

SECTION E: FOOD CHEMISTRY
AND ENGINEERING

OE1. STUDIES OF ELECTROCHEMICAL BEHAVIOR AND SOME BIOLOGICAL EFFECTS PRODUCED AT CELLULAR LEVEL OF MONOSODIUM GLUTAMATE FOOD ADDITIVE

Dora Domnica BACIU,¹ Andreea MATEI,² Aurora SĂLĂGEANU,¹ Anca COJOCARU,³ and Teodor VIȘAN³

¹INCDDMM Cantacuzino, 103 Splaiul Independentei, 050096 Bucharest, Romania

²National Institute for Laser, Plasma & Radiation Physics (INFLPR), Magurele, Romania

³University Politehnica of Bucharest, Inorganic Chemistry, Physical Chemistry and Electrochemistry Department, Bucharest, Romania

Monosodium glutamate (E-621, abbreviated MSG) is a food additive widely used in the food domain as a flavor and taste enhancer. The present study aims to evaluate MSG electrochemical behavior, its detection in food products and its biological effects on RAW 264.7 murine macrophage cells.

Both cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) experiments were performed using three types of screen-printed electrodes (DropSens) having carbon, gold or platinum as non-enzymatic working electrode. Aqueous solutions of single MSG solute as well solutions with added supporting electrolyte (KNO₃, NaNO₃ or KCl) were prepared. The CV results showed signal appearance for MSG as cathodic peaks or shoulders with a linear dependence between the current and MSG concentration. The electrode process of glutamate ion is irreversible, and diffusion controlled. Layered double hydroxides (hydrotalcite) films containing Ni and Al formed by laser deposition improved the cathodic reduction of glutamate anion, mostly for carbon screen-printed electrodes. EIS plots recorded at open-circuit potentials as Nyquist or Bode diagrams can give valuable information on the electrode/electrolyte interface behavior. We noticed that the charge transfer resistance (diameter of Nyquist semicircles) decreased in MSG solutions prepared with supporting electrolyte; this can be attributed to the enhanced electron transfer in cathodic process. Also, Bode plots showed lower values for the maximum of phase angles thus evidencing a better electrical conductivity of the interface.

We demonstrated the possible detection of MSG from food products by means of CV method using the aqueous extracts from bologna sausage (PA), frankfurter hot dogs (CF), hot dogs with cheese (CB) and vegetable soup concentrate cubes (SM). In the case of carbon screen-printed electrode, the linear correlation between cathodic peak current and MSG concentration suggests the possible use of CV for its direct determination for food industry.

On the basis of this calibration curve we have found the concentration order of MSG in food samples as the following: CF < PA < CF < SM.

The *in vitro* study of antiproliferative effect, cytotoxicity and proinflammatory activity of MSG using the RAW 264.7 murine macrophage line was conducted in 3 complementary directions: first, establishing the ability of monosodium glutamate to induce cell mortality, by using the MTT assay to determine cell viability; second, establishing by its oxidizing activity if MSG is toxic for cells inducing oxidative stress, measured by the Griess test for determination of extracellular NO; third, to observe whether MSG presence induces an immune response quantified by the secretion of proinflammatory cytokines, tumor necrosis factor (TNF α) in this case, measured through the immunoenzymatic ELISA technique. Tests regarding the viability of MSG on the murine macrophage tumor cell line suggest that its toxicity is due, in part, to the increase in oxidative stress. The low levels of TNF α suggest that MSG does not act by inducing inflammation but causes cellular damage through nitrogen oxide production. Regarding the cytotoxic effects induced by MSG on murine macrophages at concentrations similarly to native biological conditions, we observed a uniform decrease of TNF α secretion for exposure of RAW cells in more concentrated MSG solutions (higher than 25 mM), a fact which is apparently contrary with some literature data that indicated an increases of this cytokine levels following MSG intake.

PE1. CHEMICAL COMPOSITION AND TEXTURE EVALUATION OF FOOD EMULSIONS

Sergiu PĂDUREȚ

*Faculty of Food Engineering, Stefan cel Mare University of Suceava, Suceava,
Romania*

Emulsions represent an important class of semisolid foodstuff; many food products exist as emulsions at some phase throughout production process. The emulsion can be defined as a mixture of two immiscible phases, one of the phases being dissipated as small round droplets in the other one. The emulsion samples analyzed in this research were represented by butter with different fat content. The butter's physicochemical parameters analyzed were as follows: moisture content, fat content and color parameters. For samples firmness measurements a texture analyzer was used (Mark 10 Corporation, ESM 301, USA) fitted with 100 N load cell. Also a gas chromatograph (Shimadzu Corporation) was used for fatty acids determination.

