Tomas Bata University in Zlín

Science Activity Annual Report

2021

CONTENT

1 DEFENDED DOCTORAL THESES

In 2021, a total of 28 theses were defended: 10 at the Faculty of Technology, 10 at the Faculty of Management and Economics, 5 at the Faculty of Applied Informatics, 1 at the Faculty of Humanities, and 2 at the University Institute.

1.1 Faculty of Technology

Degree Programme: CHEMISTRY AND MATERIALS TECHNOLOGY

Degree Course: Technology of Macromolecular Compounds

Amini Moghaddam Maliheh, Ph.D.

Date of defence: 28. 5. 2021

Supervisor: prof. Ing. Vladimír Sedlařík, Ph.D.

Functionalized biodegradable co-polyesters for medical applications

Abstract

This doctoral thesis is aimed at development and characterizations of novel biodegradable polylactid acid based systems for medical applications. The first part of this work is dedicated to preparation and characterization of novel biodegradable mikro struktured antibacterial systems where the antibacterial activity of the prepared materials was ensured by incorporation of the inorganic additive based on double sulfates of aluminumThe second part is focused on preparation and characterization of 3D polymer structures. The antibiotic gentamicin sulfate was used as model bioactive agent suitable for would dressing applications. Both experimental parts were also comprised of the detailed structural a degradation studies that bring novel insights into the field of biodegradable polyesters medical research.

Ing. **Hamid Yasin** , Ph.D.

Date of defence: 29. 4. 2021

Supervisor: prof. Ing. Petr Svoboda, Ph.D.

Cross-linking, Morphology and properties in polymer blends and composites

Abstract

Three electrically conductive carbon containing composites were studied: (1) ethylene vinyl acetate (EVA)/carbon fibers (CF), (2) ethylene-butene copolymer (EBC)/electrically conductive carbon black (CB) and (3) EBC/CF. The composites were prepared by mixing on a two-roll mill or in a Brabender. Sheets were prepared by compression molding. The influence of electron beam irradiation at levels 60, 120 and 180 kGy was studied for EVA/CF composites. Gel content study helped in calculation of the parameters in Charlesby-Pinner equation. Parameters G(X) = 3.78 and G(S) = 2.35 mean that both cross-linking and chain scission occur during e-beam irradiation. The ratio of the parameters G(X)/G(S) = 1.61 indicates that cross-linking prevails over the scission for this EVA copolymer. Room temperature (25°C) and high-temperature (150°C) mechanical properties (creep, stress-strain and frequency sweep) were studied by dynamic mechanical analysis (DMA). The influence of electron beam irradiation was best observed at 150°C; there was a systematic decrease in creep, increase in stress at given strain, increase in real part of shear modulus G' and decrease in loss factor (tan delta). The experimentally obtained increase in modulus due to the addition of carbon fibers was discussed with the help of Guth-Gold and Guth-Smallwood models. Shape factor L/D was estimated by direct observation by optical microscopy. The composites were tested for changes in electrical resistance during the stretching by various forces. Gauge factor, defined as the ratio of relative change in electrical resistance to the mechanical strain, was calculated. Several composites showed significant changes in electrical resistance during stretching showing a potential use of these electrically conductive composites as strain sensors that could be used for example as artificial muscles in robotics.

Ing. **Marek Pöschl,** Ph.D.

Date of defence: 21. 4. 2021

Supervisor: doc. Ing. Dagmar Měřínská, Ph.D.

