



# **International Conference on Science, Technology, Engineering and Economy ICOSTEE 2018**

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# Preface

It is our great pleasure to welcome you at the International Conference on Science, Technology, Engineering and Economy (ICOSTEE) which provides a personal communication forum for researchers, industry representatives and students. This event is a continuation in tradition of the formerly biannual International Conference on Science and Technique Based on Applied and Fundamental Research (ICOSTAF).

Topics of lectures and poster presentations are on varied topics, within the fields of machinery, measurement techniques, economics, logistics, environmental science, food science, industrial development, marketing, management, and waste utilization.

We hope that the participants have effort to share and present their scientific results and experiences to colleagues and also to young generation. One of our main aims is to build bridges for future joint projects and establish new friendships.

This conference is organized as a low-cost event in order to enable the participation of young researcher from Hungary and other countries. However, this would not be possible without the support of the Faculty of Engineering and industrial sponsors.

Specially thanks for the *Analecta Technica Szegedinensia*; *Annals of Faculty of Engineering Hunedoara - International Journal of Engineering*, and other partner journals which offer publication possibility of selected conference papers.

We are pleased to provide the participants the ICOSTEE Book of Abstracts which includes hard copy of one-page abstracts and further information regarding the conference, the city of Szeged, and the University of Szeged.

We appreciate participation and enthusiasm of all authors, oral lecturers and poster presenters.

On the behalf of ICOSTEE 2018 committees we would like to wish you a successful and stimulating day.

István Bíró  
*President of the Conference*

József Gál  
*Head of Conference Coordination*

Sándor Beszédes  
*Head of Organizing Committee*



# **LECTURES**

# THE PHYSIOLOGICAL EFFECTS OF FISH CONSUMPTION. WHY SHOULD WE CONSUME FISH ON A REGULAR BASIS?

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## **Abstract**

A survey last year examined the connection of nutrition attitudes and fish consumption, from which it turns out that several factors influence our meals, which are for example price or lack of information regarding healthy way of life. Fish contains nutrients which are essential for our organism, vitamins (for example: A; B<sub>1</sub>; B<sub>2</sub>; D), minerals and various unsaturated and polyunsaturated fatty acids (for example: Omega 3 fatty acid). The latest cannot be produced by our organism, but indispensable to its normal operation. There is literature on its various effects on the brain, immune system, and it is widely known that it plays a significant role in preventing cardiovascular diseases, since due to its anti-inflammatory effect it is able to cure inflammations on the vascular walls. Omega 3 fatty acids appear mainly in marine phytoplanktons and in sea fish in large quantity. In Hungary freshwater fish contain much less Omega 3 fatty acid, but according to experts they are competitive with sea fish in every type of vitamins, minerals and other nutrients. The healthiest fish in Hungary is bighead carp, but sterlet is also often mentioned due to its beneficial effect. We can see that our organism would need regular fish consumption. In our days we can choose from various fish types and the scale of processed fish products is wide enough, too. If somebody still cannot find the appropriate to their taste, or does not like fish either because of the fish bones or because of its odour, they should take Omega 3 products. It is important to buy such a product in pharmacy, since in drugstores we can often find variants with inadequate active substance content. Researches show that one should take 1 gram of Omega 3 fatty acid on a daily basis. Experts state that fish is one of the indispensable conditions of a healthy diet, so we should consume fish twice a week. Despite the fact that fish is delicious and healthy, it is not part of our everyday menu. The ideal consumption of oily fish would be more than 15 kg/capita/year, but in Hungary this is hardly 4 kg/capita/year. This value should be surely improved—this is fostered by VAT modified to 5% and other subsidies, too.

*Key words: fish consumption, health, way of life, Omega 3 fatty acid*



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# ECONOMY OF FISH CONSUMPTION WITH PARTICULAR ATTENTION TO THE VAT-REDUCTION IN YEAR 2018

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## Abstract

“The VAT-reduction to 5% on fish for consumption in January 2018 may foster fish consumption, since fish becomes more accessible, so demand for it is expected to increase.” The statement above was formulated during a former research of ours. Continuing our work, our specific aim is to assess the effect and result of the modified VAT. Following the European recommendation, we should consume fish at least twice a week, reducing with this the occurrence of the cardiovascular diseases, as well as promoting a healthy lifestyle. On the basis of our former survey, the price of fish appeared as an obstacle of this—both for live and for processed fish. Consuming 300 gram fish per week would be ideal. This would mean more than 15 kg of oily fish a year per capita. In contrast, the domestic fish consumption is hardly 4 kg/capita/year. In Hungary 60% of fish consumption comes from domestic freshwater fish, and about 40% comes from sea fish and from other marine species. Due to VAT-reduction, sales volume of particular affected fish has grown by more than 80% compared to the same period last year. Nevertheless seasonality in fish consumption has not changed, which was experienced during our research last year, too. The reduced VAT did not bring change in the seasonality of consumption. It can be observed that the season of freshwater fish begins in September—which is not surprising, since several types of fish can be bought in larger quantity this time. Larger supermarket chains were counting on a 15-20% sales growth due to the VAT-reduction, but in the long run they were unable to ensure this 22% price advantage (which was enabled by the VAT-reduction from 27% to 5%) to their consumers. They justify this with unfavourable weather and the weakening of HUF. These two factors would surely influence the price of fish for consumption. The support of European Maritime and Fisheries Fund with the domestic down payment foster the development of fisheries management, modernizing the Hungarian fish production and domestic fish processing as well as the marketing popularizing fish consumption within the frame of 2014-2020 Hungarian Fisheries Operational Program [MAHOP]. Time is still needed for the emergence of harmony between demand and supply, as well as for the stabilization of the market circumstances—but these steps would support fish consumption.

*Key words: fish, VAT, seasonality, supermarket chains*



*Eszter Ács is supported by the UNKP-18-1-I-SZTE-1 New National Excellence Program of the Ministry of Human Capacities.*

# THE DEVELOPMENT OF FLY ASH – RED MUD BASED GEOPOLYMER

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## Abstract

Taking into account environmental considerations, such as decreasing CO<sub>2</sub> emission and the ecological footprint, the utilisation of secondary raw materials is essential for sustainable development. Fly ash is the product of coal combustion plants that is collected by various air cleaning equipment from flue gas, and red mud is the by-product of the Bayer-process, through which alumina can be produced from bauxite. Geopolymerisation is a process that is suitable for the utilisation of such wastes to produce ceramics, cement, concrete etc. with many advantageous properties.

The main objective of the article is to present data on the development and examination of geopolymer made out of deposited fly ash from Tatabánya and red mud from Almásfüzitő.

During the experiments, red mud was added to previously optimised fly ash geopolymer in various quantities and compressive strength tests were carried out to determine the optimal fly ash and red mud ratio. However, as the cracking of the specimens could be observed, further tests were carried out on the durability of the geopolymers. The effect of the sealing conditions and RM calcination was investigated, both via visual inspection and with FT-IR analysis at the ages of 3, 7, 14, 28 and 90 days.

Based on the results, it could be concluded that the sealing conditions have direct effect on the structural characteristics of fly ash – red mud based geopolymers, but further experiments should be carried out for the identification of the ongoing reactions.

*Key words: geopolymer, fly ash, FT-IR, red mud*

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# COLOUR CHANGES ANALYSIS OF ALGAE POPULATIONS ON RGB COLOUR MODEL SCALE

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## **Abstract**

One of the biggest issue in our time, that we don't use our sources sustainable, there is not enough caring of recycling, and our natural elements reducing, and it is wasted by humanity. However, there are many aspirations, but some of them is not developed enough to achieve the level of our age. We can feel the tension between developed and developing countries, and while there are many differences is mentality, there are many similarities as well. Either sides don't really make that effort, or investments, they blame the other side, they expect the solution from anybody, but themselves.

Recycling the water, by return it to original surfaces in condition that is harmless to the biosphere is the main purpose ow wastewater treatment. There are many differences like communal (residential) wastewater, or industrial wastewater, but the demand is the same to a sewage plant, treat the loaded water from components, that risks any biological or chemical hazards.

While developing and developed countries are not located on the same level in technology or education, the needs, the requirements are the same. Safely and simply operating treatment plant, with the efficiency, that causes no pollution, to the environment, leaves small biologic footprint as much as possible, with low operating costs.

The 21th century brought brand new technologies in communication, and data transmission, and these technologies need to implant to environmental technologies as well. Monitoring a facility, and gain reliable data is not an easy task, which gains more difficulties by the difference of the education level of developing countries. To gain data for a wastewater treatment plant, has its own difficulties, it must to measure properly the fluctuation of components, while the sensitive irritable sensors must be cleaned hourly, risking the damage. These incidental mistakes can cause inaccuracies, and this way the efficiency of a treatment plant reduce.

The selective color measuring is a well-tried technology in remote sensing, different wavelengths has different meanings, and can be transformed to usable data. While the optical sensors developed in the last two decades, the idea came up, to implant it the wastewater treatment, as an optical measuring.

We used algae populations as indicators for well-known pollutants, focused on components that can evoke eutrophication. We used professional and general devices, two measure colors, and compare them, and tried to gain usable data using mainly RGB coding.

*Keywords: color measuring, wastewater, RGB*

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# ADSORPTION OF AMMONIUM USING POMEGRANATE PEEL AS LOW-COST ADSORBENT

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## **Abstract**

Ammonia nitrogen (NH<sub>3</sub> - N) is one of the common and toxic species of nitrogen and excess amount in waterway causes eutrophication, decreased in dissolved oxygen and toxic to aquatic organisms. This one of the major global environmental problem may originate from diverse sources such as industry waste, agricultural runoff and landfill leachate. According to the European Union legislations; the maximum limit for nitrogen compounds discharged onto waterways is between 10 and 30 mg/L.

In this work, adsorption was investigated which is one of the best ammonium removal methods. Recently a great efforts have been made to identify new low-cost and efficient adsorbent from agricultural waste and by-products because of their abundant availability, low-cost and eco-friendly advantages. Furthermore they could offer the possibility to recycle ammonium back for agricultural purposes.

Pomegranate peel (PP) is an agricultural waste worldwide available in large amounts, and previous research proves this adsorbent can removed variety of pollutant from wastewater such as heavy metals and dyes. However, available information on the ammonium adsorption by (PP) still missing.

The main purpose of this study was to investigate the potential of pomegranate peel (PP) for the removal of ammonium ions from aqueous solution through the determination of zeta potential, iodine number and surface active sites of raw (PP). Series of batch adsorption experiments in NH<sub>4</sub>Cl solution was designed to determine the impact of various parameters such as pH, contact time, agitation speed, adsorbent (particle size and dose) and adsorbate concentration in the adsorption process and therefore modelling the adsorption isotherm and kinetics. A comparison of adsorption capacity between unmodified and chemically modified PP with sodium hydroxide (NaOH) and potassium hydroxide (KOH) is also reported in this study.

*Key words: Pomegranate peel, Ammonium adsorption, Agricultural waste, low-cost adsorbent.*

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# SPECIAL NUMERICAL METHOD TO DETERMINE THE ELASTIC CURVE OF SUPPORTED BEAMS OF VARIABLE CROSS-SECTION

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## **Abstract**

In the lecture a new numerical method to determine the elastic curve of the simply supported beams of variable cross-section is demonstrated. In general case it needs to solve strong nonlinear second order differential equations with prescribed boundary conditions. For numerical solution the initial values of the slope and the deflection of the end cross-section of the beam is necessary. For obtaining the initial values a lively procedure is developed: it is a special application of the shooting method because boundary value problems can be transformed into initial value problems. As a result of these transformations the initial values of the differential equations are obtained with high accuracy. Procedure is applied for calculating of elastic curve of a simply supported beam of variable cross-section. Results of this numerical procedure, analytical solution of the linearized version and finite element method are compared. It is proved that the suggested procedure yields technically accurate results.

*Key words: elastic curve, simply supported beams of variable cross-section, initial guess for slope and deflection*

# A SOAP BUBBLE ANALOGY FOR MERGERS AND ACQUISITIONS

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## **Abstract**

Analogy as one of the most important forms of human thought is an important means of knowledge of the world and commonly accepted method of scientific research. In this paper analogy as a method was applied to bubbles as a model to describe mergers and acquisitions life span. Mergers and acquisitions (M&A) are transactions in which the ownership of companies, other business organizations, or their operating units are transferred or consolidated with other entities. In these processes there are a lot of elements which influence to the behavior of established connections. These elements are sometimes difficult to describe, therefore any approach including analogy is welcome. This analogy directs us to the field of natural sciences, explaining the processes of emergence, survival and bursting bubbles on the one hand. On the other hand, they are symbolic representatives of organizational processes and changes in the management of new business combinations, representing new approach applying physical and chemical phenomena in the field of economics. Following these principles and identifying analogies with M&A, we provide signposts according to physical parameters of soap bubbles, such as surface tension / internal pressure, viscosity, gravity, diffusivity, humidity, elasticity, density of the dispersed phase, deformity and bursting of bubbles in a turbulent flow in order to determine their effects and analogies with business alliances such as M&A.

*Key words: mergers and acquisitions (M&A), analogy, soap bubbles*



# COMPOSITION AND CERTAIN PROPERTIES OF GOAT'S MILK FROM SMALL FARMS IN SOUTH HUNGARY

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## **Abstract**

The most of milk products processed from cow's milk in Hungary, but the interest for goat milk products shows an increasing trend in Hungary. The background of goat breeding is well-known, but more and more data are needed for the successful breeding. Only a few bigger goat farm exist in Hungary, so there are many farmers made milk products at their own farm. Small goat farms can be characterized with extensive breeding, resulting low daily milk yield, which hampers the development of goat breeding and higher income. That's why the investigation of milking goat breeding is essential nowadays.

Pointing to this situation, we evaluated the data of goat's milk samples from a Hungarian White goat flock and a crossbred Hungarian native (mixed) goat flocks bred with extensive condition. The trend of changes in the amount and the composition of goat's milk during lactation partly met the expectations. The lactation mean of fat-, protein content and fat/protein ratio of Hungarian White goat's milk were 4.09%, 3.82% and 1.11, while in milk from mixed flock 5.04%, 3.41% and 1.41. Surprisingly, comparing own data to milking goats' data in literature, we determined low level of lactation milk yields per capita in both of flocks, 254.4 litres and 317.3 litres in case of Hungarian White and of mixed flock. This may be caused by the lacks of feeding, weather conditions and the different milking frequency. Smaller fluctuation was explored in the purchased milk data from dairy plant. Nevertheless, fat content of cow's milk was the highest, 4.35% in February, while protein content in December, 3.56% and the values of total solids followed the usual trend. However, we measured higher lactose values as usual. The average of density, viscosity (at 15°C) and freezing point of all milk samples were 1.0287 g/cm<sup>3</sup>, 2.804 mPas and -0.5509 °C.

*Key words: goat's milk composition, density, freezing point, viscosity.*

# DETECTION PROCEDURES FOR SHAFT MISALIGNMENT DETECTION: AN OVERVIEW

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## **Abstract**

There are three different types of shaft misalignment: (i) shaft angular misalignment in which shaft centrelines intersect, (ii) shaft parallel misalignment in which shaft centrelines are parallel and (iii) a combined angular/parallel misalignment. Various procedures of misalignment detection are developed: analytical and experimental.

