2020), CICECO (UIDB/50011/2020, UIDP/50011/2020 & LA/P/0006/2020), FCT (FCT/MCTES and FEDER, within the PT2020 Partnership Agreement) and projet “cLabel+”, number 46080 (POCI-01-0247-FEDER-046080 and LISBOA-01-0247-FEDER-046080) for funding. Cláudia Nunes and Elisabete Coelho thanks Portuguese national funds for their contract (CDL-CTTRI-88-ARH/2018 - REF. 049-88-ARH/2018). Thanks to YaconPortugal for providing samples.

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2. C. T. M. Pereira, D. M. Pereira, A. C. Hiramatsu, E. Y. Ventura, M. B. Bolini, H. M. André: *LWT* 150, 112054 (2021).

ISOLATION AND CHARACTERIZATION OF MARINE SULFATED POLYSACCHARIDES CONCENTRATED IN SALT PAN WATERS

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Marine environments encompass a variety of novel bioactive compounds prone to be explored. Sulfated polysaccharides, that are excreted by marine organisms, are among the main materials. Their potential antiviral, anticoagulant, antioxidant, and immunomodulatory activities has led the search for new sources and their structural features¹. Salt pans are man-made systems where seawater gives rise to sea salt due to its evaporation by wind and sunlight. Seawater contains highly heterogeneous sulfated polysaccharides that can represent half of the polymeric material found². Therefore, in this study polymeric material and polysaccharides, obtained by dialysis, were analyzed along salt production in the evaporation ponds and in the crystallizer water. Along salt production, polymeric material of seawater (13 mg/L) accumulates in the evaporation ponds (9–73 mg/L) and in the crystallizer (133–144 mg/L). This polymeric material was composed by 29% of sulfated polysaccharides, with 45 mol% of sulfate esters, 23 mol% of uronic acids, 12 mol% of galactose, and 1 to 6 mol% of glucose, mannose, xylose, fucose, rhamnose, arabinose, and ribose. These results highlight salt pan water as a worth

exploring source of highly sulphated polysaccharides for biomedical and/or functional food applications.

The authors acknowledge to FCT/MEC and the financial support of the project "MARemPÓ - A água de salmoura como fonte sustentável de compostos para o desenvolvimento de produtos comerciais para aquacultura" (POCI-01-0247-FEDER-0047200 and ALG-01-0247-FEDER-047200), CICECO (UIDB/50011/2020, UIDP/50011/2020 & LA/P/0006/2020), and LAQV/REQUIMTE (UIDB/50006/2020, UIDP/50006/2020) through national funds and, where applicable, co-financed by the FEDER - Fundo Europeu de Desenvolvimento Regional, within the PT2020 Partnership Agreement. The authors also thank Necton - Companhia Portuguesa de Culturas Marinhas S.A. for providing salt pan waters from Olhão, Portugal.

REFERENCES

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2. C. Nunes, A. Rocha, P. Quitério, S. S.Ferreira, A. Correia, M. Vilanova, M. A. Coimbra: *Int. J. Biol. Macromol.* 133, 235 (2019).

IMMUNOMODULATING POLYSACCHARIDES AND THEIR RESIDUAL ADSORBED SMALLER BIOACTIVE MOLECULES

Invited lecture

YORDAN NIKOLAEV GEORGIEV

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Research in our laboratory has resulted in pectin-carbohydrate complexes with future application in biomedicine. Pectins of *Tilia tomentosa* L. and *Lavandula angustifolia* Mill. adsorb during extraction hydrocarbons, fatty acids, sugars, phytosterols, triterpenic acids, phenolic acids, flavonoids, phenylpropanoids, etc. Phenolics and fatty acids affect their immunomodulatory effects. Lavender pectins form antioxidant complexes with catechins. A pectin-myconoside complex from the leaves of *Haberlea rhodopensis* Friv. shows potent ORAC (52173.3 TE/g) and HORAC (17774.3 GAE/g) activities.