The Effect of Rubber Compound Composition on the Vulcanizate Barrier Properties

Abstract

Rubber products are very important and can be found in many variable applications. Each rubber product have to fulfill physical-mechanical, chemical and other properties given by its application. Moreover, specific properties according the product application can be required. One of them are barrier properties. They plays significant role in the case of tyres, membranes, hoses, diaphragms, masks, moreover damping pads etc. In this case, the properties as gas or liquid permeability, but as well as mechanical vibration damping are relevant. Products with requirements on special properties, must also meet general mechanical properties, such as tensile strength, elongation, hardness etc. Required poperties can be achieved by choosing suitable type of the rubber, as well as filler. The rubber compound can be modified by various type of fillers. The most used are carbon black, because of not only a good reinforcing but also antiaging effect. In addition, there are also light fillers such as silica, kaolin, CaCO3, various clays, etc. However, due to their polar character (polar oxygen groups on its surface) these fillers are less compatible with non-polar types of rubber (natural, styrene-butadiene, butadiene and ethylene-propylene rubber). In order to achieve a good reinforcing effect even with these fillers, they must be surface-treated. One of the most used modifications in the rubber industry are modifications using coupling agent - silanes. This process is called organo-silanization. Due to this process, the rubber products filled by light fillers can achieve excelent mechanical properties. The disadvantage, however, is their high price, which significantly increases the price of the product. Therefore, other light fillers modifiers are under intensive study to gain the similar rubber products properties as by silanes. This thesis is focused on the effect of light fillers modifiers as polyethyleneglycol (PEG), dimethylsulfone (DMSO2) and other on the physical-mechanical and barrier properties of the vulcanized rubber. Coupling agent with the DMSO2 was a suitable modifier that exhibited good mechanical properties similar to silanes. The sulfonyl functional group is contained in this modifier. Another benefit of the modifier is a very low toxicity and thus significantly reduced burden on the enviroment. The addition of the DMSO2 into the rubber compound leads to the increase of the mechanical properties (stress at break and strain ...) as well as reduction in gas permeability similar or even better than in case of silane. At a certain concentration per weight of filler, there was also a reduction in gas permeability, which in some cases was even lower than with the silane TEOS used. The positive effect on the mechanical properties as well gas permeability has the addition of further modifier, maleic anhydride. The grafting of this material into the structure of styrene-butadiene rubber

followed by subsequent silica modification by DMSO2 improvement of mechanical properties and low gas permeability was achieved by grafting on to SBR rubber and subsequent modification of silica with DMSO2. In this case, even better properties (higher tensile strength, low gas permeability and low loss factor tan "delta") were measured than for silane alone.

Ing. **Erik Wrzecionko**, Ph.D.

Date of defence: 31. 8. 2021

Supervisor: doc. Ing. Antonín Minařík, Ph.D.

Preparation and characterization of hierarchically organized functional polymer layers and porous systems

Abstract

The works deals with the preparation of structured polymeric surfaces. Different approaches leading to the formation of porous systems characterized by different symmetry and size of surface structures are described here. Attention is paid to the phase separation processes in the system of popolymer/mixturef good and poor solvent. Current knowledge and hypotheses explaining the formation of surface and volume pores are described. Surface relief formation in the swollen polymer layer is discussed with respect to surface tension, Laplace pressure, capillary forces, flow, viscoelastic phase separation, solvent quality, evaporation rate and vapor condensation. These findings are then summarized in a newly proposed model describing the formation of polystyrene surface in the process of time sequenced dosing of solvent mixture. Within the work, the construction of two original instruments is described in detail. These instrument allow to control the process parameters of polymer surface forming at time sequenced phase separation at rotation. Apart from polystyrene surfaces, also the surface treatment of hyaluronan and silk fibroin based materials was addressed. Experimental results related to these surfaces suggest that the newly proposed process of phase separation can also be applied to structurally complex macromolecular systems. Structured polystyrene and fibroin layers were then utilized for the study of cells interactions with artificially prepared surfaces. It was proved that structured surfaces efficiently simulate native

environment for the cultivated cells. Besides, some specific types of hierarchically structured surfaces can initiate stem cells differentiation process.

Degree Programme: FOOD CHEMISTRY AND TECHNOLOGY

Degree Course: Food Technology

Ing. **Andrea Čablová**, Ph.D.

Date of defence: 17. 3. 2021

Supervisor: doc. Mgr. Robert Vícha, Ph.D.