The coupled rotor system is modelled using Timoshenko beam and dynamics of the shaft system is investigated. Recently, the nonlinear damping and stiffness properties are also included and the presence of superharmonic components is presented. Along with lateral vibrations, axial and torsional vibrations are mathematically described and nature of the vibration response for the case of misalignment is examined. Variety of techniques are utilized harmonic analysis: Fourier transformation, the least square technique, non parametric and parametric methods, harmonic balance method, wavelet analysis, artificial neural network, fuzzy logic, support vector machines, improved discrete Fourier transformation etc. Diagnostic features in the fast Fourier transform (FFT) of vibration response related to the type of misalignment have been revealed. A programme for dynamic of systems of bodies MSC.ADAMS is developed where the Fourier transformation in frequency spectrums was applied for detection of symptoms of failure in misalignment of rotating machines.

Based on theoretical consideration measuring procedures for misalignment detection are developed. The simplest and more traditional detection method is the vibration measuring. Based on the fast Fourier transformation it is concluded that the misalignment gives the peak for 2X frequency of vibration. One of the procedures is the shock pulse measurement. Acoustic emission technique can be used as a reliable technique for misalignment detection, providing enhancements over vibration analysis. The shaft misalignments can be detected by temperature monitoring. The early detection of shaft misalignment is obtained by measuring of temperature of couplings using thermal imaging camera or by thermography inspection. Measuring and estimating the torque with torque sensors available the misalignment fault detection. Recent measurement system comprises the laser light source for misalignment detection. Using the laser interferometer and the signal encoder the signal of misalignment is obtained. Finally, the monitoring of shaft misalignment is possible with a non-contact laser.

*Key words: shaft misalignment, fault detection, measuring procedures.*

## SOME ASPECTS REGARDING QUALITY MANAGEMENT SYSTEMS (QMS) DEVELOPMENT WITHIN SMES IN ROMANIA

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### **Abstract**

The paper includes a study on the stage of certification of Quality Management Systems in Small and Medium Enterprises (SMEs) in Romania, according to ISO quality standards. The main objective of the research was to provide valid information and evidence on the dynamics of this process over the last 9 years in SMEs with different fields of activity as well as the socio - economic impact of the implementation, certification and maintenance of Quality Management Systems by evaluating the value added by the implementation and certification of management systems for organizations that have implemented SMC and have been certified with management systems according to ISO standards

Starting from the main objective, we have chosen as a method of research, Multicriteria Analysis (AM), a method that allows both the use of quantitative criteria (ex plus value through economic indicators) and qualitative (ex. impact of SMC implementation and certification on the environment).

Starting from the main objective, we have chosen as a method of research, Multicriteria Analysis (AM), a method that allows both the use of quantitative criteria (eg plus value through economic indicators) and qualitative (eg impact of SMC implementation and certification on the environment).

The conclusion we have reached is that in companies where the implementation of a management system has reached its level of maturity, at about 3-4 years after implementation, the level at which the positive effects of the quality management system are felt, the management Peak was pleased and wanted to keep certification both on the quality standard and on other standards.

*Key words: quality management, SMEs, multicriteria analysis*

# STUDYING THE POSSIBILITY OF PROVIDING THE THERMAL REQUIREMENTS OF PASTEURIZATION BY PV/T SOLAR SYSTEM IN HUNGARY

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## **Abstract**

The food industry is one of the fastest growing in the world, especially in the developing countries. At the same time, all the countries of the world are facing challenges to the continuity of energy supply and the impact of traditional energies on the environment and human health. These countries have renewable energies that can serve as a main or auxiliary source of energy. Especially for small enterprises such as milk pasteurization farm.

The pasteurization process can be defined as the heat treatment necessary to kill or weaken pathogens within a human-consumed beverage such as milk, juice or water.

The use of renewable energy in our world today is common, given that it is available everywhere and in different forms, but within the industrial and production sector to a lesser degree depending on the many challenges and problems that bind these two together. The most prominent of these problems is first, the lack of a reference system for hybridizing industrial food needs which are fluctuating daily or annually with available renewable energy and second, calculating or measuring the Thermal utilization rate of renewable energy in the industry.

Using the PV panels can make the big part as a loss heat, so the solar energy combined panels PV/T can provide us both thermal and electrical need of an assumed plant.

In this paper, we will study the thermal utilization of PV/T solar energy system with pasteurizer device to ensure the thermal and electrical requirements of this system provided from a solar energy under the climate of Hungary.

*Key words: solar energy, PV/T, food industry, pasteurization*

# LOGISTICS IN CITIES: SKYLINES

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## **Abstract**

Simulations and computer games have been used as a teaching method for a long time. They model a section of reality to give a comprehensive, simplified but sufficient view of a problem or situation. They also give the possibility to see the results of decision-making in real time.

Cities: Skylines city-building game was released in March 2015 and several expansion packs (e.g. Mass Transit DLC, Snowfall DLC and Green Cities DLC) were released since then. Many user-made modifications have also become available since the release of the game (e.g. traffic managers) to further improve the user experience. Cities: Skylines is a single-player game, where the player acts as a mayor of the city under development. The game is an interesting example that has many well-thought ideas on city planning. The game comes up with a feeling of a real functioning city with many different aspects well simulated. The strengths of the game include the modelling of (1) citizens and their movement, (2) the traffic system and transportation, (3) the public services and service accessibility.

The aim of the game is to build a city and maximize the number of its inhabitants or solve a scenario (e.g. bad traffic situation) without exceeding the available city budget generated by taxes. This can be achieved by creating residential, commercial and industrial zones (with water and sewage pipes, power lines, etc.) and connecting these with different types of roads and railways which can lead even outside the city boundaries. Citywide bus, tram, subway, monorail lines and taxi stations or even cable car and ferry lines can be created to connect different areas of the city. Buildings for education, police, fire service and healthcare also have to be built. The development and maintenance of this infrastructure has to be financed from the city budget.

The citizens commute to work, to shopping or attend recreation activities using different means of transportation. Heavy traffic can be banned from residential areas, citizens can be encouraged to use bicycles or electronic cars to prevent air pollution.

Every type of transportation and city service has its own budget. Public transportation may have a separate day and night time budget if the player finds this necessary. The number of public service vehicles can be adjusted on every single line based on the number of citizens waiting at the stops or by looking at the number of the travellers on the vehicles. User made mods allow the gamers to set the maximum speed on roads, or adjust the lane directions at the crossings.

If the user has an adequate graphics card in the computer, the city can not only be viewed from above, but every single vehicle (or citizen) can be selected and can be followed on ground level in 3D.

Of course Cities: Skylines is a game with a simplified model of reality, but it is suitable to give an insight into the planning of a city including its logistics.

*Key words: simulation games, logistics, Cities: Skylines*

# MICROWAVE ENHANCED ENZYMATIC BIODEGRADABILITY OF CELLULOSIC BIOMASS

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## Abstract

In the process of bioethanol production, the enzymatic degradation of lignocellulosic biomass presents an effective and eco-friendly alternative to conventional methods, however, due to the rigid molecular structure of the cellulose fibers, the enzymatic hydrolysis usually requires one or more pre-treatment steps. Based on several scientific researches, physicochemical pre-treatment methods – such as microwave/ultrasound irradiation; alkaline/acid fracturing – represent a promising direction to increase the efficiency of cellulose degradation when combined with a subsequent, enzyme-based hydrolytic step.

The aim of our research was to investigate the enzymatic biodegradation of lignocellulose-containing biomass, and the effects of standalone and alkaline/acid-combined microwave irradiation on the process of the hydrolysis. Mixture of different parts of by-product tobacco plants in an aqueous suspension of 10 (m/m)% were used for the experiments. Microwave irradiation was applied at two different levels of energy that corresponds to energy density values of 9 kJ/g<sub>DM</sub> and 4.5 kJ/g<sub>DM</sub>, each with a power intensity of 250W and 500W as well. For the acid- and alkaline-combined MW pre-treatments the pH was set to pH=2.0 and pH=11.0, respectively. The 60-hours-long enzymatic hydrolysis which followed the pre-treatment steps was carried out with using a mixture of two different enzymes: cellulase from *Trichoderma reesei* and cellobiase from *Aspergillus niger* with a specific activity of 700 U/g and 250 U/g, respectively. Control samples did not come through any pre-treatment processes before the biodegradation. The reducing sugar (RS) content – the end-product of the cellulolysis – was measured with DNSA-based spectrophotometric method.

Our results revealed that even the standalone MW irradiation could increase the final end-product concentration compared to the control samples, and the highest RS concentration could be achieved when the MW operational parameters were set to 500W and 3 minutes (cf. 72±3 mg/g<sub>DM</sub> vs. 44±2 mg/g<sub>DM</sub>). When applying an acidic medium to the samples, the final RS yield was maximum when MW irradiation was applied at 500W and lasted for 3 minutes, resulting in 112±6 mg/g<sub>DM</sub> final RS concentration, however when setting the pH to alkaline range (pH=11), using a lower (250W) power intensity was more effective – with a 250W and 3 minutes-long MW treatment, the final end-product content at the end of the hydrolytic process was almost 160 mg/g<sub>DM</sub>, which indicates a nearly fourfold increment, compared to the control samples.

*Key words: microwave, lignocellulose, biomass, pre-treatment*

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# THE CONCEPT OF VALUE CREATION IN BLUE OCEAN STRATEGY AND LEAN MANAGEMENT

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## **Abstract**

The basic purpose of every business is to meet the needs of customers by gaining profits. At the same time, there is growing competition between companies in the various markets for the acquisition of buyers, which necessitates a higher level of customer satisfaction. The question arises: how can businesses increase their customer value and how an enterprise can offer products or services to consumers that they are more willing to pay than competing goods. The lecture seeks answers to the above questions by examining two management and organizational approaches, ways of thinking and philosophy, focusing on customer value creation.

The analysis focuses on the core elements of the Blue Ocean strategy and the strategic aspect of lean management. The concept, principles and key tools of customer value creation will be presented for both approaches and we will attempt to explore synergic opportunities of linking Blue Ocean Strategy and Lean Management. The most important result of the lecture is to outline how the two types of professional thinking and methodology can complement each other, how can integrate them to further increase customer value, thus contributing to the successful, efficient and sustainable operation of businesses.

*Key words: customer value, value innovation, value creation*

# MYCOREMEDIATION - BIOTECHNOLOGICAL AND ENVIRONMENTAL ASPECTS FOR SAFETY OF HUMANS AND ANIMALS

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## **Abstract**

Civilizational development causes increasing contamination with heavy metals, which leads to increased environmental pollution and accumulation such metals in food chains, posing a threat to the health and safety of humans and animals. Furthermore, commonly used active pharmaceutical ingredients (APIs) and their degradation products ending up in environment are currently a global problem. The elimination of pollution can be achieved by remediation through fungi, 'mycoremediation', which is a biological tool using the ability of mushrooms to degrade a wide variety of environmental pollutants e.g. APIs and to bind with toxic heavy metals present in the environment. Mycoremediation is a branch of biotechnology focuses mainly on the assessment of biodegradation capacity of different groups of mushrooms and enhancement their detoxification activity.

The main areas of our interest concentrate on the assessment of ability of mushroom-based remediation to accumulate and degrade cephalosporin antibiotics, azole antifungals and steroid hormones (testosterone and 17 $\alpha$ -ethynylestradiol). Selected drug classes are widely used as active ingredients in pharmaceuticals, moreover, previous studies indicate their presence in sewage or surface water. In the case of azole antifungals, it is worth to highlight their widespread usage in topical preparations, and consequently their release unchanged to the environment as well as their subsequent persistence in environment. In all cases, the tested drugs were not detected at all or were detected in a lower amount in separated culture media, and therefore the usage of mycoremediation to remove them could be considered. The key stage of the research was the identification of presumable degradation products of the investigated APIs and their transformation pathways using LC/MS/MS. The potential of biomass from *in vitro* cultures of selected edible mushroom species, such as *Laetiporus sulphureus* (*Polyporaceae*), *Agaricus bisporus* (*Agaricaceae*) and *Imleria badia* (*Boletaceae*) in terms of the ability to accumulate Cd(II) and Pb(II) was also examined. The results confirm the possibility of using the tested mycelia from *in vitro* cultures, particularly the *L. sulphureus* species, in remediation.

Due to the high uptake capacity, efficiency, low cost and safety, mycoremediation is now becoming increasingly popular technique for removing pollutants. However, further efforts are needed to better understand a metabolic and enzymatic degradation of the drugs by mushrooms in order to increase the efficiency of mycoremediation process.

*Key words: mycoremediation, edible mushrooms, in vitro cultures*



# ANALYSIS OF THE HUNGARIAN AGRICULTURAL MARKETING – BY THE SUPPLY OF LOCAL PRODUCTS’ CONSUMERS

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## **Abstract**

Nowadays marketing is the basic for all enterprises, it is important and fundamental activity. We can talk about the industry, the service sector or the agriculture. The income of the company is determined by sales of the produced wealth, their methods and their tools. In our days the marketing management has more effective significance, because of the global market and the vigorous competition.

The term agricultural marketing is composed of two words-agriculture and marketing. Agriculture, we can think about the soil, the forests, the sea, so it includes all the primary activities of production systems in relation to animal, plant, food production. But, generally, it is used to mean growing and/or raising crops and livestock. The study of agricultural marketing comprises all the operations, and the agencies conducting them, involved in the movement of farm-produced foods, raw materials and their derivatives, such as textiles, from the farms to the final consumers, and the effects of such operations on farmers, middlemen and consumers.

In our primer research a questionnaire was made by us. The topic of the questionnaire was the consumption of these local products and the knowledge about the common agricultural marketing. The main group of our research was the graduated people, we think, they have more information and income, so they attitude is positive for these products. Finally the questionnaire was answered by 220 persons – from all part of the country. The data analysis and diagrams were made by the Microsoft Office Excel 2010 program.

We have known, the most of the participants had heard about the agricultural marketing, but the main institute, AMC not yet. The AMC programs are not too famous by them, but the other, similar festivals are prominent. The most important motivations of the shopping are: quality, using of local raw material and the healthy lifestyle. The problems with the local products – in the opinion of the participants are: higher price, less choice, no too comfortable shopping.

*Key words: agricultural marketing, questionnaire, local products,*

# RANKING HUNGARIAN RESEARCHERS USING H INDEX AND TOTAL NUMBER OF CITATIONS

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## Abstract

In this paper, using the h-index and the total number of citations, the best 100 Hungarian researchers from several disciplines is ranked. The list may be formed based on the h-index and the total number of citations, given in Web of Science, Scopus, Publish or Perish Program and Google Scholar database.

Data for the first 100 researchers from Hungary are presented. Google Scholar is the most complete. Therefore, to define a single indicator, h-index calculated by Google Scholar may be a good and simple one. The author chooses the Google Scholar database as it is the broadest one.

*Key words: Ranking Hungarian researchers, h-index, total number of citations, Google Scholar database*

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# TRENDS OF FOOD CONSUMPTION FOR HEALTH CONSCIOUS LIFESTYLE

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## Abstract

In our fast-paced world the eating habits of people are constantly changing. New trends are emerging and people begin to follow those whether they want or not. One of these trends is health-conscious nutrition associated with a healthy lifestyle. Tompa (2008) stated that a healthy eating of consuming different foodstuff, food supplements and drinks for the long run and regularly in such proportions, quantities and variety that can reduce the risk of illnesses as proven in research is truly beneficial to health.