This work was supported by the Bulgarian Academy of Sciences (BAS) [grant №DFNP-17-62/July 26, 2017] and the Bilateral grant agreement between the BAS and Czech Academy of Sciences (2020–2022).

MEASUREMENTS AND SIMULATION OF CHROMATOGRAPHY OF MANNITOL AND OTHER SACCHARIDES SOLUTION

SIMONA GILLAROVÁ*, SVATOPLUK HENKE, DANIEL RŮŽIČKA, TOMÁŠ SVOBODA, ZDENĚK BUBNÍK

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This work deals with the discontinuous separation of mannitol on strongly basic anion exchanger from a solution which modelled the composition of carbohydrates contained in the celery stalks. The fractions obtained from the individual batch separations were analyzed by HPLC/RI. Based on data from batch experiments, continuous separation was performed using computer simulation in Aspen Chromatography™. The batch separation confirmed the gain of pure mannitol fraction free of glucose, fructose and sucrose. Subsequently, the usability of the proposed continuous process for industrial applications was evaluated.

This work was supported from the grant of Specific university research – grant No A1_FPBT_2022_008.

NATURAL DEEP EUTECTIC SOLVENTS IN PECTINS EXTRACTION FROM BLACK CURRANT POMACE

EWA GÓRSKA*, ALEKSANDRA MAZUREK, IZABELA PAWLACZYK-GRAJA

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Interest in the management of waste from fruit processing as a cheap source of polysaccharides is an attractive direction in the development of sustainable technologies. Poland is a leader in the cultivation of blackcurrant fruit and the production of its products, generating at the same time a large amount of pectin-rich pomace. In order to isolate them, natural deep eutectic solvents (NADES) as the extraction medium, based on choline chloride (as HBA) and citric acid (as HBD), in various molar ratios, were used. The obtained products were purified and characterized by chromatographic and spectroscopic methods.

This research was funded in whole by the National Science Centre, Poland, under research project no UMO-2020/39/O/ST8/03514.

PECTIN DEPOLYMERIZATION BY UV/TiO₂ UNDER DIFFERENT CONDITIONS**BETIM HAJDARI, SVATOPLUK HENKE, SIMONA GILLAROVÁ, TOMÁŠ SVOBODA, VLADIMÍR POUR, ZDENĚK BUBNÍK***University of Chemistry and Technology Prague, Technická 5, Dejvice, 166 28 Prague, Czech Republic
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Pectin oligosaccharides (POS) are suggested as novel candidates of prebiotics. This work deals with depolymerization of pectin using UV light/TiO₂ under different temperatures and pH. Furthermore, the individual contribution of TiO₂ and UV light on the overall pectin depolymerization is evaluated. The solution of pectin is prepared by mixing lemon peel powder pectin with distilled water in magnetic stirrer. Subsequently, samples were characterized for the content of mono-, oligosaccharides and uronic acids by HPAEC-PAD.

*This work was supported from the grant of Specific university research – grant No AI_FPBT_2022_008.***PREPARATION OF GALACTOOLIGOSACCHARIDES FROM WHEY USING NOVEL COMMERCIALY AVAILABLE β -GALACTOSIDASES****DMYTRO HARKAVCHENKO, IRINA SHAKIRZIANOVA, ANNA MACŮRKOVÁ, JIŘÍ ŠTĚTINA, LADISLAV ČURDA****University of Chemistry and Technology, Prague, Department of Dairy, Fat and Cosmetics, Technická 5, 166 28 Prague 6, Czech Republic
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Galactooligosaccharides (GOS) are non-digestible oligosaccharides with prebiotic properties that can be prepared by transgalactosylation reaction using a suitable β -galactosidase. Application of new commercially available β -galactosidases Nurica (Danisco) and Saphera Fiber L (Novozymes) in mixture of evaporated whey and milk were tested for production of GOS preparation with yield more than 40% of GOS. This GOS preparation is applicable as prebiotic supplement and soluble fiber in yoghurt production.