The fat content of analyzed samples ranged between 81.5% and 59.3% while the water content increased with the decrease of the fat content from 16.82% to 38.78%. The butter brightness varies from 89.50 to 95.15 the highest values being recorded by the samples with the lowest fat content. All a^* color parameters were in the negative part of the green – red axis with the values ranged between -7.33 and -6.41; instead the b^* color parameters are all in the positive part of the yellow–blue axis more towards yellow. The b^* color parameter varied from 19.28 to 31.42, the highest value being observed for butter samples with the highest fat content. Pearson correlation highlighted a positive correlation between fat content and samples firmness ($r = 0.883^*$) and also a negative correlation between moisture content and firmness ($r = 0.904^*$).

Both mechanical and color parameters of the analyzed samples were influenced by the fat and water content. A high fat content causes a high firmness, adhesiveness and a low cohesiveness.

Acknowledgement: *This work was supported by “DECIDE - Dezvoltare prin educație antreprenorială și cercetare inovativă doctorală și postdoctorală”, Cod proiect POCU/380/6/13/125031, proiect cofinanțat din Fondul Social European prin Programul Operațional Capital Uman 2014 – 2020”*

PE2. DESIGN AND CHARACTERIZATION OF AERATED CONFECTIONERY PRODUCTS

Raluca - Olimpia ZIMBRU and Sonia AMARIEI

*Faculty of Food Engineering, Stefan cel Mare University of Suceava, Suceava,
Romania*

The confectionery industry is a unique and diverse food sector, involving a wide range of ingredients and technologies to produce innovative and special sweet products. Generally, the desired structure of the bakery products and especially of confectionery ones depends on the aeration process. The purpose of this study was to develop new aerated confectionery products using different raw materials and techniques and also to characterize them in terms of chemical composition, porosity, texture properties and appearance. For chemical characterization of the confectionery samples the protein content, moisture, fat content, total acidity, water activity and the concentration of soluble substances were measured. The texture profile analysis is a double compression test which can quantify a large number of texture parameters in a single analysis and it was used for texture measurements of the design samples. The aeration process was performed by mechanical whipping with a planetary mixer.

One factor analysis of variance - ANOVA highlighted that the samples concentration of soluble substances express as ° Brix differ significantly ($p < 0.01$); the confectionery samples with vegetable cream showed the highest concentration of soluble substances (26.75). The fat content ranged between 14.50 % and 21.05 %, while the protein content was in the same range (10.40 - 9.55 %). The aeration process of confectionery products leads to a lower caloric intake by increasing the final volume of the product and by reducing the amount of ingested food. As regarding the texture parameters, the protein content influences the samples fracturability, while the air introduced into the product influences the samples hardness.

- [1]. J. H. Miah, A. Griffiths, R. McNeill, S. Halvorson, U. Schenker, N. D. Espinoza-Orias, J. Sadhukhan, *Journal of cleaner production* 177 (2018) 732-751.
- [2]. R.W. Hartel, H. Joachim, V. Elbe, R. Hofberger, *Confectionery science and technology* (2018) 536 pp, Springer Switzerland.
- [3]. B. Duquenne, B. Vergauwen, C. Capdepon, M. A. Boone, T. De Schryver, L. Van Hoorebeke, J. De Block, *Food hydrocolloids* 60 (2016) 317-323.

PE3. EVALUATION OF THE RHEOLOGICAL PROPERTIES OF THE DOUGH AND THE CHARACTERISTICS OF THE BREAD WITH THE ADDITION OF PURPLE POTATO

Sorina ROPCIUC, Mircea OROIAN, Ana LEAHU, and Cristina DAMIAN

Stefan cel Mare University, Faculty of Food Engineering, Suceava, Romania

The aim of this study was to determine the rheological characteristics of the dough at the addition of purple potato paste in different quantities (0-100 g). The wheat flour type 480 and 1250 were used. The rheological characteristics of the dough were determined with the help of Chopin Alveograph analyzing the tensile strength. The rheological measurements were made with the HAAKE RheoWin Mars 40 rheometer and the dough's visco-elastic modulus was analyzed at the frequency of 1-20Hz. The bread samples were analyzed in terms of volume, porosity, color, and texture. The textural parameters determined with the help of the texturometer were the elasticity, adhesiveness and stickiness of the bread crumb. It has been found that the addition of purple potato dough does not adversely alter the rheological properties of the dough. The elasticity and stickiness of the bread core increases with the increase of potato addition in the case of whole-grain flour. The color of the bread intensifies as the dose of purple potato paste increases.