A GFK research about healthy behavior (2016) suggested that there is a constantly growing need for healthy food in Hungary. Although price sensitivity works against conscious diet, health consciousness and demand for healthy food shows a growing trend.

Some food consumer trends without the need for completeness:

- Health Food: These products satisfy the needs of health conscious customers. Health and quality control aspects are connected.
- Anti-Fat-Food: They target overweight and obese consumers.
- Naturfood: It is a requirement for foods to be “all inclusive”, natural, healthy and bio-quality
- Whole Food: Fresh organic food that are readily available for consumption.
- Mood Food: The emphasis is on the stress relieving and mood enhancing qualities of food.
- Hand-Held Food: The trend that can be eaten on the go.
- Slow Food: Healthy, relaxed lifestyle in consuming food. Openness to “old-new” types of food.

Food trends, therefore, include the most important topics and trends that currently are most important for consumers. Today the most typical trend-calling words: speed, comfort, health, environment, responsibility, experience and expertise.

*Key words: health conscious lifestyle, food trend*

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# WASTE MANAGEMENT OF A TEMPORARY FACILITY

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## **Abstract**

In our study we conducted a communal and hazardous waste generated during the operation of a Temporary Facility. The aim of our study is to assess the type, composition and quality of the maintenance materials which was entered by the current trends of the logistical support and the facility management to determine the environmental load indicator of the facility and the waste management activity in the operational task system.

During the study, we examined the characteristics of municipal waste in order assess the potential of the disposal of waste, as an opportunity for the utilization of tertiary biomass. It was necessary to know the characteristics of temporary facilities, especially from a military point of view, as the investigated temporary facility was located at the southern border of Hungary with 4 Border Protection Bases (hereinafter BPB).

As a result of the environmental impact assessment of the temporary facilities, four BPB operating, and supply systems emerged in the waste disposal sites on the material transport outlets, according to the responsibilities of separate independent technical supporter system. Particular attention has been paid to the control of public utility operations, the resulting 1406 m<sup>3</sup>/month sewage and 225 m<sup>3</sup>/month municipal waste data. After evaluating the results, we recommend the waste management plan considering the existing operating system by calculating the collection capacity and frequency of the transport.

We evaluated the output of material transport from the measured data, as well as assessing the possibility of waste disposal on site, such as sewage treatment and solid waste incineration. In line with the relevant results of the study, more than 75% of the total transported amount of waste from the facility can be reduced. In addition, evaluating the composition of wastes can be said that the conscious supply of materials can reduce the volume of waste to be transported by up to 95%. By doing so, 95% of the terrorist attack can be reduced against the military camp on the operation area.

*Key words: temporary facility, waste management, plan of waste handling*

# EFFECTIVE MANAGEMENT OF RDI PROJECT NETWORKS

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## **Abstract**

With an ever-increasing number of research papers tackling diverse area of interests, covering all the project's lifecycles, from the strategic decision to participate in an inter-organisational RDI project, to the impact evaluation of the project's results, the research in the area of project management is far from being „unfashioned”. On the contrary, the significant number of the new theories arisen in the management field (e.g. collaborative networks, team science, implementation science) underlines the importance of the effective management of knowledge and values created in project's networks and highlights new challenges for both scholars and practitioners in the field.

Aimed at creating a more accurate vision of the project performance in RDI projects, based on an integrative approach scaffolding value network and collaboration benefits models through the social network analysis, here we propose an evaluation model for RDI projects in inter-organisational environments of both theoretical and practical utility.

The mixed method used for the evaluation of the research design and data obtained from the analysis of the project networks involving 33 organizations as distributed social networks participating in four RDI projects, have led us to propose a valuable method to visualize and evaluate the progress of the project's collaborative efficiency using accurate methods for social networks analysis. The model we propose can reduce the information asymmetry in RDI inter-organisational projects and increase the value network, fostering technical and allocative collaborative efficiency.

The results obtained verify our evaluation model for effective management of complex project networks, supporting efficient allocation of the network collaboration benefits and the effective development of reciprocal network links, as an effective method for increasing the value and stability of the RDI inter-organisational networks.

*Key words: project networks, network collaboration benefits, value network, RDI network performance*

# ROLE OF DISTANCE IN TERRITORIAL ECONOMIC COHESION – A COMPARATIVE ANALYSIS OF RELATIVELY SMALL AND LARGE TERRITORY COUNTRIES IN EUROPE

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## **Abstract**

The economic development and economic cohesion within a specific country can be influenced and determined by a number of factors. During our research, we have been focusing basically on regional aspects and on *the distance factor*. We measured the distance from the capital city, or central (most developed) region and the distance among regions. Since the economic development can be captured traditionally by the GDP – and in parallel this indicator is historically the most widely available for NUTS2 – we used it as a basis for our calculations. We were curious about the role and relevance of *distance* relating the territorial differences in relatively small or in relatively larger EU countries. For our analysis, we used the methodology and formulas of territorial differences and neighborhood effect.

*Key words: distance, economic cohesion, regional, territorial differences*

# HISTORICAL LANDMARKS OF THE MANAGEMENT OF MAJOR URBAN LOGISTICS PROJECTS IN IMPERIAL TIMISOARA

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## **Abstract**

This article follows a holistic approach to the management of the major urban logistics projects of Imperial Timisoara. The research conducted so far has been based on unilateral treatments: either exclusively historical or engineering. Research of such projects requires multi-scientific and multidisciplinary treatment angles.

Our investigative optics is a managerial-holistic one, which integrates, besides the historical, technical / technological aspects, the architectural aspects, along with the multicultural, socio-human, ethnic, anthropological, urban, structural, processual and functional aspects. In this sense, the strategic references of urban essence are related to the potential of Timisoara city to have been able to carry out such projects, in the contexts specific to the different periods of its logistic development.

The multitude of researched data sources, information and documents enables us to innovate the approach of major urban logistics projects, using the logic of public management, in a holistic, integrative vision. We are convinced that such research, in such a way, will contribute substantially to a deeper understanding of Timisoara's contribution to his own Europeanization and the region he was part of, the Imperial Historical Banat.

*Key words: Urban Logistics, Urban Public Management, Holistic Approach, Projects.*

# THE WAY OF THE PHARMACEUTICAL INGREDIENTS TO THE FINISHED PHARMACEUTICAL FORM

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## **Abstract**

The modern pharmaceutical industry is a strictly controlled area. Both national and international rules apply, but none of these deals with logistical issues arising from the manufacture of the product. Following the path of a drug, it is possible to get acquainted with the problems that arise and their solution.

The drug is much more than a common product. The drug is a product of confidence, which is provided with information. It defines its quality as well, to comply with the relevant directives and standards in the manufacture of, and that the enclosed information is sent to the user.

This requires the manufacturer, the distributor and the user to comply with it. There is no production without material handling, but GMP (Good Manufacturing Practice) does not yet have a chapter on logistics. References to handling raw materials and finished products can be found in the corresponding GMP chapters, the responsibility of the correct execution are borne by the manufacturer. In this case, the effect of the common sense prevails exponentially, keep the medicine in mind and it has to be done, that no loss, no quality deterioration is not caused by the transport, handling of such loads, storage.

It is typical that the raw material and the finished product are going through the entire site during the pharmaceutical manufacture. Starting from the warehouse, it runs through the manufacturing facilities, on the packaging, and some units go to the lab, so that eventually, in medicine form returns to the warehouse, from where it goes further in the supply chain through the pharmacies to the patients.

In our study we examine the logistics activity and problems of a small pharmaceutical company and tasks to be solved presented in the light of the theory.

*Key words: pharmacy, logistics, GMP, drug*



# THE LOGISTICS OF HUNGARIAN WASTE MANAGEMENT SYSTEMS AFTER THE CHANGE OF REGIME

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## Abstract

The environmental situation in Hungary was falling behind the developed Western European countries by decades during the communist period. There was a significant lag, particularly in waste management. The change of the regime opened the opportunity for a significant change in the environmental protection and waste management in Hungary. The most visible changes were experienced in the logistics of waste management. Of course, this would not have happened without the financial support of the EU. The first two regional waste management projects of the ISPA program were launched in the regions of Szeged and Debrecen in the early 2000s. The EU-supported projects included significant logistics developments.

In the case of municipal solid waste, the role of logistics is significant in the collection, transport, temporary storage and certain pre-treatment operations. The purpose of waste transport logistics is, on one hand, to ensure the environmentally sensitive treatment of the waste, on the other hand, to transport the waste from the place of origin to the treatment site in the most efficient way. To reach these goals, similarly to the methods used by the developed Western European countries, waste logistics developments in Hungary were launched when the political-economic regime changed. In line with the EU objectives, the strategic aim of the development was to increase the rate of waste utilization significantly and to ensure the necessary logistical conditions. To reduce transportation costs, to reduce the volume of loose municipal solid waste and the recovered secondary raw materials by compression, to optimize the collecting routes and to reduce the distances were decided as well.

In the framework of the development of the collection infrastructure, standard collecting bins, tanks, and containers appeared, which were compatible with the special waste transport vehicles. Especially in larger cities the first selective waste collection networks and the modern compressing containers also appeared in the recyclable waste collection. Since the beginning of 1995, the replacement of obsolete transport vehicles has been begun, with the acquisition of modern, high capacity, more efficient compressing vehicles. To reduce waste transportation and treatment costs and to create the right conditions for recovery, sorting plants and trans-shipment stations were built. Route planning software for designing the collection networks, GPS tracking systems and inbuilt identifying chips in the collection containers are widely used. Due to the developments of the last 20 years, the logistics of Hungarian waste management has reached the level of the most developed countries.

*Key words: logistics, transport, waste management*

*Acknowledgements: The author is thankful for the interviews to the managers of waste management public service companies of South-Alföld, Hungary.*

# ROTATING VECTORS OF 2-DEGREE-OF-FREEDOM OSCILLATION

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## **Abstract**

The 2-Degree-of-Freedom oscillation system has a great importance in the fields of dynamic vibration reduction and of metamaterials. Mainly the research of metamaterials has gathered momentum recently, since the protection against vibration with smart materials has become a highly important research project worldwide. The aim of this paper is to introduce the analytical solving process of the linear 2-Degree-of-Freedom oscillation with rotating vectors. The author found that the rotating vector method was used only for description of 1-Degree-of-Freedom oscillation, so that has been improved for 2 masses with linear characteristic springs and viscous dampers with periodic excitation. Relationship between the phase shift and the amplitudes of the two masses' motion has been revealed. Both depend on only the frequency rate and the Lehr's damping ratio. A  $G_{21} = A_2/A_1$  modulus has been introduced and called amplitude rate. Furthermore the influence of non-linear parts is also presented shortly on the basis of numerical calculation.

*Key words: rotating vectors, 2-degree-of-freedom, phase shift, amplitude rate*

# **POSTERS**

# IMPACTS OF MICROWAVE PRETREATMENTS ON THE ANAEROBIC DIGESTION OF DAIRY WASTE ACTIVATED SLUDGE

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## Abstract

Microwave (MW) irradiation is one of the new and possible methods used for pretreating sludge before biological treatment. Following its use in different fields, MW irradiation has proved to be appropriate in the field of environmental research. In this study, we focused on the effects of MW irradiation on solubilization, biodegradation and biogas production during anaerobic digestion of dairy sludge. We have collected results from different published papers and examined the changes in the soluble fractions of the organic matter and the biogas yield to evaluate the efficiency of MW pretreatment. Additionally, the energetic efficiency was also examined theoretically. For batch reactors and in terms of an energetic aspect, the most economical pretreatment of sludge was at 630 W for 12 min irradiation time (1 kg of sludge, 1:10 solid: water). At this, COD solubilization, SS reduction and biogas production were found to be 18.6%, 14% and 35% higher than the control, respectively. While in semi continuous anaerobic digesters, combining microwave pretreatment with anaerobic digestion led to 67%, 64% and 57% of SS reduction, VS reduction and biogas production higher than the control, respectively. Therefore, energy output will increase for same amount of sludge and the same retention time as was observed here. Therefore, the energy per unit weight of dairy sludge is significantly higher after MW pretreatment, making the quality of the sludge better suited for anaerobic digestion. The theoretical calculations demonstrated that the energy input required to carry out the microwave treatment is lower than what obtained from biogas combustion, demanding use of 60% of produced energy as input. This amount does not include losses in energy transformations, nor account for heat losses during the pretreatment process. However, with an optimized design and operational procedure, these amounts can be kept to minimum.

*Key words: microwave, sludge, biodegradability, biogas*

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# BIOLOGICALLY PRETREATED DAIRY WASTEWATER ULTRAFILTRATION

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## **Abstract**

Since, dairy industry uses water almost in every processing steps, it produces a large amount of wastewater. This water contains many kinds of pollutants. The major ones are; organic matter, fats, suspended solids and nutrients. These different kind of substances and compounds result high organic content in dairy effluent. For a while, environmental agencies have been doing strict measures in order to reduce the emission of wastewater.

Our goal was to investigate a possible solution that may be effective in the treatment of dairy wastewater. A two-stage biological and physical process for the treatment of model dairy wastewater was investigated.

For biological treatment, both, aerobic and anaerobic treatments were carried out in biological fermentors. After that in the second stage, as a physical treatment, membrane separation was used. Aerobic biologically treatment and 10 kDa ultrafiltration (*UF*) membrane was found to be suitable for effective organic content decreasing. The samples were analyzed by pH, total dissolved solids (*TDS*), turbidity and chemical oxygen demand (*COD*) measurements.

It was found that the aerobic treatment was more effective compared to the anaerobic treatment. After 14 days biological treatment 66.8% and 12% *COD* decreasing were observed using aerobic and anaerobic conditions respectively.

The results of the one stage ultrafiltration tests showed that the *COD* membrane rejection was 60.2%. It increased to 92.9% when biological treatment was carried out before *UF*. Furthermore, it was 99% if it compared to the original wastewater organic content.

Membrane flux increased and the membrane total resistance values, reversible and irreversible resistances decreased with aerobic biological pretreatment: about 33% lower total resistance was observed. With biological pretreatment the distribution of resistances also changed.

Compared with the single *UF* and biological treatment process, this two-stage biological and *UF* treatment process had a higher efficiency and less membrane fouling.

*Key words: ultrafiltration, biological treatment, dairy wastewater*

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## SUBACUTE EFFECTS OF A FOOD FLAVOUR ON FISH MODEL

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### **Abstract**

Modern food industry widely uses a variety of flavour and fragrance materials. One of the most used compound group, the aldehydes. The benzaldehyde, also known as artificial almond oil, is one of the most commonly used flavouring in food industry. Toxicological effects of this compound are well known, a lot of information can be found in the literature.

4-ethylbenzaldehyde is also a member of aldehyde group, the physical properties are similar with benzaldehyde, also has almond scent. Unlike benzaldehyde, according to its chemical safety sheet it has no chemical safety assessment. Until now, only one experiment can be found of its effects on vertebrates. This compound can be also found at the group of flavours and fragrances.

The aim of this study was to examine the subacute DNA damaging and histopathological effects of EBA. Genotoxic effects of EBA in zebrafish were evaluated by using micronucleus assay. Significant increase in the micronucleus frequency had been described for all the tested concentrations. Histopathological alterations were found in the liver of the treated fish group with 11 mg/L EBA, but only at the end of the 21 day experiment.