WHAT IS THE POTENTIAL FOR (1-3)(1-4)- β -D-GLUCANS TO BE BENEFICIAL IN A PLANT SOURCE?**MICHAELA HAVRLETOVÁ^{a,b,*}, VERONIKA GREGUSOVÁ^a, PETER HOZLÁR^c, JOZEF GUBIŠ^b***^a Department of Biotechnology, Faculty of Natural Sciences, University of SS. Cyril and Methodius, Nám. J. Herdu 2, Trnava, 917 01, ^b National Agricultural and Food Centre – Research Institute of Plant Production, Bratislavská cesta 122, Piešťany, 921 68, ^c National Agricultural and Food Centre – Research Institute of Plant Production – Research and Breeding Station in Víglaš-Pstruša, Pstruša 334, Víglaš, 962 12, Slovak Republic
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(1-3)(1-4)- β -D-glucans, the cell wall polysaccharides occurred mainly in generative organs of selected *Poales*, are not only health-beneficial for humans, they also dispose of important functions in the plant. They are glucose sources of energy, tools exchanging water, nutrients, and phytohormones, they have architectonic role in the cell wall, as well as protective function thanks the gel-like structure flexibility and elasticity of the cell wall. Fine differences in the structure of the polymer are responsible for its overall conformation, physicochemical properties, and biological functions.

*The potential of β -D-glucans in cereals is studied thanks the financial support of the project APVV-18-154.***MID-INFRARED SPECTROSCOPIC EVALUATION OF CULTIVATED OYSTER MUSHROOM *PLEUROTUS ERYNGII* AS THE SOURCE OF MEDICINAL POLYSACCHARIDES****CHAHRAZED JAFFALI^{a,b,*}, ROMAN BLEHA^a, AYDA KHADRI^b, SAMIRA ASCHI-SMITI^b, PAVEL KLOUČEK^c, IVAN JABLONSKÝ^d, ANDREJ SINICA^a***^a Department of Carbohydrates and Cereals, University of Chemistry and Technology Prague, Czech Republic, ^b Department of Biology, University of Tunis El Manar, Tunisia, ^c Department of Gardening, ^d Department of Crop Production, Czech University of Life Sciences Prague, Czech Republic
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The aim of this work was the vibrational spectroscopic characterization of fruiting bodies and mycelia of oyster mushroom *Pleurotus eryngii* cultivated in Tunisia and Czech Republic. The polysaccharide fractions were obtained from fruiting bodies by extraction with hot water and further purification. In addition, polysaccharides were also isolated from the liquid cultivation medium. FTIR spectra of raw materials and obtained fractions were compared to evaluate their composition. Polysaccharides of various structures were found to be the main components of the fractions together with smaller amounts of proteins.

This work was supported by the Ministry of Agriculture of the Czech Republic (project QK1910209).

THE INFLUENCE OF NITROGEN FERTILIZATION ON THE CONTENT OF STARCH, PROTEIN AND GLUTEN IN PERSPECTIVE GENOTYPES OF COLOURED WHEAT

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The content of starch, protein and wet gluten in the grain of 13 coloured wheat genotypes (*Triticum aestivum*) was analysed. The genotypes were grown at three levels of nitrogen nutrition and its effect on the observed parameters was statistically evaluated. The highest fertilisation level significantly increased protein/gluten content and decreased starch content, but certain differences were observed between genotypes.

This research was funded by the institutional support MZE-RO1118 QK1910343, and NUTRACORE of the Regione Piemonte (POR FESR 2014-2020).

FACILE QUANTIFICATION OF ALDEHYDE STARCH IN A PHOTOMETRIC ASSAY BASED ON 2-AMINOBENZAMIDE OXIME

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The oxidation of starch to aldehyde starch opens up a wide range of further functionalization, e.g., via cross-linking. In investigating this oxidation, we found that classical analytical methods rely on time-consuming and work-intensive titration protocols. To accelerate the screening process we implemented a photometric assay based on the selective adduct-formation of 2-aminobenzamide oxime (ABAO) and aldehydes. The UV-active adduct can easily be quantified in a platereader, allowing for parallel processing of multiple samples with a readout in a fraction of the time and in consistency of conventional methods.