Synthesis and study of physicochemical properties of 1-adamantylimidazolium ligands for supramolecular complexes with cucurbit[n]urils and cyclodextrins

Abstract

Supramolecular chemistry is a rather new discipline, providing highly complex insight into reversible non-covalent interactions between molecules. The objective of the dissertation was to prepare and study multitopic ligands based on adamantane core. First, specific deuterium-labelled bis(1-adamantylmethyl(benz)imidazolium) salts were synthesized. Furthermore, ESI-MS data was used to determine a binding properties with cucurbit[7]uril. It was found on fragmentation pathways under collision-induced dissociation (CID) that 1-methyladamantane part of these molecules is able to oscillate inside of cavity CB7. This movement is related to two different fragmentation pathways, which can be also attributed to the different axel bulkiness of bisimidazolium salts. Within the second part of this work, imidazolium and benzimidazolium salts with aliphatic sidearms terminated with carboxylic acid functional group were synthesized. Proton transfer reaction was utilized to control the formation of negatively charged carboxylate as a response to pH changes. Binding strengths of imidazolium and benzimidazolium derivative guests were investigated with cucurbit[n]urils, "alfa"-cyclodextrin ("alfa"-CD) and "beta"-cyclodextrin ("beta"-CD). Because an appropriate competitor for measurements was not found, we can only roughly estimate association constant values of ligands with CB7 to be of the order >107 dm3.mol-1. Both "alfa"-CD and "beta"-CD bind the ligands with association constant values of 104 dm3.mol-1. According

to 1H NMR spectroscopy, the lipophilic adamantylmethyl part of the ligands was complexed with CB7, CB8, "beta"-CD, while hydrocarbon chain was complexed with "alfa"-CD. Unexpectedly, the smallest tested macrocycle of cu-curbit[n]uril family, CB6, did not bind hydrocarbon chain with reasonable K value at any pH of the environment. Molecular structures of all prepared carboxylic acid derivatives were confirmed by single-crystal X-ray diffraction analysis. The ever highest K value for 1:1 complex was reported in 2017 for a bis(trimethylammonio) derivative of diamantane. Therefore, we decided to prepare novel binding motif based on bis(4-aminophenyl)diamantane. Since the diamantane precursors are not available commercially, the synthesis of this intriguing cage hydrocarbon was adopted from literature and optimized within the third part of this work. Finally, trimethylanilinium salt based on adamantane core was synthe-sized. Due to 1,4-phenylene linker between the adamantine cadge and cationic trimethylammonium moiety, the association constant was expected to be in the range from 108 dm3.mol-1 (no ion-dipole interactions) to 1012 dm3.mol-1 (optimal ion-dipole interactions). As it was expected, the association constant with CB7 was found in the middle of the abovementioned range (KCB7=3,4×1010 dm3.mol-1) while binding constant value with "beta"-CD was unusually high. Thus it was demonstrated that phenylene linker be-tween ammonium group and the adamantane cage can be used as an efficient tool for tuning of the affinity towards CB7 preserving very high affinity to-wards "beta"-CD.

Ing. **Lucie Perníkářová**, Ph.D.

Date of defence: 12. 1. 2021

Supervisor: doc. RNDr. Burešová Iva, Ph.D.

Improving the quality and extending the shelf life of frozen semi-finished bakery products

Abstract

The aim of the dissertation thesis was to deal with the issue of gluten-free breads made from frozen dough and semi-finished products. Breads that have been frozen during technological process are currently widely available on the market. These products deal with positives (the supply of "fresh" bread during the day) and negatives (worse textural properties). In the