*Key words: 4-ethylbenzaldehyde; flavours; genotoxicity; zebrafish*

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# EXAMINATION OF INTELLIGENT MEASUREMENT SYSTEM (IMRE) APPLICATIONS

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## **Abstract**

Building management systems of the cold storages also perform measuring functions, so with the help of an appropriate algorithm, each parameter of the cooling system can be checked with great confidence. Chilled food transportation and distribution does not have much of this kind a high-tech system. In delivering food to local retail stores, it has a significant share in smaller, simpler refrigerated lorries or vans. With these systems, supervision, monitoring the temperature it is usually not possible for the driver. As a result, food safety risk in the transport of refrigerated isothermal operating safety, measurement, data collection will be in focus.

In the case of an examined system, the task of the diagnostic is to quantify the parameters by comparing the parameters with the expected values to determine whether the system is functioning properly. When using instrumental tests, we infer from some measurement data the right functionality. If the parameters are within the expected limits, the test ended with good result, even if there are some malfunctions during operation. Short-term or momentary measurements cannot detect the problems or deficiencies that cause problems. After few hours of continuous data collection and visualizing, a change in the measured parameters can be detected even if there could not be identified any irregularities during measurements. Graphic display of the data allows visual evaluation, so analysing the measured parameters in function of time can easily and quickly reveal the hidden failure.

The IMRe (Intelligent Measuring System, in Hungarian **Intelligens Mérő Rendszer**) device shall be setup one time, then no further user command (resetting the device) shall be required. To ensure the device can always restart itself when an issue detected an additional monitoring micro-controller must be added which restarts the main micro-controller if needed. When data is measured, it is uploaded to a server. An input or data record value may be further processed and then stored in a feed which collect all the data received. A feed then can be visualized using line plots or bar diagrams or other methods. Visualisation of different feeds can be grouped together into a single page. A group of visualisations arranged by the user is called a dashboard. Each user can have several dashboards. These dashboards are freely editable, and expendable based on the usecase needs.

In our study we identify a hidden failure in the cooling system only by analysing the data collected by IMRe. Faulty behaviour was caused by a misplaced sensor. The temperature sensor collects air temperature data instead of the temperature of the evaporator, in this way sending incorrect data to control system of the cooling unit. The temperature sensor faultless, elements of cooling system are correct, the defective operation simply caused by the incorrect data signal coming from the misplaced sensor. To eliminate the problem temperature sensor was placed between heat exchanger disks. Subsequently, a few days of testing had a good result.

*Key words: wireless data analysing, diagnostic, measuring system, microcontroller*

# APPLICATION OF MICROWAVE TREATMENTS AND DIELECTRIC MEASUREMENTS IN WASTEWATER AND SLUDGE UTILIZATION PROCESSES

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## **Abstract**

Microwave irradiation has been proved to be an effective method for dehydration of biomaterials, and, to increase the disintegration degree of municipal waste activated sludge, for instance. Efficiency of microwave heating is determined by the dielectric parameters, but, however, the structural properties (solubility, change of chemical bonds, ratio of free to bounded water etc.) affect the dielectric characteristic of materials, as well.

In our work we focused on to investigate i) the effects of continuously flow microwave pre-treatment on the aerobic and anaerobic biodegradability of food industry originated sludge, and, moreover, ii) the relationship between the change of dielectric parameters and biodegradability indicators, as well.

The continuously flow microwave pre-treatment was suitable to increase the biodegradability of dairy and meat industry wastewater sludge, which is manifested in higher biogas yield and accelerated mesophilic anaerobic digestion process. Our results verified that the organic matter removal efficiency in a municipal wastewater treatment technology can be detected by dielectric measurements.

A strong correlation was observed between the change of disintegration degree of sludge exposed to microwave irradiation, and the change of dielectric constant. It was also established, that the increment of biodegradability can be detected by dielectric measurements, as well.

Further research is needed to investigate the applicability of dielectric measurement for in-line and real time efficiency estimation and control of microwave assisted pre-treatment process for different originated sludge and other biomaterials.

*Key words: microwave, dielectric properties, sludge, wastewater*

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# ALUMINIUM MATRIX COMPOSITES – AN OVERVIEW ON THE MATERIALS SUBSTITUTION AND EFFICIENT USE OF MATERIALS

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## **Abstract**

Development of metal matrix composites has been an important innovation in materials engineering over the past decades. Metal matrix composites offer several attractive advantages over traditional engineering materials due to their superior properties. Therefore, the metal matrix composite become economical alternatives to the monolithic alloys due to their improved specific strength, stiffness and wear resistance combined with better physical properties such as low density and low coefficient of thermal expansion.

Materials substitution significantly affects the trend toward more efficient use of monolithic materials. The increasing use of alternative materials in aircraft, automotive and construction applications has motivated the metal industry to provide lighter weight aluminium alloys and metal matrix composites. This paper presents an overview of aluminium matrix composite systems on aspects relating to processing of matrix from re-melted aluminium wastes.

*Key words: metal matrix composites, aluminium matrix, re-melted aluminium wastes*

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# VIBRATIONAL TESTS AND ANALYSIS ON MATERIALS USED IN THE AIRCRAFT

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## **Abstract**

The current cargo capacity for aircraft is about 20% of their total weight, increasing this ratio would significantly increase the economics of aircraft logistics. This is why it's important for material sciences to advance so that the materials used in aircraft construction become lighter while still retaining their structural integrity. In this paper we examined materials used in aircraft construction (steel, aluminum, plastics and composites) at the University of Szeged Faculty of Engineering. Using vibrational analysis we analyzed the test pieces for their natural frequency, we did this to gain insight to the range of frequencies that are least attenuated by the material the aircraft wings are made from. Using the data we gathered we wish to draw conclusions to which materials are more suited for aircraft wing construction.

*Key words: composites, vibrational analysis, material science*

*Acknowledgements: The authors are thankful for the financial support provided by the EFOP361 project.*

# COMBINATION OF ACTIVE COMPOUNDS OF ESSENTIAL OIL AND HHP TECHNOLOGY IN CHICKEN MEAT

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## Abstract

Chicken meat belongs to a category of naturally high perishable foods. To stop or inhibit the changes antioxidants/antimicrobials or physical preservation methods can be used. High hydrostatic pressure (HHP) extends shelf life while retaining the original flavour and characteristics of food. Application of natural essential oils (EOs) or active compounds of EOs can improve the inhibition of microbes in HHP treated meat products and can result better oxidation stability. To combine ACs with HHP technology, ACs should be selected which fit to the character of meat. Allyl isothiocyanate (AITC) is a colourless, volatile and aliphatic organosulfur compound found in horseradish, cabbage, wasabi, brussels sprouts, broccoli. AITC possess strong effectiveness in causing cell membrane damage, leakage of intracellular components and inhibiting bacteria at all growth stages. The aim of this study to examine the effect of combination of AITC and HHP on the properties of raw chicken meat.

Fresh chicken breast meat was obtained from a local abattoir. Meat was cut (free from bone, connective tissue, skin and visible fat) minced using a meat grinder. The meat was then homogenized and divided into groups. Amounts of meat were mixed with 500 and 1000 ppm AITC (dissolved in 5% sunflower oil); and control (only oil). The samples then placed in polyethylene bags and heat sealed. The high hydrostatic pressure treatment was carried out at 300 or 600 MPa for 5 minutes at room temperature using the RESATO FPU-100-2000 apparatus. After treatments samples were stored at  $4 \pm 0.5$  °C for up to 28 days. The samples were then taken at different time intervals for different analysis on day 0, 14 and 28. Later, pH, colour parameters, thiobarbituric acid reactive substances (TBARS), sensory attributes (E-nose), total aerobic cell counts were monitored.

For almost all of the parameters studied, a significant effect was demonstrated with respect to the AC concentration used and the pressure treatment level taking into account the storage time. The increasing concentration of AITC was becoming lighter ( $p < 0.001$ ), becoming redder ( $p = 0.008$ ) and producing a smaller number of microbes ( $p < 0.001$ ). AITC did not change the pH of the meat ( $p = 0.051$ ) and the TBA number did not change either ( $p = 0.485$ ). Pressure treatment also made the samples brighter ( $p < 0.001$ ), decreased a \* ( $p < 0.001$ ) and significantly reduced the number of microbes ( $p < 0.001$ ). The TBA number was not influenced by pressure treatment ( $p = 0.184$ ). All the factors except for the TBA number were significantly different. Electronic nose results have shown that all of the parameters studied had a detectable effect on the volatile components of the samples.

*Key words: chicken meat, allyl isothiocyanate, HHP, storage*

*Acknowledgements:*



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# INSTRUMENTAL ANALYSIS OF SENSORY PROPERTIES OF CHICKEN MEAT TREATED BY COMBINED THERMAL AND NONTHERMAL FOOD PRESERVATION TECHNIQUES

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## **Abstract**

Modern food processing procedures try to provide gentle ways to ensure safety of treated food products in order to meet consumer expectations. Minimally processed food products are prepared based on principles of hurdle technologies. Sous-vide heat treatment is a series of different food operations. Key to mention: selection, sorting, preparation (eg cutting), processing (seasoning, dosing), vacuum packing, heat treatment, cooling, chilled storage, regeneration and serving of raw materials. Among the non-thermal processes, high hydrostatic pressure treatment (HHP) can be successfully applied as a physical barrier during food processing. At present, the marketing of HHP treated foodstuffs requires maintenance of a cold chain. The temperature of the cold chain has great significance, but maintaining of low temperature is a serious burden on the manufacturer. If this cooling requirement can be slightly relaxed, it is possible to produce and sell products more economically. In our investigations we wanted to find out how the combination of gentle heat treatment (sous-vide) and high hydrostatic pressure treatment applied in different order, space and time affect the instrumentally measurable sensory properties of chicken meat.

Raw chicken breasts were purchased from the local commercial market. They were cut into half and placed into vacuum bag and then sealed. Part of the samples were heat-treated in a water bath at 55 and 60 ± 1 ° C for 60 minutes. The high hydrostatic pressure treatment was carried out at 300 or 600 MPa for 5 minutes at room temperature. In addition to single, heat-treated and only pressure-treated samples, we also performed combined treatments. Part of the samples were first heat-treated, then pressurized, the other part was first pressurized and then heat-treated. Colour was measured using a Minolta CR-400 chroma meter. Texture measurements were carried out at room temperature with a Stable Micro System TA XT Plus instrument. Head space analysis of samples was performed by an NST3320 type electronic nose. For the evaluation of electronic nose results multivariate statistical analysis were used, namely, Canonical Discriminant Analysis (CDA).

In case of single treatments, L\* (brightness) and b\* (yellowness) increased as effects of pressure and sous-vide treatment. Increasing L\* values show that when higher temperature or pressure was applied the sample became brighter. The tendency of results were more complex when combined treatment were applied. Multifactor variance analysis of results of combined treatments has statistically confirmed that all three factors (heat treatment temperature, pressure level and order of treatments) have significant effect on L\* of meat. The statistical analysis of results of texture and electronic nose measurement also justified that these factors had significant effect on sensory properties.

*Key words: chicken meat, sous-vide, HHP, sensory properties*

*Acknowledgements:*



*Supported by the ÚNKP-17-4 new national excellence program of the ministry of human capacities.*

# THE USAGE POTENTIAL OF ACTIVATED CARBON IN SUGAR BEET MOLASSES PURIFICATION: INFLUENCE ON COLOUR AND TURBIDITY

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## Abstract

Sugar beet molasses represents valuable sugar industry by-product due to the diversity of present compounds. Constrains towards molasses complete exploitation through present compounds valorisation initiated numerous investigations. The primary aim of the corresponding investigations was to identify an effective treatment for sugar and non-sugars separation. Separation of sugar and non-sugars concentrated in the sugar beet molasses could be achieved by various adsorption based treatments under appropriate conditions.

Considering successful application of activated carbon as an adsorbent of non-sugars in juice purification, the presented study aims to investigate its usage potential in molasses purification. In this regard, granulated activated carbon adsorption performance was determined through sugar beet molasses colour and turbidity assessment.

According to the applied Box-Behnken experimental design, the influence of 3 independent parameters: pH (3, 5 and 7), temperature (40, 60 and 80°C) and activated carbon concentration (1, 3 and 5 g/L) on molasses colour and turbidity were examined. The molasses dry substance (10° Brix) was kept constant in all conducted experiments. Response surface methodology was used for determination of applied parameters significance.

Molasses colour and turbidity reduction extent was greatly dependent on pH. Applied strongly acidic conditions (pH 3) were adequate for reaching maximal molasses colour reduction while the opposite effect was observed in molasses turbidity reduction. Furthermore, an increase in the activated carbon concentration contributed to the molasses colour reduction. The influence of treatment temperature was not established as significant in terms of molasses colour and turbidity reduction.

The obtained positive results regarding molasses colour and turbidity reduction upon activated carbon application confirm its adsorption potential towards non-sugars present in molasses. Nevertheless, to accomplish balance between satisfactory molasses colour and turbidity reduction, determination of adequate treatment conditions is crucial and requires further research.

*Key words: molasses, colourants, adsorbent, purification*

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# CREATING A MICROSOFT ACCESS APPLICATION FOR CLIENT-FOCUSED SERVICES

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## **Abstract**

Microsoft Access provides simple and intuitive ways to create sophisticated databases with user-friendly interface that is easy to use even for average users.

The main goal of our project was to create a user-friendly application to store and retrieve data of clients using the services of a certain company. The data to be stored:

- name of the client,
- the service used by the client,
- date and time of service,
- the name of the employer providing the service.

By storing and summarising these data it became possible for the company to get annual or monthly information on the popularity of the provided services and the activity of the employers, etc.

Microsoft Access 2010 was used to build the necessary database and the user interface:

- Table objects were created to store the data. Every table had to contain a primary key to uniquely identify a row (a record) in a table. These primary keys were also used to connect the tables.
- Query objects were created to select and summarise data based on certain user-adjustable filtering criteria. Action queries were also programmed allowing the user to modify the data stored in the tables.
- Forms were designed to help the user to access the data in a user-friendly way.
- Reports were also designed to allow the printing of the filtered and summarised data.
- Macros made from a series of commands were also created for some special functions.

We also had to make sure that the user could only have access to the data but could not modify the structure of the database and the user interface.

To access the different objects, services in the database, a user interface with menus – called switchboard in Access – was also created and launches automatically when the application is opened.

*Key words: Microsoft Access, database*

# FENTON AND DIFFERENT LIGHT SOURCE ASSISTED PHOTO-FENTON REACTIONS FOR THE PURIFICATION OF REAL THERMAL WASTEWATER

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## Abstract

Thermal water has a numerous fields of applications thanks to its beneficial features. Due to its high temperature, thermal water can be used as energy source and another main application field is therapeutic utilization [1]. Thermal water often contains high amount of inorganic and/or organic contaminants, therefore its purification is required before the final disposal [2]. Although phenolic and humic substances can be successfully degraded by ozone treatment, the high radical scavenger content of salty thermal waters often prevents the effective COD or TOC reduction [3]. In the present study the oxidative purification of a real thermal wastewater (with high hardly oxidizable organic content and high carbonate concentration) was investigated comparing different AOPs, such as Fenton reaction, and photo-Fenton reactions with different light sources (additionally ozone treatment was also investigated as a reference purification method). Investigating the effect of ferrous ion content and hydrogen-peroxide concentration, the 1:25 molar ratio was found to be the most effective in relation with the absolute value of COD and TOC reduction rate. The investigation of the effect of different light sources (UV-A, UV-C and VUV fluorescence tubes with intensity maximums at 360, 254 or 254/180 nm and visible light emitting tube) revealed that both the purification efficiency, and the “apparent quantum yield” of COD or TOC reduction increased with the energy of photons (decreased with the wavelength of photons) possibly due to the more effective regeneration of Fe<sup>2+</sup>, and the parallel processes like direct photolysis of organic contaminants (both in case of UV-C and VUV irradiation) and direct production of hydroxyl radicals from water molecules (only in case of VUV irradiation).