We thank Lisa Riedlsperger for their technical support. The providence Lower Austria (BioSet, K3-F-603/003-2018) is gratefully acknowledged for financial support.

GEL-FORMING EXTRACTS FROM THE FRUITING BODIES OF THE *AURICULARIA* MUSHROOMS

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The ear- to shell-shaped fruiting bodies of the genus *Auricularia* are well known as food and therapeutic agent. The study is focused on the preparation and potential use of the gel-forming extracts from these mushrooms. The dried extracts contained 50% of soluble polysaccharides, which mainly composed of glucose and mannose, as well as acetyl residues, glucuronic acid, xylose, galactose, and D-glucosamine. The composition indicates the presence of homo- and heteropolysaccharides. The storage stability of the extracts at different concentrations, pH and temperatures was compared with sodium hyaluronate.

DEVELOPMENT AND EVALUATION OF FLOURS FROM CEREAL AND LEGUME FLOURS FOR BISCUITS MAKING

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Biscuits are a popular staple in the human diet, but often not particularly healthy. Therefore, five types of cereal and legume flours were characterized for making functional biscuits. Analytical methods were used to determine the physicochemical properties of the flours: moisture, protein, ash, solvent retention capacity (SRC); dietary fiber, total starch and resistant starch content; pasting properties. Based on these analysis, flours were blended in different ratios. Blends with wholegrain wheat flour or wholegrain rye flour were particularly promising options for biscuit dough.

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THE EFFECT BOTANICAL ORIGIN OF STARCH ON MECHANICAL PROPERTIES OF SOLVENT CASTED FILMS

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Thermoplastic starch films based on pastes of different botanical origin were obtained by solvent casting method. Pasting properties of starch suspensions in presence of plasticizer as well as mechanical properties of obtained starch films were analyzed. It was found that the effect of botanical origin as well as amylose content on the mechanical properties is multidirectional.

POTATO JUICE – A RAW MATERIAL WITH UNIQUE POTENTIAL FOR FOOD INDUSTRY AND MEDICINE

Invited lecture

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Potato juice, tuber cytosol, was for many years considered simply as an industrial waste, generated during starch production. Over the years it has been used as a fertilizer and an ingredient of animal feed. However, current studies show, that its components exhibit multidirectional biological activity including, in particular, cytotoxic activity against cancer cells of the gastrointestinal tract and an anti-inflammatory effect within it. Potato juice can be used in medicine and for the production of functional food, also taking advantage of the favorable amino acid composition of its protein fraction.

THE EFFECT OF CHEMICAL MODIFICATION OF STARCH ON RHEOLOGICAL PROPERTIES AND TEXTURE OF TOMATO KETCHUP

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The aim of the work was to establish how chemical modification of potato starch affects rheological properties and texture of tomato ketchup. Food grade modified starches: E 1404, E 1412, E 1420, E1422 and E 1450 were the basic working material. Native potato starch was used as reference. Tomato ketchups thickened with 3.3% of starch were investigated employing rotational rheometer and texture analyzer. It was found that cross-linked starch preparations have the most favorable properties for this type of application.

STRUCTURAL CHARACTERIZATION OF POLYSACCHARIDES FROM CLEMENTINE BY-PRODUCTS

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By-products obtained after clementine juice extraction mean about 50% of the fresh fruit. After processing the clementine by-products using different treatments, the food industry can use them because they are rich in polysaccharides, such as pectin and cellulose. Therefore, the aim of the work was the structural characterization of the polysaccharides present in clementine by-products through FTIR and Raman spectroscopy in order to know their specific composition. Also, neutral sugars were determined by GC-FID. The resulting spectra revealed some differences among the different treatments applied.