practical part, the rheological properties of gluten-free biologically leavened frozen dough were monitored. Gluten-free breads were made from amaranth, chickpea and buckwheat flour with water additions of 65, 70 and 75 % (weight percent based on the weight of the flour). Samples of gluten-free breads were made according to two recipes. The first recipe was basic and the second recipe contained additives - xanthan gum and instant rice flour. Two types of gluten-free pastries were evaluated - gluten-free breads made from frozen dough and gluten-free breads made from frozen semi-finished products. The extension test was used to evaluate the rheological properties. The texture parameters and the specific volume of gluten-free breads made from frozen dough and semi-finished products were measured. The textural properties and the specific volume of frozen samples were compared with fresh baked products according to the basic recipe. At the end of testing, all types of bread were evaluated by sensory analysis using a hedonic scale. All samples of gluten-free breads that were frozen had significantly worse values of specific volume, textural properties and sensory analysis. The use of xanthan gum significantly affected only some of the measured textural properties of gluten-free breads - the hardness reduction of chickpea and buckwheat breads. The use of instant rice flour had a positive effect on the sensory analysis (taste and aroma) of chickpea and buckwheat breads made from frozen dough and semi-finished products.

Ing. **Khatantuul Purevdorj**, Ph.D.

Date of defence: 19. 8. 2021

Supervisor: prof. RNDr. Leona Buňková, Ph.D.

Strategies to reduce biogenic amines produced by microorganisms

Abstract

In the present dissertation thesis, we investigated the influence of the selected protective cultures, their cell-free supernatants (CFS) and nisin on tyramine (TYM) production. Firstly, we examined the inhibitory effect of CFS from 22 protective cultures and nisin against biogenic amines producers isolated from various foods. The antimicrobial activity of the neutralized supernatants and nisin was determined by the agar-well diffusion method. Based

on the obtained results, 2 protective cultures (Lactococcus lactis ssp. lactis biovar diacetylactis CCDM 686 and CCDM 689) whose CFS showed the highest antimicrobial activity on tyramine producers were further studied. The influence of these 2 protective strains, their respective CFS and nisin on tyramine production by 2 strains, namely Latilactobacillus curvatus T3 and Lactiplantibacillus plantarum RIBM 89, was determined. These 2 strains were highly sensitive to the tested supernatants from lactococci and to the nisin. In addition, the effect of two cultivation temperatures (30 +- 1 °C and 12 +- 1 °C) and the impact of a different addition time of the protective cultures, their respective supernatants and nisin to the tyramine producers were examined. The kinetics of tyramine production were observed in vitro in the growth medium and the final amounts of tyramine were analyzed by HPLC/UV after previous derivatization with dansyl-chloride. The both tested strains (Lat. curvatus T3 and Lac. plantarum RIBM 89) showed a significantly higher tyramine production at 30 °C than at 12 °C ($P<0.05$). The addition of tested protective cultures and their respective CFS to the tyramine producers led to a decrease of tyramine content in both cultivation temperatures. The highest reduction of tyramine content (by 84% compared to the control) was observed after the cultivation of Lac. plantarum RIBM 89 with protective culture Lc. lactis ssp. lactis CCDM 689 at 12 °C (inoculation time of the both strains were 0 h). Based on the results obtained from the monitoring an impact of nisin on TYM production by strains RIBM 89 and T3, it can be concluded that the addition of nisin at all 3 concentrations reduced the TYM content in all cases. In all BAproducing strains tested, a higher decrease of tyramine content was determined in the environment with a higher applied concentration of nisin. Inoculation of protective cultures and their metabolites (CFS and nisin) in the later growth phase of BA-producing strains had no inhibitory effect on decarboxylase activity of these strains. Consequently, in order to prevent formation and accumulation of tyramine in high concentration in fermented food products, it is advisable to use nisin-producing strain or its metabolites (CFS and nisin) to enhance safety and quality of these fermented food products. However, further research should be done in order to examine these Lactococcus strains and their CFSs in real food system.

Ing. **Blanka Svobodová**, Ph.D.

Date of defence: 12. 1. 2021

Supervisor: prof. RNDr. Kubáň Vlastimil, DrSc.