*Key words: Fenton reaction, photo-Fenton treatments, ozonation thermal water, AOPs*

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## E-MOBILITY IN SZEGED – ELECTRIC CARS AND CHARGING POINTS

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### **Abstract**

In our wider and narrower environment, due to the significant developments in the automotive industry, increasing attention is trending towards electric powered vehicles. Trams and trolley buses have been running in Szeged for many decades, and recent years in self-propelling version. At the same time the population's buying activity of electric powered cars is increasing.

The University of Szeged, Faculty of Engineering (together with the Szeged Transport Company) participate in a HORIZON2020 tender called „ELIPTIC” (Electrification of Public Transport in Cities) research-development project, which started on 1 June 2015 and ends on 31 May 2018.

One of the main aims of the Eliptic project is to explore what kind of extra services the hybrid trolleybuses can provide in Szeged, and how they can contribute sustainable public transport, thereby shaping and developing the attitude of the population in this area. Connected to the application's topic, with our survey we measured what the population know about electric vehicles and the filling points, asked their opinion, and searched for an answer to the revealed challenges. In September 2017 University of Szeged, Faculty of Engineering cooperated with university's students and they did the questionnaire survey among the population.

We did a personal questionnaire survey during our research to explore the habits of current and potential, in the future electric car users in connection with traffic and charging, demands and preferences related to electromobility.

The current vehicles users and the potential electric car customers belong to the questionnaire's focus group. We will ask their opinion and we will search answers to the emerging challenge. Our investigation is a part of a project (H2020) run for several years, which is to reveal opportunities for public transport and personal transport to become electric.

*Key words: electric cars, electric charging, Szeged, environment protection*

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# OPTIMIZING OF EXTRACTION OF BIOACTIVE COMPONENTS FROM SEA BUCKTHORN (*HIPPOPHAE RHAMNOIDES* L.) POMACE AND DEVELOPE OF ANTIOXIDANT-ENRICHED APPLE JUICE

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## Abstract

The food waste is a critical subject in every industry, in every household; but in many cases by-products should not be considered as waste. In our study, we were looking for an alternative to the use of sea buckthorn pomace to open new opportunities for the food industry. The chosen cultivar, Ascora is from Hungary, these sea buckthorn contain high biological activity components, primarily polyphenols, flavonols which compounds are known to have potential antioxidant properties. The dried pomace was extracted in a different method to achieve the highest antioxidant content. Ethanol and acetone were used as solvents, applied in different concentration: 20 m/m % and 40 m/m %. After the centrifugation, the solvents were removed and replaced with water. For the selection of the optimum extraction method, various spectrophotometric measurements were performed, which included the ferric reducing ability of plasma antioxidant capacity (FRAP) method, 1,1-diphenyl-2-picrylhydrazyl assay (DPPH), trolox equivalent antioxidant capacity method (TEAC) and determined of total polyphenol content. With the best extract, three types of apple juice were made from apple juice concentrate by diluting it with different percentages of water and pomace extracts. The above-mentioned spectrophotometric measurements were also performed for the prepared drinks in order to check the increase in amount of antioxidant components in the apple juice. Acceptability of enriched juices was determined by sensory evaluation and short market research. On the basis of the results the optimum extraction agent is 40 m/m % acetone for enriching apple juice. The results of the market research showed that there is a demand for the consumption of enriched juice with sea buckthorn pomace extracts. According to the sensory analysis, fruit juice enriched with the 1:1 ratio of extract: water mixture is the most optimum according to evaluators. Further examination could reveal whether the extracted antioxidant content of the pomace could be used as bio-preservatives in the food industry.

*Key words: sea buckthorn, pomace, apple juice, antioxidant*

# EXAMINATION OF DIFFERENT PRETREATMENT METHODS TREATING MODEL WASTEWATER

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## Abstract

Membrane filtration, as a promising technique has been developed and appeared to be a good solution for different separation problems. However it has a remarkable efficiency, there is an urgent need to develop pretreatment methods to avoid membrane fouling. The aim of this study was to test different pretreatment processes such as sedimentation, microfiltration (*MF*) and centrifugation before ultrafiltration (*UF*) of model dairy wastewater. The pretreatment effects on the membrane separation efficiencies were investigated and compared.

In the first part of this study, *MF* separation experiments using ceramic membrane were carried out. The influences of operational parameters, such as transmembrane pressure (*TMP*) and recirculation flow rate ( $q_{Vrec}$ ) were investigated. Permeate fluxes, membrane resistances and membrane rejections were measured and calculated in terms of turbidity, conductivity, total dissolved solids (*TDS*), and chemical oxygen demand (*COD*) values.

In the second part of our work sedimentation and centrifugation experiments were examined.

These single methods like one stage pretreatment experiments were carried out at pH 4, 8 and 12 in order to know which condition has the best efficiencies. The results showed that acidic conditions had the highest decreasing rates. The most effective centrifugation parameters were 5000 rpm for 10 sec, which resulted 99.4 % turbidity rejection.

In the third part of my work *UF* separation experiments using polymer membrane were tested. During the *UF* experiments pH 4, 6 and 8 and the pore size of 7, 10 and 30 kDa were tested. The most efficient *COD* rejection was 58.9% using 10 kDa *UF* membrane at pH=4.

With the optimal parameters of the pretreatment processes *UF* will be tested in the near future in order to know the two stage process efficiencies on the membrane fouling decreasing.

*Key words: pretreatment, microfiltration, ultrafiltration, dairy wastewater treatment*

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# COMPARISON OF FILTER MATERIALS USED FOR DEPTH FILTRATION

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## Abstract

Examination of the depth filtering operation is very important from an energetic and quality point of view. The filtration is one of the most determining operation in many technologies. According to the operating mechanism we distinguish: surface and depth filtration. It is desirable to analyze the filter materials used for the depth filter, the time required for filtering, the purity of the filtrate, or the possibility of backwash (filter layer cleaning), filtration pressure, etc.

In case of depth filtration, the filter material is formed by a natural or artificially formed layer and the solids to be removed remain into the inside of the filter layer: As an example, some of the drinking water receive from bank filtered water resources. It means the water is cleaned of gravel and sand layer.

The purpose of our investigation is analyzing, and comparative examination of different filter materials used in depth filters and to appropriate filter material is used in the technologies. We examined green glass, diatomaceous earth, quartz sand in different fractions and specially designed plastic filter material. The pilot equipment for the tests has been designed for gravitational and forced flow also, in each case same filter layer height was used. During filtering was measured and examined: time of filtration, flow rate; purity of the filtrate. Our results were showed by methods of Carmen and d'Arcy, and comparison with porosity of the filter material.

The pilot-measurement equipment is suitable for testing filter media applied to filtering technology, assessing the quality of the operation and estimating the technical parameters (flow rate, filtration pressure, etc).

*Key words: depth filtering, filter media, filtrate*

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# A COMPARATIVE STUDY ON THE REMOVAL OF ANIONIC AND CATIONIC DYES FROM AQUEOUS SOLUTION BY LAYERED DOUBLE HYDROXIDES

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## Abstract

Organic dyes that are generated from various industries have recently become a serious concern due to the increased quantity discharged into the environment. These dyes are very stable in the nature and therefore cause severe problems to the environment as well as to human health. Consequently, rapid and efficient approach for the removal of colored dyes from water is essential and has become an imperative in this field of research. Recently, layered double hydroxides (LDHs) have attracted much attention in the field of environmental friendly processes. They consist of stacked hydroxide layers with charge-balancing anions in the interlayer and have tailoring possibilities that enable the variation of numerous synthesis methods and parameters: The layered structure collapses after thermal treatment leading to the formation of non-stoichiometric metastable mixed oxides with developed surface area and specific acid-base and redox properties. Therefore, our work was aimed to investigate the behavior of synthesized ZnAl-LDHs and their mixed oxides (thermally treated at 500°C/5h) in the removal processes of anionic (Methyl Orange-MO) and cationic (Rhodamine B - RhB) dyes. Structural, textural and morphological analyses were carried out for the material characterization. Experiments were conducted in an open cylindrical Pyrex reaction vessel containing 100ml of solutions ( $C_{MO}=4\mu\text{mol/l}$  or  $C_{RhB}=10\mu\text{mol/l}$ ) and 50mg of powdered materials. At defined intervals aliquots were centrifuged and MO/RhB concentrations were determined using UV-VIS spectrophotometer at 463.9nm and 554nm, respectively. The results showed that the LDHs and there derived mixed oxides exhibited high adsorptive capacities for MO removal from aqueous solutions (~50% of initial MO after 45min for LDHs and almost complete adsorption after only 10min of contact for mixed oxides). Interestingly, both materials did not show any adsorptive capacity for RhB removal, but after photoactivation of the reaction solution (UV light irradiation:  $0.912\text{mW/cm}^2$ ), both materials exhibited photocatalytic activity (~25% for LDHs and ~80% for mixed oxides after 300min). The investigation revealed that in the removal process of anionic dyes, the adsorption process is the dominant overall process due to the possibility of intercalation of MO molecules in the interlayers of layered hydroxides. On the contrary, for the removal of cationic dyes this is not the case, but interestingly enough the same synthesized materials showed very satisfying photocatalytic behaviour. It can be concluded that the synthesized materials can be used simultaneously as adsorbents for the removal of anionic dyes and as photocatalysts in the degradation of cationic dyes, making these materials multi-functional and vastly promising for their application in the field of environmental protection.

*Key words: adsorption, photocatalytic reaction, anionic and cationic dyes*

*Acknowledgements: The financial support from the Ministry of Education, Science and Technological Development of the Republic of Serbia (Contract No. OI172022).*

## USING MICROSOFT EXCEL VBA IN A BIOMETRIC CASE STUDY

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### Abstract

Spreadsheets can be used to calculate values from data and display the results in tables or charts. Microsoft Excel spreadsheet software supports the use of Visual Basic for Application (VBA) development environment which supports the creation of the users' own programs with user-defined functions. This feature is particularly useful when executing complex and repetitive calculations.

Sometimes, before calculating statistical data, we need to check whether our data (the random sample) is normally distributed and for numerical data type, one of the most effective methods is the Shapiro-Wilk test.

Excel can be used to execute the Shapiro-Wilk test in a user-friendly, programmable way with a little knowledge of VBA. The task requires complicated computing; thus, it is advisable to create a universal method which can be readily re-used with datasets with a different number of elements. Excel also supports the creation of a user-friendly, intuitive interface.

The formula of the Shapiro-Wilk test gives a value which is compared to a critical value (dependent on the sample size and the Type I error probability). Smaller Shapiro-Wilk values than the critical value indicate that the sample is not normally distributed.

In the research, the samples originated from the measurement of a type of crop with 44 chemical components per sample. These samples were available from three types of crop, for three consecutive years and according to two cultivation methods. Three parallel measurements were made in the same conditions (including crop type, year and cultivation mode). As a result,  $44 \times 3 \times 3 \times 2 \times 3 = 2.376$  numerical data had to be evaluated.

At first, a worksheet was programmed with the necessary calculations which were hidden from the user. Then the interface was created for the user in another worksheet to input the data, to set the Type I error probability and then display the result based on the calculations on the hidden worksheet: whether the input data is normally distributed or not.

Since the data input into the spreadsheet could be automated, several datasets could be evaluated one after another. As a result, samples gathered for a biometric study could be verified very quickly before executing further statistical calculations.

*Key words: Excel, VBA, statistical evaluation*

# EXAMINATION OF NATURAL REFRIGERANT APPLICATION IN PILOT FOOD REFRIGERATION EQUIPMENT

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## **Abstract**

The cooling demand can be found in different parts of the food chain in different ways: One way is to cool down the raw materials as fast as it could be, another way to reach very low temperatures, and of course to provide nearly constant temperature for food product in case of transportation and distribution. Artificial cooling is widely used to solve these problems.

The limited data that is available suggests that currently the cold-chain accounts for approximately 1% of CO<sub>2</sub> production in the world, however this is likely to increase if global temperatures increase significantly. Using the most energy efficient refrigeration technologies it would be possible to substantially extend and improve the cold-chain without any increase in CO<sub>2</sub>, and possibly even a decrease.

Unfortunately, there is more evidence to there is a large amount of obsolete refrigerant used in the food industry. R22 (chlor-difluormethane) is the second most used refrigerant –about 30% share-, except in the Wine and Fish sectors. It is in use in all the analysed sectors, is owed to its versatility and equipment age, essentially. Besides being found in older individual refrigeration systems, it is suitable for an enormous variety of refrigeration applications, across a wide range of temperatures. Controversially, R22 has an ODP of 0,05, so it destroys the ozone layer, and has a GWP of 1810. This value is relatively low compared to another CFCs or HCFCs, but much higher than the limit set by international regulations. Since 2010 it is prohibited to refill or service these cooling systems. They still in operation till some major failure occurs, then the refrigerant could be replaced to natural refrigerant.

In many cases, use of natural refrigerants involve some risks that conventional refrigerants do not. Two types of risks are considered: Flammability is characterised by the concentration of Lower Explosive Level (LEL). At this concentration in air by volume, the air-refrigerant mixture can ignite and explode by a spark. The higher the concentration, the less dangerous is the mixture. Another property is the burning velocity. If the burning velocity of the mixture is lower than 10cm/s, the mixture could not explode. Some regulations (Eg. 517/2014 EU) allows only 20% of the LEL in closed spaces, so the chance of an explosion is nearly zero. The chance of exposure can be minimized, for example by restrict the charge in a cooling system. This limit for household refrigerators is 150g flammable HC.

We found that there's a hard push by the regulations to apply more and more natural refrigerants, because of their direct and indirect impact to the environment is very low. By contrast, these have lot of risks to the health, therefore there's a big challenge in changeover to natural refrigerants. Hydrocarbon based natural refrigerants have a great advantage over conventional ones: the comparable system charge dropped by nearly 50% when replace HFCs by HCs. This significantly lower the risks to human health.