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POLYSACCHARIDES FROM FLAXSEED – ISOLATION BY NATURAL DEEP EUTECTIC SOLVENTS

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Linen is a plant with a very wide industrial use. The important reasons for the cultivation of flax are fibers and oil obtained from seeds of this plant. Linseed is also a source of gelling polysaccharides with pro-health properties, especially with a beneficial effect on the digestive tract. Natural deep eutectic solvents (NADES) as safe for the environment turned out to be an attractive extraction medium for isolation of the polysaccharides. It has been noticed that NADES, composed of choline chloride and citric acid, in the proper proportions, is an extremely effective solvent in obtaining dietary fiber from flax seeds.

The work was supported by a statutory subsidy from Ministry of Higher Education for Wrocław University of Science and Technology.

FLEXIBLE AND GREEN MULTILAYER PAPER COATING FOR BARRIER ENHANCEMENT OF PAPER PACKAGING

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Packaging is critical for the preservation of merchandise like biomedical and food products. However, packaging materials are typically single-use plastics and rarely recycled or repurposed due to various challenges. In this study, a novel multilayer packaging assembly consisting of paper, thermoplastic starch (TPS), and a thin layer (12 µm) of biopolymers were fabricated and characterized. Results in this work demonstrated that multilayer assemblies provide functional packaging properties making them promising sustainable material options for packaging applications.

The financial support of NSERC is greatly appreciated.

ENVIRONMENT-FRIENDLY TECHNIQUES IN ISOLATION OF PECTIN CONJUGATES FROM FRAGARIA VESCA L. LEAF

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Environment-friendly techniques for the isolation of plant polysaccharides, properly selected in terms of sequence and optimal process parameters choice, e.g. degreasing with supercritical CO₂, extraction supported by ultrasounds or microwaves, ultrafiltration, may play a key role in reducing process time and increasing efficiency. The impact of the above-mentioned factors on the technology of separation of plant products and their biological effects will be illustrated on the example of pectin conjugates with polyphenols isolated from leaves of wild strawberry (*Fragaria vesca* L.).

The work was supported by a statutory subsidy from Ministry of Higher Education for Wrocław University of Science and Technology.

THE INFLUENCE OF COOKING ON THE CONTENT OF B-GLUCANS AND POLYPHENOLS IN SIX BARLEY VARIETIES

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The content of β-glucans and polyphenols was analysed in six varieties of naked barley (AF Lucius, AF Cesar, Nudimelancrithon, KM 2975, KM 3189, KM 2551) intended for human nutrition. Both compound groups are classified as the substances with positive effect on human health. To see how cooking process could influence the content of β-glucans and polyphenols, both natural and cooked grains have been analysed. The results of the study should contribute to finding the gentle technologies with the aim to minimize the degradation of health beneficial compounds during processing.

The study was supported by the Ministry of Agriculture of the Czech Republic, institutional support MZE-RO1118.

CHEMICAL STRUCTURE AND CELLULOSE AFFINITY OF SEAWEED CELL-WALL POLYSACCHARIDES

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Species of the seaweed genus *Ulva* (Chlorophyta) have been studied extensively for several decades, as they contain the multi-functional, sulphated polymer ulvan. In this work, the focus was on the non-ulvan alkali-extractable fraction of *Ulva* cell walls. The fraction's structure was fully characterised using biochemical and spectroscopic methods: phycoxyloglucan was found to be a linear β -(1,4)-polymer of glucose and xylose, featuring xylose stretches up to four residues long. The affinity of phycoxyloglucan for cellulose was measured in comparison with the well-known land-plant-specific polymer xyloglucan.

This work was supported by EPSRC SOFI (Soft Matter and Functional Interfaces) CDT.