Study of biologically active extracts from selected medicinal plants for application in modern food industry

Abstract

The aim of this work was to study medicinal plants from the tropical region that are scarcely investigated, for the possible application of their biologically active compounds in the modern food industry. The increasing interest of consumers in functional foods fortified by natural ingredients providing a health benefit and civilization diseases prevention, as well as the pressure on producers concerning the food safety against microbial contamination and prolonged shelf-life using natural antioxidants, opened a new market in modern food industry. Aerial parts of Momordica charantia L. and leaves, stems, fruits, and roots of Solanum stramoniifolium Jacq. were tested. Extracts prepared in 80% ethanol were submitted to the biological activity screening (antioxidant, anti-inflammatory, antitumor and antimicrobial) and their toxicity was evaluated in primal cell line test with PLP2. As part of the antimicrobial activity screening, the inhibition of both sensitive and resistant pathogenic bacteria was studied. The identification of the phenolic compounds present in the crude extracts was performed by liquid chromatography-mass spectrometry method (LC-MS) in order to determine the molecules responsible for the strong biological effect and already attributed to significant biological activity. The present structures were mainly the derivatives of hydroxycinnamic acid and glycosylated derivatives of quercetin, kaempferol, and isorhamnetin.

Degree Programme: PROCESS ENGINEERING

Degree Course: Tools and processes

Ing. **Jan Kledrowetz**, Ph.D.

Date of defence: 25. 6. 2021

Supervisor: doc. Ing. Jakub Javořík, Ph.D.

Use of FEM to design the shape and construction of agricultural tires

Abstract

In 1888 J.B.Dunlop invented and was granted a patent on the first tyre as we know it today. After that, the tyre began to spread rapidly throughout the world. Since then, the tyre has developed into a very complex and functional transport component. With the gradual expansion of applications, the demands on materials and tyre construction increased. After 2nd World War, production of radial tyres began, which was the biggest change in the construction of tyres until then. Shortly afterwards, tubeless tyres were introduced. Nowadays, tyres are subject to enormous demands in terms of speed, load capacity and mainly safety and reliability. Tyres are such a complex product that they are undoubtedly impossible to produce without a thorough development. This includes many different types of calculations, often very complex, requiring a deep understanding of mathematics and physics. As computer technology developed and improved, a finite element method-based systems began to expand rapidly. Over the years, appropriate material models have also developed significantly. This thesis deals with numerical simulation of agricultural tyres. In comparison with most of other types of tyres, these are exceptional in their size and large deformation during operation. Nowadays, most tyres are manufactured with radial construction. Therefore, this work focuses only on it. The first part is devoted to the calculation of the tyre profile. The shape of the tyre profile depends on the shape of a so-called meridian. In this work, selected tyres are designed so that the meridian is in the so-called equilibrium shape. Such state is described by a system of complex mathematical equations that can only be solved numerically. In this new method, standard FEM software is used to calculate this shape without having to solve manually this set of equations. The accuracy of this solution was verified by comparing it to the meridian calculated by a standard analytical method for several tyres of different designs and sizes. In the next part, these meridians are used and model of the whole tire is created. First, a 2D axisymmetric model, which is suitable for the calculation of rotationally symmetric tasks; in this case inflating the tire with the required pressure. This calculation is followed by an expanded 3D model, which is further loaded with a radial force. Creating such 3D model is very easy and the computational demands are small. The disadvantage is that when the calculation uses results from an axisymmetric model, its shape, even if it is modelled as 3D, must also be axisymmetric. Subsequent model that was created is a complete model of a tyre with the real tread pattern. This model is more complex, it cannot use the results from the axisymmetric task and therefore requires much longer computational times. Reinforcing parts, carcass and belts, are described by various available ma-

terial models. All versions are compared to the measurements of tyre dimensions under inflation and radial deformation characteristics in order to evaluate the most accurate and efficient solution.

Ing. **Přemysl Strážnický**, Ph.D.

Date of defence: 25. 6. 2021

Supervisor: doc. Ing. Soňa Rusnáková, Ph.D.