PE4. OSMOTIC DEHYDRATION OF APPLE AND PEAR SLICES: COLOR AND CHEMICAL CHARACTERISTICS

Ana LEAHU, Cristina GHINEA, and Mircea-Adrian OROIAN

*Stefan cel Mare University of Suceava, Faculty of Food Engineering, 13
Universitatii Street, 720229 suceava, Romania
analeahu@fia.usv.ro*

Osmotic dehydration is the pre-treatment method of preservation the fruit and vegetable to increase its shelf-life in which these are immersed in concentrated salt or sugar solutions.

The effect of osmotic dehydration was investigated on the color and chemical characteristics of dehydrated fruits (apple and pear) in fructose osmotic solutions. Difference in CIE-LAB, chroma - C^* and hue angle H^* were performed with a Chroma Meter CR-400/410. Apple (*Malus domestica* 'Jonathan') and sweet autumn pear variety (*Pyrus comunis*) were osmotically dehydrated in three aqueous solution of fructose (40, 60 and 80%), during 3 h of process at temperatures of 20 °C, with fruit/osmotic agent ratio of 2:1. Water loss and solids gain showed significant differences depending on the concentration of the osmotic agent and process time. The use of highly concentrated osmotic solutions induced losses of phenolic content (TPC) and ascorbic acid in sliced apple and pears. Fructose concentration and osmosis time induce significant increase of a^* and b^* colorimetric parameters but did not affect the lightness (L^*) of pear slices.

PE5. LIFE CYCLE ASSESSMENT OF FERMENTED MILK: YOGURT PRODUCTION

Cristina GHINEA and Ana LEAHU

*Stefan cel Mare University of Suceava, Faculty of Food Engineering, 13
Universitatii Street, 720229 Suceava, Romania
cristina.ghinea@fia.usv.ro*

Yogurt is a fermented milk product, resulted through milk acidification by lactic acid bacteria, highly appreciated worldwide. In this study, life cycle assessment (LCA) methodology was applied for modelling of environmental impacts associated with yogurt production. The system boundaries include the following activities: milk processing, transport, solid waste and wastewater treatments. Functional unit set for this study is 1 kg of produced yogurt. The input and output data were collected from various sources like reports, databases, legislation and others. All these data were used further in the impact assessment stage performed with GaBi software which includes LCA methods like CML2001 -Jan. 2016, ReCiPe 1.08, UBP 2013, EDIP 2003 and others. Results showed that the global warming potential (GWP) determined for yogurt was 2.92 kg CO₂ eq. per kg of yogurt, while acidification potential (AP) was approximately 0.014 kg SO₂ eq. per kg of yogurt. It was observed that the main contributor to all impact categories is consumption of electricity during the yogurt production, mainly in the pasteurization, evaporation and cooling stages. 61.4% of the emissions resulted from transportation of raw materials contributes to GWP, while 38.3% to photochemical ozone creation potential (POCP). Emissions from wastewater treatment are contributing especially to the eutrophication potential (EP), while emissions from solid waste landfilling are contributing mainly to POCP.

PE6. PRODUCTION OF BETA GLUCAN FROM SPENT BREWER'S YEAST

Ionuț AVRĂMIA

Faculty of Food Engineering, Ștefan cel Mare University of Suceava, Romania

Yeast cells (*Saccharomyces cerevisiae*) have been widely used in many branches of industry, not only in baking and alcohol production. Interest in yeasts has gradually increased with the possibility of being used as a source of nutrients, functional foods with potential biological activities or in bioremediation.

In the beer industry for example, yeast *Saccharomyces cerevisiae* exhibit a finite replicative lifespan after which, due to a high amount of polysaccharides, amino acids, polyphenols, and mineral compounds they can be reused in obtaining new valuable compounds. World-wide spent yeast is still underutilized, a significant amount of yeast are mostly used for swine and ruminant feed. Only in the brewery about 2.1 million tons/year of spent yeast could represent an alternative source of bioactive compounds such as beta glucan, a β -1,3/1,6 polysaccharide found in the yeast cell wall.

On this basis, for this study spent yeast slurry from brewery with an 18% solid content was subjected to extraction in order to obtain β -glucans. After the autolysis by endogenous enzymes a further alkaline acid treatment was applied to break the cell wall, followed by successive washings for isolation and characterization the water insoluble glucan.