ISOLATION AND CHARACTERISATION OF POLYSACCHARIDES FROM FRUITING BODIES OF MEDICINAL FUNGUS *Hericium erinaceus* STRAIN KZ-120

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The aim of this work was the isolation and structural characterization of polysaccharide fractions from *Hericium erinaceus* strain KZ-120. Polysaccharide fractions were obtained by successive extractions with cold water, hot water and alkali solution. The chemical composition and structure of isolated polysaccharides were analysed by organic elemental analysis, spectroscopic and separation methods.

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OLEYL-HYALURONAN SELF-ASSEMBLY AND ITS INTERACTIONS WITH BOVINE SERUM ALBUMIN

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Oleoyl-hyaluronan (O-HA) is an amphiphilic polysaccharide that can be used as a drug carrier. Its self-assembly was improved when using a solvent with ions due to charge compensation on the HA backbone. Moreover, the functional properties such as drug loading capacity and its penetration into skin were enhanced. Interactions with serum proteins are often considered a bottleneck for carriers' application. Interactions of O-HA and bovine serum albumin (BSA) were elucidated by various techniques and divided into three regimes. Structural changes were found and described. Resulting system retained the drug.

CHARACTERIZATION OF BUCKWHEAT SOURDOUGHS AND EVALUATION OF THEIR FUNCTIONALITY

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Buckwheat is a pseudocereal with significant nutritional qualities and a wide potential for use in the food industry. Buckwheat flours were characterized and they were subsequently used for the preparation of gluten-free sourdoughs. Buckwheat sourdoughs were made under different process conditions (sourdough yield, time, temperature, the presence of a starter fermentation culture) and analysed (pH, TTA, microbiology assessment). The prepared sourdoughs were successfully used as bread recipe ingredients. The antifungal activity of sourdough bread was determined.

This work was supported from the project QK1910036 and Czech Technology Platform for Foodstuffs, Federation of the Food and Drink Industries of the Czech Republic in the working group "Cereals in Human Nutrition".

CHARACTERIZATION OF SUGAR BEET PECTIN IN DIFFUSE AND THIN JUICE

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Isolated polysaccharide fraction of diffuse and thin juice was characterised by molecular weight using SEC chromatography Omnisec Reveal, Malvern (Pananalytical, USA) coupled with triple detection. A multi-angle light scattering (low-angle light scattering, LALS and right-angle light scattering RALS), differential viscometer (DP) and refractive index (RI) detectors were employed. Calibration was performed with a Polycal dextrans standards. The found average molecular weight of starch ranged between 10^5 Da and 10^6 Da.

DEVELOPMENT OF SOFTWARE TOOL FOR ESTIMATION OF CHROMATOGRAPHY EQUILIBRIUM DISPERSIVE MODEL PARAMETERS FOR SEPARATION OF SACCHARIDES AND MANNITOL

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Preparative chromatography using ion exchange resin is an efficient method for the separation of monosaccharides. Continuous chromatography with a simulated moving bed is a popular technology for industrial production. To find the optimal operating parameters for the SMB chromatography system, a mathematical description of the chromatography process is necessary. Therefore, the software tool utilizing functionalities needed for the determination of chromatography model parameters based on various and messy experimental data has been developed.

This work was supported from the grant of Specific university research – grant No A1_FPBT_2022_008.

IDENTIFICATION OF POLYSACCHARIDES AND PROTEINS IN THE RVA PROFILE "WHEAT FLOUR ETHANOL METHOD"

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Presented work is aimed at progressive method of combined estimation of pasting properties of polysaccharides and technological quality of proteins by using of the viscometer Rapid Visco Analyser, namely the *Wheat Flour Ethanol Method* profile. The viscosity record during 30 min includes two viscosity peaks; by comparison of ones for standard white wheat flour, type A wheat starch and wheat gluten, the peaks were identified successfully. By addition of 5% wheat gluten into finely milled chickpea, pea and lentil flour samples, the validity of the peak pair identification was confirmed also for these legume materials.

This work was supported by Czech Technology Platform for Foodstuffs, Federation of the Food and Drink Industries of the Czech Republic in the working group "Cereals in Human Nutrition".