*Key words: natural refrigerant, environmental load, flammability*

# MATHEMATICAL ANALYSIS OF COLOUR PARAMETERS

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## Abstract

Recently time there is a growing interest in pasta made from durum semolina, because these pastas don't contain egg. Therefore the colour characteristics of the semolina are dominant in the visual colour of products. The colour changes of dry pastas made of different semolina during storage was investigated. The relationship between the  $\beta$ -carotene content and colour characteristics of semolina was evaluated too. The pastas were made from seven types durum semolina. The six months storage experiment was carried out two different ways: in natural light, and in dark. Colour measurements were performed with a Minolta CR colour measuring instrument. The CIELab colour system was used for colour characterization. The colour characteristics of dry pastas were measured twice a month. During six month the colour coordinates ( $L^*$  lightness,  $a^*$  redness and  $b^*$  yellowness coordinates) of pasta products didn't change significantly in the light-protected storage condition. The values of  $\Delta E_{ab}^*$  colour difference calculated between colours coordinated measured first and colour coordinates measured during storage were less than 2 unit, so the changed of the colour did not perceptible. In the case of natural light exposed samples the values of  $\Delta E_{ab}^*$  colour difference calculated between colours coordinated measured first and colour coordinates measured during storage were commonly higher than 3 unit since the 56th day of storage

The changing of the colour parameters indicated that the pastas became darker and less yellow. Significant linear relationship was established between the  $\beta$ -carotene content and  $b^*$  yellowness coordinate of semolina.

*Key words: colour measurement, durum pasta, semolina*

# POSSIBILITIES TO CONTROL SOLID UPTAKE DURING OSMOTIC DEHYDRATION OF CARROT SLICES IN SALT SOLUTIONS

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## **Abstract**

The application of edible coatings as a barrier protects food products from microbiological, chemical and physical degradation, but they can also be used to increase the efficiency of some food processing processes. For example, edible coatings can reduce loss of colour, flavour and nutrients during processing and in that way improve the shelf-life of the product. Osmotic dehydration is a process of partial removal of water by bringing the plant material, most commonly, fruit or vegetables, into contact with a hypertonic (osmotic) solution. The removal of water is based on the non-destructive phenomenon of osmosis through the semipermeable membrane of the plant cell wall. The diffusion of water is accompanied by simultaneous counter diffusion of solutes from the osmotic solution into the tissue that can alter product quality. The major disadvantage of osmotic dehydration, which limits its application to food processing, is the diffusion of solute into the plant tissue.

The aim of this study is to investigate possibilities for control of solid gain during osmotic dehydration of carrot discs. Coating agents used in this study are carrageenan (2%), gelatine (2%), potato starch (3%), corn starch (3%) and maltodextrin (20% and 50%). Coating solutions were prepared with distilled water. Prepared samples were dipped in the aqueous coating solution. For carrageenan and gelatine coating dipping time was 30 s (at 30°C), after that samples with carrageenan coating were dipped for 30 s into 2% calcium chloride solution used for gelling activation. For starch and maltodextrin solutions dipping time was 3 min at 70°C. After dipping, samples were left on the aluminium sieve for 3 min to allow fixing of coatings. Starch and maltodextrin coatings, in order to solidify the coatings, were placed in the oven at 60°C for either 10 or 30 min.

The dehydration efficiency index (DEI), stands for the water loss (WL) to solid gain (SG) ratio. As coating is aimed at limiting solid gain and promoting water loss, the DEI is an excellent way to evaluate different coating treatments as well as influence of process conditions. All coatings gave statistically higher values of dehydration index compared to non-coated (control) sample at the 5% level of significance. Higher values of DEI were obtained for samples that were dried for 30 min when compared with same coating type dried for 10 min. The difference is that edible coatings probably protect the surface of the samples from the rapid dehydration while they are dried, and in that way water loss values are higher for samples with coatings than for the non-coated samples dried for the same oven drying time. Maltodextrin coatings (50% and 30 min) had shown the best results in controlling solid uptake during osmotic dehydration of carrot slices. A significant improvement in DEI also is achieved with a lower concentration of maltodextrin (20%) with a longer coating time. Corn starch also provides satisfactory index values while other coatings, although leading to index improvements, are not as effective.

*Key words: osmotic dehydration, edible coatings, dehydration efficiency index*



# SLUDGE REDUCTION IN ATTACHED GROWTH WASTEWATER SYSTEM ASSUMING FOOD CHAIN REACTOR

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## **Abstract**

Reduction of dry mass in wastewater sludge management is crucial to reduce the operational cost of a sewage treatment plant (STP). Sludge reduction processes could be based on the enhanced endogenous metabolism, cell lysis and cryptic growth or by predation and biodegradability of inert solids. The latter one requires long sludge residence time (SRT) and a cascaded biological treatment system. This could be achieved by applying attached growth biomass, where the microorganisms are fixed to a carrier. In a cascaded system due to the presence of higher order organisms (protozoae and flagellae) less sludge is produced compared to a single compartment biological basin. The reason is that these organisms require DO level of 1-3 mg/L, and BOD<sub>5</sub> concentration lower than 30 mg/L. Sludge reduction is achieved by creating a food chain and part of the inert solids is transformed to biodegradable solid.

Our aim was to predict the sludge reduction rate by numerical analysis in order to determine the magnitude of the possible optimisation by taking advantage of cascaded reactors. The performance of a 1,000 m<sup>3</sup>/d capacity STP was calculated by mass balance modelling. ASM2d wastewater model was applied introducing a fraction rate describing the utilisable inert solid fraction.

As a result of the analysis it can be stated that sludge reduction is approximately 0-6% if the inert fraction rate is between 0-0.4, and 15% of total mass reduction could have been achieved if the reactor with single compartment was cascaded and at least 5 reactor zones were separated in a biofilm system. As a continuation of the analysis, full scale treatment plant measurements and verification are projected.

*Key words: biofilm, food chain, sludge, wastewater*

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# BREWERY TECHNOLOGY MEASUREMENTS

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## **Abstract**

The technology of beer production, as well as beer consumption habits have been changing during the history. Small-scale beer production can handle special demands, serving a submarket. Craft beer refers to professional small-scale beer with the intention of beer master to involve an unique taste.

The demand for objective, quantitative parameters describing the brewing technology is increasing due to the strict condition of quality management systems in food industry. These indicator parameters have high relevance in the process of producing safe products. The quality of beers is described by several parameters; the majority of them are measured by analytical methods. These parameters can be measured in independent laboratories as well-equipped laboratories are not available in small breweries.

As all periods could affect the quality of finished beer, the balance of the whole production process needs to be maintained.

During our research we followed up the manufacturing process of three different types of beer. We examined the pH value, (DO) dissolved oxygen (mg/l), (ORP) redoxpotential (mV) and (EC) electrical conductivity ( $\mu\text{S}/\text{cm}$ ) of the product at 9 sampling points. We used the same methods at each sampling points.

*Key words: brewing, measuring technology, production control*

# BIOGAS PRODUCTION POTENTIAL AND KINETICS OF MICROWAVE PRE-TREATMENT OF FOOD INDUSTRIAL WASTEWATER

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## **Abstract**

In today's energy demanding life style, when fossil fuels are gradually depleting in addition to rising costs and instability in the major producer countries, there is always a need for exploring and exploiting new sources of energy which are renewable as well as eco-friendly.

Renewable energy has become one of the best alternatives for sustainable energy development. Among renewable energy sources, biomass as a primary energy source has the highest potential in Hungary. Organic waste produced by agriculture, food industry or any other area of the economy can not only be converted to renewable energy source but can also be disposed of during this process. In addition, the waste can be disposed of an alternative source of water in areas where there is no need to use drinking water.

Although anaerobic digestion is widely used to stabilize organic waste, pre-treatment technologies are gaining acceptance. The overall anaerobic degradation of organic waste is generally limited by the hydrolysis rate of organic suspended matter. Improving the steps of hydrolysis with different pretreatment methods allows the availability of solid substrates for anaerobic bacteria, accelerating digestion and increasing the amount of biogas generated.

In this study effect of microwave pre-treatment on the anaerobic degradation of meat industrial wastewater was evaluated through the calculation of performance parameters by using simplified mathematical models. The models were all used with experimental data from the anaerobic biodegradability tests fed with microwave pre-treated wastewater. Experiments indicated that pre-treated samples gave higher yield of biogas compared to non-pretreated one.

*Key words: wastewater, anaerobic digestion, kinetic model*

## ANTIOXIDANT ACTIVITY OF WHEY PROTEINS

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### Abstract

The process of cheese making produces huge amount of whey with commendable nutritional potential. Many types of whey proteins coming from milk serum and from caseins (e.g.  $\alpha$ -lactalbumin, lactoferrin,  $\beta$ -lactalbumin and glycomacropeptide) should be applied to produce bioactive peptide chains.

Whey protein isolate powder (WPI) was dissolved in distilled water with a concentration of 10 w/w% as investigational solution. Laboratory scale ultrasound processor with a maximum power of 100W was used to pre-treat the samples. Best conditions of treatments in the examined range (60-100% of amplitude, 5-30 minutes of treatment time) were determined by Central Composite Face-centered model with a software named Statistica ver. 13.

Bromelain enzyme from pineapple was used for the breakdown of whey proteins. Differences of antioxidant activity were measured by 2,2-diphenyl-1-picrylhydrazyl (DPPH) method.

Results revealed that sonication without enzymatic proteolysis can increase biological activity of peptide chains in cheese whey, but the effect of enzymatic treatment was higher: sonicated samples had  $3.0 \pm 0.5\%$  growth of antioxidant activity compared to the control samples, while enzymatic treatment produced  $18.3 \pm 0.4\%$  increment.

Positive effect of combined treatment was not proven: when enzymatic digestion followed the sonication of WPI solutions, growth of biological activity was only  $9.7 \pm 0.5\%$ .

*Key words: Whey, DPPH, ultrasound, bromelain*

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## ENZYME RECOVERY FROM REAL FERMENTATION BROTH

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### **Abstract**

Ultrafiltration is a widely used technique whose main complication is membrane fouling. This phenomenon causes both reversible and irreversible flow resistances that can be minimized with special techniques e.g. ultrasonic treatment and/or stirring. The application of sonication can increase the flux by breaking the concentration polarization and cake layer on the membrane surface without impairing the structure of the membrane.

Our work focused on modelling of stirred and/or ultrasound aided ultrafiltration of cellulase and  $\beta$ -glucosidase enzymes from real fermentation broth of experimental tobacco plants.

Membrane filtrations were done in a laboratory-grade batch ultrafiltration cell, extended with stirrer and ultrasound processor. The effects of stirring speed and ultrasound treatment were investigated on the membrane's permeate flux efficiency and on the quality of recycled enzymes. Hermia's analysis was carried out to get detailed information about membrane fouling. Resistance values were calculated by the resistance-in-series model as well.

The enzymes could be successfully from real fermentation broth. Tests of enzyme activity revealed that enzymes can keep their activity during either stirred or sonicated processes. New hydrolysis with recovered enzymes showed that there's minimal need to add new enzymes to the system to keep the efficiency of the process.

*Key words: sonication, ultrafiltration, enzyme recovery, Hermia's model*

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# THE SITUATION OF THE HUNGARIAN PEACH PRODUCTION-, PARTICULARLY THE PLANTATION IN SZATYMAZ

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## **Abstract**

There are a few data connected to the situation of the Hungarian peach production and its international position. The peach is native fruit in China, and Persia (Iran). It has got to Europe in XIX<sup>th</sup> century. The first name was the Malum Persicum by the Italian people. Nowadays in the world, the peach is on the 10<sup>th</sup> place, in the range of the most important fruits. In the EU there are about 3.2 million hectares to grow peach, the most important countries are: Spain, Italy, Poland, Portugal and Greece.

The topic of the current thesis is the introduction of peach production in the area of Hungary and Szatymaz. The aim of the secondary literature review is to highlight the economic importance and different characteristics of peach production.

The traditional, yellow-peach is the most popular in EU (50%), the part of the yellow nectarine is 30%. The participation of the white peach and nectarine is about 15%, and the rest 5% is for the Prunus Persica (donut peach).

In Hungary there are about 4000 hectares for the peach – plantation. The trees are really old, and their density is big.

The study also aims to shed lights on how producers view selling their products in Productive Cooperatives, what changes would be essential in the Hungarian peach production in the future.

The secondary research has been supplemented by primary research. The primary research method included an in-depth interview. The results of the interview show that the productive land area has been continuously decreasing in the area of Szatymaz, but it seems to be stabilizing nowadays. The producers are suspicious about Productive Cooperatives and their views van hardly be changed. The peach production in Hungary could be modernized, which would result in the boom of the sector.

*Key words: peach, deep interview, productive Cooperatives*

# VOLUMETRIC MASS TRANSFER COEFFICIENT IN AN EXTERNAL-LOOP AIRLIFT REACTOR WITH SELF-AGITATED IMPELLERS CONTAINING AQUEOUS SUCROSE SOLUTION

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## **Abstract**

External-loop airlift reactor are widely employed in biochemical and pharmaceutical industry mainly due to their simple construction, low energy requirements and good mixing characteristics. Their productivity is mostly controlled by gas-liquid mass transfer. Due to the widespread demand for the improvement of yield and productivity various alteration in construction have been proposed to enhance mass transfer rates and hence, increase productivity of airlift reactors. One of the possibilities is the instalment of various internals for the breakage of bubbles in order to reduce mean bubble size and consequently increase interfacial area and volumetric mass transfer coefficient.

In this work, the influence of installed self-agitated impellers on the volumetric mass transfer coefficient in an external-loop airlift reactor containing Newtonian viscous fluids was investigated. Tap water or aqueous 46 wt.% sucrose solutions were used as liquid phase. To quantify the effect of impellers on mass transfer all experiments were performed in a configuration without impellers and a configuration with impellers.

The results showed that in both airlift configurations the volumetric mass transfer coefficient increases with the increase of superficial gas velocity. In Newtonian sucrose solution volumetric mass transfer coefficient values were significantly lower (up to a factor of 3) in comparison to water mainly due to lower interfacial area available for mass transfer. The instalment of self-agitated impellers increased volumetric mass transfer coefficient in the range 13-40% because of the reduction in mean bubble diameter and minor decline in liquid velocity. The improvement in volumetric mass transfer was more pronounced in water as a liquid phase since water initially produces larger bubbles compared to sucrose making it more susceptible to the effect of impellers. Also, higher increase in volumetric mass transfer coefficient was obtained at lower superficial gas velocities in both liquid phases.

*Key words: external-loop airlift; volumetric mass transfer coefficient; self-agitated; impellers*

*Acknowledgements: This research was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Project No. 172025)*

## MATERIAL TESTS AND ANALYSIS OF AIRCRAFT MATERIALS

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### **Abstract**

The payload is only 20% of a presently used cargo aircraft's take-off weight, the circa half of the rest 80% is the empty weight. So it is obvious that reducing the empty weight improves significantly the economy, hence there is a huge demand in the aircraft industry for light structural materials with advanced parameters. Choosing a material is based on the following features: allowable stress, fatigue limit, crack-spread, corrosion, heat-resistance, accessibility and machinability, material cost and process resource demand. Our investigations focused on the tests of materials applied in aircraft's wing structure that can be made of wood, metal, plastic and composite materials. We made tensile tests by the QUASAR 100 tensile strength-testing machine of University of Szeged, Faculty of Engineering. The standard test specimens were manufactured from different wing samples (steel, aluminium, plastic, composite) received from the Airport of Szeged. During the tests we analysed the upper and lower yield points, tensile strength, elongation at rupture which features are essential from the point of view of their application.