Acknowledgements: *This work was supported by “DECIDE - Dezvoltare prin educație antreprenorială și cercetare inovativă doctorală și postdoctorală”, Cod proiect POCU/380/6/13/125031, proiect cofinanțat din Fondul Social European prin Programul Operațional Capital Uman 2014 – 2020”*

- [1]. J. Bai, Y. Ren, Y. Li, M. Fan, H. Qian, L. Wang, G. Wu, H. Zhang, X. Qi, M. Xu, Z. Rao, Physiological functionalities and mechanisms of β -glucans, Trends in Food Science & Technology.88 (2019) 57-66.
- [2]. I.M.P.L.V.O. Ferreira, O. Pinho, E. Vieira, J. G. Tavarela, Brewer's *Saccharomyces* yeast biomass: characteristics and potential applications, Trends in Food Science & Technology 21 (2010) 77-84.
- [3]. X. Y. Liu, Q. Wang, S.W. Cui, H.Z. Liu, A new isolation method of β -D-glucans from spent yeast *Saccharomyces cerevisiae*, Food Hydrocolloids 22 (2008) 239-247.

PE7. THE CORRELATION BETWEEN QUALITY PARAMETERS AND MINERAL CONTENT OF FRUIT JUICES

Simona DOBRINAS, Alina SOCEANU, Nicoleta MATEI, Viorica
POPESCU, and Andreea GRIGORAS

*Ovidius University, Department of Chemistry and Chemical Engineering, 124
 Mamaia Blvd, Constantza 900527, Romania*

Fruit juices are a rich source of nutrients and valuable components [1-2]. The aim of this study was to investigate the quality parameters such as total acidity, vitamin C, total phenolic compounds, total nitrogen, protein content, Brix index, free CO₂, carbohydrates from fruit pulp, fresh juice and different brands representative for the Romanian market of orange, lemon, grapefruit, kiwi, apple and pear juices. It was also studied the content of iron, copper and chromium in order to calculate Pearson correlation coefficients. The highest amounts of total phenolic compounds, respectively total nitrogen and carbohydrates were detected in grapefruit fresh juice. The results showed that correlations for all the studied fruit juices samples between total phenolic compounds, respectively protein content and mineral content are positive. The total phenolic content is closely correlated with iron ($r = 0.9428$) and copper ($r = 0.9873$) for all of juices samples. A significant correlation was statistically observed between the total phenolic content and the concentration of copper ($p = 0.01 < 0.05$). No significant correlation was observed in the case of chromium (Pearson coefficient is negative in all cases). Also, no correlation was observed in the case of vitamin C. Consequently, the correlations of total polyphenols and protein content with mineral content suggested the influence of these compounds on mineral bioavailability.

- [1]. M. Navarro-Pascual-Ahuir, M. Jesús Lerma-García, E. F. Simó-Alfonso, J. M. Herrero-Martínez, *Food Chemistry* 188 (2015) 596-603
- [2]. Z. Derakhshana, M. Ferranted, M. Tadie, F. Ansarie, A. Heydarif, M. Sadat Hosseinig, G. Oliveri Contid, E. Khalili Sadrabadf, *Food and Chemical Toxicology* 114 (2018) 108-111

PE8. QUALITY CONTROL OF WHITE AND ROSÉ WINES

Nicoleta MATEI, Alina SOCEANU, Simona DOBRINAS, and Viorica POPESCU

Ovidius University, Department of Chemistry and Chemical Engineering, 124 Mamaia Blvd, Constantza 900527, Romania

Physico-chemical analyzes are a valuable tool in knowing the composition of grapes, must and wine in different stages, but also of the finished wine subject to bottling. One of the parameters, volatile acidity analysis was probably the first measure of wine quality and is routinely used as an indicator of wine spoilage. The sulphur dioxide was indispensable in winemaking due to conservation properties and the alcohol concentration acting as antiseptic for yeasts, reducing the total acidity and contributing to the wine bouquet [1,2]. The aim of this study was to investigate the quality parameters such as: pH, volatile acidity (VA), total acidity (AT), sulphur dioxide (SO₂) and alcohol concentration (CA) for white and rosé wines and one of homemade rosé wine. The GlassChem oenological system was used to determine SO₂, VA and CA. AT was determined by acid-base titration and the pH was measured with a pH220 pH-meter from Extech Instruments. VA and AT were maximum for the home-made rosé wine. For the white wines the pH values ranged between 2 and 2.7 and between 3 and 3.5 for the rosé wines, respectively. Physico-chemical parameters studied for white and rosé wines were within the maximum limits allowed by the actual legislation, except for one white wine, whose sulphur dioxide content exceeds the maximum limit allowed. Volatile acidity value obtained for homemade rose wine exceeds the permitted limit.

[1]. A. Criscuoli, N. Frison, E. Drioli, Separation and Purification Technology 215 (2019) 384–389

[2]. S. S.M.P. Vidigal, A. O.S.S. Rangel, Talanta 168 (2017) 313-319