POLYSACCHARIDE-BASED FLOATING MICROPARTICLES FOR INTRAGASTRIC DELIVERY OF CURCUMIN

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Currently, research is focused on microsized biocompatible delivery systems for bioactive natural products to increase their suitability as therapeutics or comestibles. Thus, carboxymethylcellulose-based microparticles for the intragastric delivery of curcumin were studied. Triglycerides were used as a component of the delivery systems to ensure flotation and improve the bioavailability of curcumin. The microparticles were compared for morphology, particle size and distribution (SEM), encapsulation efficiency (UV-Vis) and stability. Curcumin release kinetic was studied under gastric conditions *in vitro*. The aim of the research was to select the most useful polysaccharide-lipid composition.

MICROWAVE-ASSISTED SYNTHESIS OF LACTOSE OCTAACETATES AND THEIR APPLICATION IN A COSMETIC HAND GEL

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Lactose octaacetate is a biodegradable surfactant with antimicrobial, cytotoxic, and antiviral properties. The aim of this study was to obtain lactose octaacetates by microwave irradiation and to apply them in a cosmetic gel. Lactose ester was synthesized by esterification of lactose with acetic anhydride for 10 min (yield 74%) and degree of acetylation (DS) 3.62. A transparent cosmetic hand sanitizer gel was prepared with 0.1% lactose ester, ethanol, 0.1% bergamont oil and hydroxypropyl cellulose. The rheological properties and sensory evaluation of the product were performed.

The current research is funded by project 2202C / 2022 through the Research Fund of the Technical University – Gabrovo.

THE INFLUENCE OF PRETREATMENT AND LACTIC ACID FERMENTATION ON DIETARY FIBRE AND BETA-GLUCANS IN *NEOBOLETUS ERYTHROPUS* MUSHROOM

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Mushrooms are a good source of dietary fibre and beta-glucans. The influence of pretreatment and lactic acid fermentation on the levels of dietary fibre and beta-glucans in wild edible mushroom *Neoboletus erythropus* mushroom was determined. Fresh mushrooms were blanched in water and then fermented for 17 days with addition of two different probiotics *Lactobacillus acidophilus* strain LA5 (Hansen) and *Lactobacillus plantarum* strain SWA016 (Swanson) until the pH was <4.5.

Research funded by the Ministry of Science and Higher Education statutory grant.

THE ANTIOXIDANT ACTIVITY OF CHITIN NANOCRYSTALS IN POLYLACTIC ACID FILMS

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Active packaging can be used to extend the shelf-life of food (reduce food waste), and is in line with consumer demands for less chemical preservatives. Ideally, the packaging material would be biodegradable, thus also contributing to less plastic waste.

In this context, we investigate the biodegradable plastic polylactic acid, and use chitin nanocrystals to create additional functionality, in this anti-oxidant effects. Besides creating this effect, the nanocrystals should also remain in the packaging material. We investigated antioxidant properties by DPPH (1,1-diphenyl-2-picrylhydrazyl) radical scavenging of chitin nanocrystals, and nanocomposite films with polylactic acid, which were prepared using acid hydrolysis and solvent casting methods respectively.

The nanoparticles showed higher (~ 5 times) antioxidant activity as the base chitin. Moreover, the addition of chitin nanocrystals to PLA films provided antioxidant property to the nanocomposite, and this effect could be enhanced by the positioning of nanocrystals at the surface of the film. This is an important step toward creating additional functionality in biodegradable plastics.

OPTIMIZATION OF THE YEAST-GLUCAN PARTICLES PREPARATION PROCESS

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Glucan particles (GP), isolated from the common baker's yeast (*Saccharomyces cerevisiae*), are promising bioactive carriers for targeted drug delivery. However, to increase their viability in pharmaceutical development, glucan particles require a rigorous study of their constitution as well as the process itself. In this work, the standard laboratory method of GP production was investigated and an optimization of the process was conducted aiming to propose a more cost, labor and time-effective GP preparation pathway while maintaining the final product quality.

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