*Key words: material tests, aircraft, tensile strength, yield point, elongation at rupture*

*Acknowledgements: The project has been supported by the European Union, co-financed by the European Social Fund. EFOP-3.6.1-16-2016-00014. The authors are thankful for it.*



# NEAR INFRARED SPECTROSCOPY INVESTIGATION OF WHITE BUTTON MUSHROOM PRESERVED BY COMBINED TREATMENTS

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## **Abstract**

Mushrooms are very valuable raw materials. That's why a lot of preserving methods were used for them during the last decades. The traditional is the heat treatment, but it can cause a great loss in the valuable components of the raw materials. Due to this fact and the new claim of the consumers, the minimal processing technologies become more important in the preservation of food.

For preserving the white button mushroom we used high hydrostatic pressure (HHP) and sous-vide technology. The parameters were 55°C, 75°C, 300MPa, 600MPa and their combination. After lyophilization, the samples were examined with Fourier Transform Near Infrared Spectroscopy (FT-NIR). For evaluating the data we used Canonic Discriminant Analysis (CDA). According to the results of the CDA, the samples made with the two preserving method are not in a different half of the discriminant space, but they are getting farther off the raw sample. Probably, the less change is caused by the single heat treatment, because these samples are the closest to the raw one. Thanks to this fact, these samples are also farther off those that was made with combined treatments than the samples made only with pressure treatment. The treatment order does not have an important role, because the group of the samples are very close to each other. However, in the case of the smaller dose (55°C/300MPa, 300MPa/55°) the groups are slightly farther off each other.

To sum up, all the treated samples are different from the raw one, so the change is demonstrable. The less change is caused by the heat treatment, and the effect of the single pressure treatments is similar to the combined ones. In the latter case the groups of the sample are very close to each other, and if we use the bigger dose (75°/600MPa, 600MPa/75°C) we get products with almost the same properties.

*Key words: mushroom, HHP, sous-vide, NIR*

*Acknowledgement:*



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# ELECTRONIC NOSE INVESTIGATION OF WHITE BUTTON MUSHROOM (*AGARICUS BISPORUS*) PRESERVED BY COMBINED TREATMENTS

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## **Abstract**

Mushrooms are very valuable raw materials. That's why a lot of preserving methods were used for them during last decades. The traditional is the heat treatment, but it can cause a great loss in the valuable components of the raw materials. Due to this fact and the new claim of the consumers, the minimal processing technologies become more important in the preservation of food.

For preserving the white button mushroom we used high hydrostatic pressure (HHP) and sous-vide technology. The parameters were 55°C, 75°C, 300MPa, 600MPa and their combination. The treated samples were examined with electronic nose. For evaluating the data we used Canonic Discriminant Analysis (CDA).

According to the results of the CDA, the groups of the samples can be differentiated. The preserving treatments result a product with another character. In the case of the simple treatments the bigger dose (75°C, 600MPa) causes greater separation from the raw sample. The difference between the two heat treatments is bigger than the pressure treatments. In the case of the combined treatments, the treatment order does not causes the definite isolation of the sample groups. However, if we use them in the smaller dose, the samples separate more from each other. There is a bigger difference between the heat and the combined treatments than between the pressure and the combined ones.

*Key words: mushroom, HHP, sous-vide, electronic nose*

*Acknowledgement:*



„SUPPORTED BY THE ÚNKP-17-2 NEW NATIONAL EXCELLENCE PROGRAM OF  
THE MINISTRY OF HUMAN CAPACITIES”

# THE DEVELOPMENT OF LOW-COST BIOGAS REACTOR

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## **Abstract**

One of the possible utilisation methods for organic wastes is anaerobe decomposition (fermentation). The main product of this process is biogas which is usually used for energy purposes due to its composition (mainly methane and carbon dioxide). The residual solid material after fermentation can be used as soil conditioner.

Lab-scale fermentation can be carried out using the “VDI 4630 – *Fermentation of organic materials Characterisation of the substrate, sampling, collection of material data, fermentation tests*” standard. Based on the conditions described in the standard, a small-scale low-budget reactor system were prepared. The temperature during the holding time was controlled with water bath and the gas production was determined with fluid displacement method. A peristaltic pump was used for the recirculation of the gas to mix the base material. Furthermore, the temperatures of the environment, the water baths and the inside of each reactor was automatically registered on a data collector.

*Key words: biogas reactor, fermentation, slurry*

## FURTHER DEVELOPMENT OF A RADIO-CONTROLLED MODEL CAR

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### **Abstract**

At the University of Szeged Faculty of Engineering, my project for the CAD-CAM Applications course was the CAD model of my own radio-controlled model car with Autodesk Inventor. I chose this project for my thesis, too. I've been interested in model cars since my childhood and I am motivated to find the way to improve the driving properties of my racing car, so the topic of my thesis is the further development of it. Analyzing the car I found more opportunities for this.

First possible development is the design of a new cooler. The performance of the electric engine decreases when the temperature of the engine is too high. To avoid this I redesign the heatsink and change the cooling fan to a more powerful one.

The drive system has a regular problem. Because of the lack of an effective power distribution between the front and rear drive, the wheels often spin, reducing the efficiency of the drive. To solve this problem I design a central differential mechanism between the front and rear one, hoping to keep the drive running more smoothly, even extending the longevity.

I analyze the aerodynamic properties of the car body with Autodesk Flow Design and according to the results, I will design a new, better one and a bottom chassis cover.

*Key words: CAD, Autodesk Inventor, RC car, Autodesk Flow Design*

# FRONT RUNNING GEAR DEVELOPMENT FOR THE AIRRARI PNEUMOBILE RACING CAR

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## Abstract

The University of Szeged Faculty of Engineering has taken part the International Pneumobile Competition since 2009. The pneumobiles are compressed air powered racing cars which are designed and manufactured by students.

Our race teams achieved a lot of great successes, meanwhile we gained a lot of experience. In every year 2-4 racing cars participated from Szeged at the competition in Eger as well as at the gala races organised in Kecskemét and Budapest. So far 10 cars have been made in Szeged and each car had a lot of modifications.

Last year one of the main fields of our development was the front running gear. Until 2015 we use rigid running gears but the increasing speed made necessary to design a sprung one. The higher and higher cornering speed needs better running gears. On the inner side of a three wheeled vehicle the wheel could lift up from the ground in a corner and the car drift out. A well-optimized sprung running gear is one of the most important components of a successful racing car. It results higher stability and cornering speed.

Our requirements against the new front running gear and steering system are the following: negative wheel camber angle as on the previous cars, to reduce the axial load of the front wheel on the outer side of the corner. Spring stroke is 20 mm out and 40 mm in, the change of the track must be minimal in this range, the turning circle diameter must be less than 6 meters, the actions of the springs are independent, during the actions of the springs the toe-out of the wheels must be constant.

We use our own-designed rack and pinion steering gear represented in this article. It has new modifications. The gear rack has adjustable guide bearing, so the backlash of the 2016 version is greatly reduced.

The new running gear is designed with Autodesk Inventor. The correct working check and final modifications were done with Lotus Shark Suspension Analysis software.

*Key words: pneumobile, running gear, steering gear, Lotus Shark Suspension Analysis*

*Acknowledgements: The authors and the Airrari Szeged Pneumobile Team are thankful for the financial support provided by our sponsors represented on the racing car and at the team's all appearances.*

# THERMOANALYTICAL QUALITY EXAMINATION OF CONFECTIONERY RAW MATERIALS AND PRODUCTS

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## **Abstract**

In today's modern quality assurance systems (GMP, HACCP) is essential for a complete examination of the raw materials to a finished products, documentation of processes. The systems aim at quality assurance and harmonious cooperation of quality control, eliminating critical points. Solid base materials have different crystallization, re-crystallization, polymorph, can have melting point characteristics, which can be used to identify specific materials, to detect possible impurities. Another such feature is the moisture content of the material, and crystal water content. During production may undergo up to several hundred degrees of temperature change, which may cause unwanted transformations, it is important to define these parameters before the process is started. This method is used in thermal analysis, which is already being applied in several areas.

The examination has two components; analysis of various sugar-containing hard candy mention, whose TG-DSC was measured at Faculty of Pharmacy, University of Szeged with a Mottler Toledo TGA / DSC 1, which was operated by Géza Regdon PhD associate professor. The analysis of the measured data was performed by software called STARe Thermal Analysis. On the DSC curve of 25%, 50%, 75% candy around 60 °C, an endothermic peak appears, which is probably due to the interaction of substances. They may report the initial inversion of sugar, but may also mean the melting of the crystal structure, the candy structure was only partially crystalline. The peak appears as a larger area in the case of higher sugar content. This peak can be used to identify such a term hard candy syrup and sucrose, or the parameters of the peaks after recording a calibration line, even an unknown sugar content can be accurately determined.

In the confectionery industry, until today, the thermodynamic characteristics of hard candy are empirically determined. The method presented in this paper provides tangible results in making production more smooth. A similar character DSC curves provide opportunities for contamination or to exclude an undesirable sugar inversion. It is possible to add additional components to the melting point, to examine the effects on it decomposition temperature.

*Key words: thermoanalytical quality, confectionery, crystallization, endothermic peak*

# INVESTIGATION OF SORPTION OF 2,4-DICHLOROPHENOL ON SPECIAL HUNGARIAN OIL SHALE

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## **Abstract**

Environmental pollution would be a global problem therefore new methods have to be developed in order to eliminate the different contaminants e.g. from the natural waters. Special problems are caused by the organic pollutants generated in the chemical industry and agriculture (technological intermediates, pesticide residues etc.). These compounds are often highly toxic and contaminate both the soil and the groundwater. The study of environmental behavior of these chemicals is very important and can help in pollution prevention.

The aim of the present work was to find a method to reduce the groundwater contamination caused by organic compounds. The applicability of a special Hungarian oil shale as an adsorbent was tested. The organic material content of the applied oil shale was above 30 % being mostly kerogen. Static equilibrium experiments were carried out in order to study the adsorption of 2,4-dichlorophenol from aqueous solution using analytical methods like HPLC-UV. The data fit to a Langmuir-like isotherm within the equilibrium concentration range of 0 and 100 mg/l. According to the laboratory tests conducted so far this adsorbent immobilizes the contaminants more efficiently than a number of other substances applied in different remediation technologies. Concerning the amounts added, above 90 % of the 2,4-dichlorophenol was adsorbed by the oil shale.

The contaminants are bound strongly by the sorbent therefore they cannot be washed out by the groundwater flow. It results in prolonged retention time of these compounds thus their biological availability will be better. The sorbent has its own special bacterium flora which can lead to effective biodegradation as well as to lower toxicity.

The application of the oil shale has a significant advantage because it does not require a separate treatment process for regeneration. Results showed that this oil shale can be used efficiently in the treatment of natural waters polluted by chemicals.

*Keywords: oil shale, adsorption, 2,4-dichlorophenol*

# POSSIBLE IMPLEMENTATIONS OF THE CLOUD-BASED DATA-CENTRIC IOT PILOT PLATFORMS FOR SMART CITIES AND AGRICULTURE

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## **Abstract**

The Internet of Things (IoT) is starting to appear everywhere in many shapes and forms. But security is one of the most crucial thing that could trip up the growth of the IoT. Following security principles used in enterprise computing can help clear that issue. Already there are more connected devices than people on the planet, according to leading researchers in this area. By 2020, there will be 50 billion connected devices, outnumbering people by more than 6 to 1. Most of these devices will be controllable over the Internet, and they will increasingly be responsible for collecting and transmitting sensitive data. Today consumers might own an app that collects information on their exercise routine. In a few years, those same people might have an Internet-enabled medical device that continually delivers data to their doctor. In the wrong hands, data from home management systems could be used to assess user's whereabouts. Likewise, businesses could be vulnerable when they connect things like HVAC, irrigation, or commercial appliances.

*Key words: IoT, Smart city, Cloud platform*



# USE OF SORGHUM FLOUR FOR BREAD AND CAKE PRODUCTION AFTER HEAT TREATMENT

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## **Abstract**

Although the modern dietary recommendations forces us to decrease the carbohydrate rich cereal products from our everyday diet, we have to say that they are one of the most important staple foods. As they give the energy basis to the human body and have an important role in the protein intake they are stable components of the foodstuffs, therefore, their selection is necessary to improve their positive effects. Sorghum is an ideal opportunity increasing the demand, as its consumption has several nutritional benefits. On the other hand, it is a gluten free cereal, so it can be attractive both for those who suffer from coeliac disease and those who tries to remove gluten from their diet because of any non health-related reason. The task is to make attractive sorghum based products for the market. The general problem with these products is the structure – if it is possible to form a dough what preserves its shape and structure during processing, storing and transform, most cases it is too dense compared to the gluten containing bakery products.

Dry heat treatment can significantly improve the quality of bakery products made from sorghum flour. In our experiments we evaluated the baking properties of flour mixtures of sorghum flour, corn and rice flour, oatmeal and potato, corn and rice starch alone and in combinations. We found that the flour composition significantly influenced the physical properties of bakery products while the differences were negligible in the case of cakes. The conclusions are similar in the case of sensory evaluations: the consumers did not experienced significant differences in the case of cakes, however, in the case of bread the taste, appearance, structure and overall acceptance showed large differences.

*Key words: sorghum flour, heat treatment, baking*

# MEMBRANE FILTRATION TESTS FOR DAIRY WASTEWATER SEPARATION

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## Abstract

Dairy industry, as one of the most water-based food technology, produces large amount of wastewaters that has high concentration of organic matters with high chemical and biological oxygen demand (*COD* and *BOD*). Without proper treatment, discharging wastewaters into sewerage and living waters is a risk that may lead to serious environmental damage such as eutrophication. Compared to conventional dairy sewage treatments, membrane filtration is a promising method, as it reduces organic load to a large extent, in addition the process runs on mild conditions, high fluxes and low transmembrane pressures, that is, a relatively economical process. Also, combined with membrane module vibration, membrane fouling, a main drawback of membrane separation techniques can be reduced. This method produces reusable water and the retentate with high organic concentration, could be recycled as biogas.

In this study, vibratory shear enhanced ultrafiltration (*UF*) and nanofiltration (*NF*) processes for synthetic dairy wastewater purification were carried out. The surface characteristics of 5, 7 and 10 kDa molecular weight cut-off (*MWCO*) *UF* membranes were also investigated via contact angle measurement. In membrane separation experiments, the operational parameters, such as pressure and module vibration amplitude were examined on the filtration efficiencies: fluxes and membrane rejections of turbidity, total dissolved solids, conductivity and *COD*.

In contact angle measurements the volume of dropped samples and residence time of the droplets were investigated in order to compare different membranes.

Our results show that membrane filtrations can be successfully applied when our aim is to produce as low as possible *COD* permeates for discharging, or the goal is to achieve a concentrate with the highest possible *BOD*, for post-treatment in order to gain sufficiently high biogas production. 5 kDa *MWCO* membrane showed the best results for both purposes. In terms of membrane attributes, the time the droplets spent on the surface was only considerable with the highest cut-off membrane, and the droplets were the most stable in time on 10 kDa membrane.

*Key words: dairy wastewater, contact angle, filtration, vibration*

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# MODELLING OF CEREAL ORIGINATED BEVERAGE ULTRAFILTRATION BY HERMIA MODEL

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## Abstract

Membrane filtration process are gaining more attention and focus in food industry due to their advantages (environmental friendliness, cost saving and product improvement) compared with other conventional methods. However, membrane can be easily fouled by various solutes, for instance, protein and polysaccharide in food industry. Fouling decreases permeate flux severely and thus increases filtration processing time, which is not economically effective. The characterization of membrane fouling mechanism is highly important especially during the ultrafiltration process. In order to produce higher permeate flux and greater solute rejections, a clear understanding on membrane fouling mechanism is essential.

In this work, Hermia's models were used to investigate the fouling mechanisms. According to the modified Hermia model, there are four main fouling mechanisms: complete blocking, standard blocking, intermediate blocking and cake layer formation. In complete pore blocking, the particle size is larger than the membrane pore size; thus, pores are blocked completely. In the standard-blocking mechanism, particles are much less than the membrane pore diameter so can enter the pores and deposit inside the pore walls, which may lead to blocking of pores and reduce the pore volume. In the intermediate-blocking mechanism, the particle size in the feed is the same as the membrane pore size; however, the membrane pore is not necessarily plugged by particles, and some particles may deposit on each other. Both large and small particles can accumulate on membrane surface to form the cake layer in the cake-formation mechanism.

Membranes made of polyethersulfone (PES) with molecular weight cut-off (MWCO) of 10 kDa were used in this study. Ultrafiltration experiments were performed at different cereal originated beverage (rice and oat), transmembrane pressures (0.05 and 0.1 MPa) and stirring rate (100, 200, 300 and 400 rpm). By fitting the experimental data into four models, fouling mechanism which was prevailing can be identified. The main fouling mechanism can be confirmed according to the relevant coefficients of determination ( $R^2$ ) calculating experimental data. Larger  $R^2$  values indicated better fitting models.

*Key words: ultrafiltration, fouling, cereal originated beverage, Hermia model*

*Acknowledgements: The authors are thankful for the financial support provided by the Hungarian State and the European Union (EFOP-3.6.2-2017-00010 – RING 2017) and the project Hungarian Science and Research Foundation (OTKA contract number K 115691).*



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# CONNECTION BETWEEN THE KERNEL HARDNESS AND THE FLOUR QUALITY IN HUNGARIAN WINTER WHEAT

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## **Abstract**

Kernel hardness controls by friabilin protein and it depends on the relation between protein matrix and starch granules. Friabilin presents in high concentration in soft grain varieties and it is low concentration in hard grain varieties. The high gluten, hard wheat flour generally contains about 12,0-13,0 % crude protein under Mid-European conditions. The relationship between wheat protein content and kernel texture is usually positive and kernel texture influences the power consumption during milling. Hard textured wheat grains require more grinding energy than soft textured grains.

The aim of our research was to determine the possible relationship between kernel hardness and various other parameters of the flour (dough visco-elastic characteristics, wet gluten, water absorption, flour recovery, alveograph). We used Perten SKCS 4100 to determine the kernel hardness, while the Perten 3303 mill was used to establish Particle Size Index (PSI). Registered and widely used Hungarian wheat varieties (7 of HRWW and 4 of SRWW) were applied in the study. Twin correlations were used to determine the relationship among the various traits.

According to the results, there is a very strong correlation between the milling energy and the kernel hardness ( $r=0.99$ ). The correlation between hardness index and the examined flour parameters was also significant ( $r=0.81-0.87$ ). We found strong correlation between the milling energy and water absorption  $r=0.878$  of the flour. The associations found in this study will help to better understanding the wheat grain and flour quality technological aspects.

*Key words: wheat kernel, flour parameters, SKCS 4100*

## EFFECT OF OPHIOBOLIN A ON KIR2.1 POTASSIUM CHANNEL IN CHICKEN SKELETAL MUSCLE CELLS

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### Abstract

Ophiobolins are members of the family of phytotoxic metabolites, and they possess antitumor, antibacterial and antifungal activities. The ophiobolin A and derivatives exhibit a broad spectrum of biological activities but their biological consequence are not well known. The cellular inward rectifier currents ( $I_{K1}$ ) are sustained by kir2.1 ion channels mainly and have a role in maintaining the resting membrane potential, contributing to the beginning and the final repolarization in all cells. Recently, it was revealed in our laboratory that the 6-epi-ophiobolin A (6EOPA) influenced the elasticity of the cell surface, the Young's modulus had been moderately changed as well as the cell volume and the heights of the cells.

*Aim and methods:* The aim of this study was to investigate the effect of 6EOPA on chicken skeletal muscle cells. For this purpose, we treated muscle cells with low concentration of OPA as an external stimulus and used immunofluorescence method for labelling kir2.1 channel complexes. Detection was performed with an Olympus FV1000 confocal laser scanning microscope.

*Results:* The kir2.1 ion channels are colocalized with anchoring protein of synapse-associated protein 97 (Sap97) in non-treated cells, but we determined only partial overlaid kir2.x channel complexes in the presence of 6EOPA. The protein pattern was altered and the level of kir2.x was decreased compared to controls. These results highlight the physiological role of kir2.1 ion channel complexes together with Sap97. The associated complex structure of kir2.1 ion channels with Sap97 protein is essential for maintaining the normal physiological function of inward rectifier currents contributing to normal potassium ion homeostasis in muscle contraction.

*Key words:* ophiobolins, Kir2.1 potassium ion channel, chicken muscle cells

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## EVALUATION OF THE SEASONAL EFFECT ON THE MILK PERFORMANCE OF COW'S AND GOAT'S

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### **Abstract**

The overwhelming part of cow's milk is processed in dairy plants but only a few one make milk products from goat's milk in Hungary. In case of cow's milk, the seasonal changes in the amount and the composition of processed milk follow the calving regime because of the intensive breeding. But in case of goat's milk, these parameters are determined by the usual changes during the lactation. In this study the *goal* was a long term monitoring for the parameters of raw milk and compare between cow and goat.

*Aim:* Our aim was to evaluate data of the amount and composition of cow's and goat's milk from a dairy firm and from two goat farms.

*Materials and Methods:* Data of dairy firm represents a yearly purchasing while the milking performance of goats was investigated during lactation. We examined the quantitative changes in the indicators of nutritional values in raw milk from Holstein Friesian cow's samples collected by Szekszárdi Tolnatej Zrt. Company during one year and monitored seasonal changes of the content values. But the data of goat's milk from a Hungarian White goat flock and a crossbred Hungarian native (mixed) goat flocks were investigated.

*Results:* During one year, we validated amount of protein, carbohydrates, lipids and other parameters changing of the raw milk in the seasons of both animals. In case of cow's milk, the seasonal changes in the amount and the composition of processed milk follow the calving regime because of the intensive breeding. The values of proteins and lipids of raw milk were growing periodically between early summer and December in cows. The trend of changes in the amount and the composition of goat's milk during lactation partly met the expectations. The lactation mean of fat-, protein content and fat/protein ration of Hungarian White goat's milk were 4.09%, 3.82% and 1.11, while in milk from mixed flock 5.04%, 3.41% and 1.41, respectively. Comparing these data of milking goats to those in literature, we determined low level of lactation milk yields per capita in both of flocks, 254.4 litres and 317.3 litres in case of Hungarian White and of mixed flock. This might be caused by the lack of feeding, weather conditions and the different milking frequency.

*Key words:* raw milk of cow's and goat's, seasonal changes, composition

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# NATURAL FIBRE REINFORCED POLYMER COMPOSITES FROM TEXTILE WASTES – AN OVERVIEW ON NEW POSSIBILITIES

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## **Abstract**

The current interest for natural fibres from textile wastes as an environmentally correct composite reinforcement has motivated the investigation of new possibilities. For instance, the textile fibres from the textile wastes were recently found to have adequate mechanical properties to reinforce polymer composites. Most natural fibre composites, including the textile waste inserted composites, however, are fabricated with traditional non-degradable polymer matrix but still presenting a recycling advantage over the common glass fibre reinforced polymer composites. Therefore, textile waste inserted composites stand out as a relevant class of engineering materials.

The greatest challenge in working with natural fibre reinforced polymer composites is their large variation in properties and characteristics. However, with appropriate attention to fibre and resin design and structural geometry, natural fibre composites may prove a viable alternative to traditional materials in the future. Industrial ecology, eco-efficiency, and green chemistry are guiding the development of the next generation of materials, products, and processes.

*Key words: polymeric composite materials, bio-reinforcement, bast fibers (flax, hemp or jute)*

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# HIDRODINAMIC FORCE INFLUENCED HEAT TRANSPORT AT CONVECTIVE DRYING

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## **Abstract**

This paper presents results of experimental and theoretical approach of heat transfer around simple porous bodies during forced convection. The calculated heat transfer coefficients using the measured parameters shows a higher values as the heat transfer coefficients values from the dimensionless Nusselt correlations given in the literature. The reason of this difference was provided by theoretical way using a boundary layer theory. There exist general equations for the heat, mass and momentum transfer on the boundary layer. Numerous experimental and theoretical studies deal with the solution of these equations by analytical or numerical way. An analytical model was proved by this experimental study; and the existence of the non-zero surface velocity caused by hydrodynamic force is verified during the steady-state period of convection drying.



# EFFECT OF SHAFT MISALIGNMENT ON COUPLING AND ENERGY CONSUMPTION

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## **Abstract**

One of the most important requirements of the market competition is the production of economically produced products on customer's demand and in proper quality. That can be guaranteed only by reliably operating machines, instruments being in good conditions, so their maintenance is of capital importance. It is worth considering it, since the overwork of machine adjustment returns multiply during the lifetime of the machine.

The subject of our research is the investigation of different shaft misalignments' effect on a given machine group's lifetime. Our goal is the evaluation of the here measured bearing vibrations by SPM method and spectrum analysis, and as an innovation the analysis of economic effects of coupling alignment and applied investigating methods. The literature describes in detail the measurement of bearing vibrations, so we only slightly deal with it. But the economic effect of the coupling alignment has not been sufficiently investigated yet, so in this paper we make effort to reduce this lack by measuring the power consumption. We think there is some incompleteness in the recognition of shaft alignment faults, so we analyse the misalignments with temperature and noise measurement, too. During our work we have investigated the skew shaft misalignments. Our measurements partly confirm the literature descriptions, but we achieved surprising results as well.

# UTILIZATION OF ADVANCED OXIDATION PROCESSES FOR ADVANCED MEMBRANE SEPARATION OF OIL CONTAMINATED WATERS

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## Abstract

Water source protection is a major challenge of the 21st century [1], therefore continuous developments of available wastewater treatments are necessary. Hazardous oily contaminants can be effectively purified by the available membrane separation techniques, such as microfiltration [2, 3] and ultrafiltration [2, 3], however the accumulation of hydrophobic contaminants on the membrane surface leads to membrane fouling and significant flux reduction, which often limits the economic utilization. Promising fouling mitigation solutions can be classified into two main groups: (1) utilization of photocatalytic and/or hydrophilic nanomaterials to develop antifouling and/or self-cleaning membranes [4, 5] and (2) investigation of suitable pre-treatments (such as destabilization, ion exchange, gas injection, oxidation), which are able to reduce the accumulation of the contaminants on the surface [6, 7]. In the present study the available advantages were discussed, when different photocatalytic nanomaterial (TiO<sub>2</sub> or TiO<sub>2</sub>/CNT nanocomposite) modified membranes or pre-ozonation were used during the membrane filtration of oil-in-water emulsions. Available fluxes, different filtration resistances (i.e. membrane-, reversible- and irreversible resistances), flux recoveries, fouling mechanisms were discussed in detail.

*Key words: membrane filtration, advanced oxidation processes, oil-in-water emulsion, fouling mitigation*

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# INVESTIGATION OF THE EFFECT OF OZONE PRETREATMENT IN THE MEMBRANE FILTRATION OF REAL DAIRY WASTEWATER

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## **Abstract**

The dairy industry generates wastewaters characterised by high biological and chemical oxygen demand representing their high organic content, mainly carbohydrates, proteins and fats originating from milk. There are several investigations to reuse of dairy wastewaters; membrane processes are a promising method to treat such wastewaters. Earlier works proved that with membrane filtration an appropriate retention can be achieved and the permeate can be reused. However, membrane fouling is a limiting factor in these processes. Advanced oxidation processes (AOPs) such as ozon-pretreatments are widely used in the fields of water and wastewater treatments and are known for their capability to mineralise a wide range of organic compounds. AOPs also have some other effects on the filtration procedure, e.g. the microfloculation effect of ozone may play a significant role in increased elimination efficiency and causing a decreased level of irreversible fouling.

This study aimed to investigate the effect of ozonre as pre-treatment before ultrafiltration of real dairy wastewaters. Fluxes, filtration resistances and pollutant retentions were determined and compared.

*Key words: membrane separation, ozone pretreatment, wastewater treatment*

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# DEVELOPMENT OF MATZO MADE OF WHOLEMEAL RYE FLOUR AND ITS IMPLEMENTATION IN THE INDUSTRY

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## **Abstract**

Bakery products are one of the most important food sources of the population. In the baking industry, continuous development of products is required because consumers with different nutritional needs are pushing for new requirements for food. Along with the low caloric content, there is growing attention to the functional effects of foods. In our work, we focused to increase the fibre content in a special bakery product which is one of the main trends in the development of food in the baking industry.

The aim of our work is the development of a matzo made of wholemeal rye flour, which helps in healthy nutrition for the customer's and more economical from production's point of view.

We chose the matzo for our work because, thank for its simple recipe and technology, it's very suitable for product development for consumers with different nutritional needs. The main aim of the product development in our project is to increase the nutrient content by the raise of mineral and fibre content.

In the first part of our work we performed basic measurements with flours used during product development. We measured the quantity and quality of gluten protein with Glutomatic-Gluten Index System, the activity of amylase enzymes with Falling Number 1400 and we did a complex dough monitoring with METEFÉM Valorigraphe FQA 205 of BL80, BL160, RL90 and RLTK flours. In the course of the studies we have found that BL80 and BL160 contain large amount of strong gluten proteins and each flour is low in enzyme content. In the baking industry flours with low enzyme content have negative impacts on the properties of the product but this feature doesn't matter to the matzo. In the dough monitoring it was found that each flour is suitable for matzo making, but RL90 is only slightly recommended because the large amount of water it absorbs reduces the efficiency of production.

In the second part of our project we compare the basic matzo with matzos made of 3 different recipes. We measured the ash content, the acid content and fibre content with 2010 Fibertec System of samples. Then we made an economic calculation.

Based on results of examinations it can be ascertain that the new product shows more advantageous values of the fibre content's and the prime cost's point of view.

*Key words: trend, development, nutrition, matzo*

## NUTRITIONAL JUDGEMENT OF ORNAMENTAL POULTRY MEAT

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### **Abstract**

In our experiment, we compared different properties of an ornamental poultry, the silk hen, with guinea fowl and a meat producing hen breed, the Orpington. The experiment started with hatching. The animals were raised free range, fed with the same feed. We measured the growth rate during breeding and then the slaughter yield, i.e. the proportion of meat parts. The ratio of the silk hen's thigh to the cut body was nearly twice as large as the other two breeds, but the breast was only slightly smaller. When examining the chemical composition of the breasts and thighs we found that the water, fat and protein content of the silk hens are similar to the guinea fowl, and contain less fat than the Orpington. There was no significant difference in the technofunctional properties (water holding and water binding capacity). Based on the results of the colour measurement we found that the flesh of the silk hens is much darker, and it has a blackish shade. This was also supported by the sensory examination. Critics did not disliked the dark-coloured meat, which was considered to be delicious and stocky.

*Key words: ornamental poultry, nutrition, organoleptical properties*

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