Processing and Characterization of Natural Composites

Abstract

Sheep wool is known primarily as a material used since ancient times, especially in the clothing industry, but also in the construction and engineering industries. It is used mainly for excellent thermal insulation properties, in popular use, it was used not only for the production of footwear but also blankets. The composite material with a polymer matrix of phenol-formaldehyde resin and a filler from wood sawdust was invented in 1907 by the chemist Leo Hendrik Baekeland, and this material was etched in memory under the name Bakelit and was mainly used for the production of light parts such as electronics, cars, he also made handles for tools and implements. The topic of the dissertation is the processing and characterization of natural composites. The main part of the work is research into the preparation of natural composites from sheep fibers. This issue is mainly addressed by a comprehensive approach to the use of natural fibers in composite materials. The research in this dissertation deals with the processing properties and experimental testing of mechanical, acoustic, and electrical properties of designed composite samples with the same percentage of filler and evaluation of the achieved results. The work brings new knowledge in the field of composites with organic fillers based on sheep fibres. This dissertation continues the tradition of using sheep wool with a possible application in construction as an acoustic and electrically non-conductive barrier while maintaining mechanical properties comparable to commonly available building materials. This dissertation builds on the tradition of using sheep wool with a possible application in construction as an acoustic and electrically non-conductive barrier while maintaining mechanical properties comparable to commonly available building materials such as thermo-acoustically insulating polyurethane panels. Sheep wool especially breeds

with low fibre quality, has become a waste that is not used, mainly due to the low purchase price, which could be an advantage over higher production costs with high input costs. The dissertation aims to find applications for sheep fibres as fillers in polymer matrices and to expand knowledge about their static and physical properties. Especially for ecological potential comparable in properties with products at a more affordable level for recycling and landscape maintenance.

1.2 Faculty of Management and Economics

Degree Programme: ECONOMICS AND MANAGEMENT

Degree Course: Management and Economics

Ing. **Jiří Dokulil**, Ph.D.

Date of defence: 14. 7. 2021

Supervisor: prof. Ing. Boris Popesko, Ph.D.

Determinants of budgeting and planning systems selection and their impact on organization behavior and performance

Abstract

The submitted theses is focused on one of the most researched and discussed managerial accounting techniques, budgeting. The research emphasizes the need to examine the factors affecting the selection and setting of planning and budgeting systems, respectively effectiveness of these systems. To expand knowledge about these fields, a web-based survey was devised with the aim of gathering data, followed by hypotheses testing through application of Z-test and Pearson's chi-square test of independence. In an effort to better understanding the determinants of planning and budgeting system, the qualitative research was conducted in the following part of dissertation. The case study, as an output of the qualitative research, analyses in detail the individual processes relate to the planning and budgeting system of a selected industrial company owned by a foreign concern. Based on semi-structured interviews with representatives of all levels of the organizational structure and the use of the coding method, the research generated six key theoretical concepts that are intended for future testing on a wider sample of companies.

Fortesa Haziri, Ph.D.

Date of defence: 8. 7. 2021

Supervisor: doc. Ing. Miloslava Chovancová, CSc.

Gamification and purchase intention

Abstract

Gamification has received considerable attention from researchers and practitioners. Disciplines, where gamification is widely studied, are archaeology, education, health, politics, and marketing. Regarding the definition, gamification is considered as an innovative set of activities to motivate and engage in enhancing processes. In consumer behaviour, game elements are viewed as important because the brain dopamine system is activated when games are played, an event that affects the process of inquiry. Employing gamification in the trade industry is expected to assist retail companies to create a fun and enjoyable purchasing experience by focusing less on price and aggressive promotional campaigns. By following the post-positivism paradigm and the deductive method, the research problem has been identified by the theoretical knowledge at disposal, which leads to research design and formulation of research questions and objectives. Therefore, this study aims to develop a comprehensive model and provide empirical evidence concerning purchase intention when game elements are considered towards consumer motivation and engagement within the selected Western Balkan countries, Albania, and Kosovo context. To conduct this study, two frameworks, MDA and TAM, have been taken into consideration. Before beginning with primary data collection, secondary data were considered. The secondary data gathered from different organizations, institutions, and business assisted in improving research quality.

Ing. **Lucie Hrbáčková**, Ph.D.

Date of defence: 27. 1. 2021

Supervisor: prof. Ing. David Tuček, Ph.D.

Risk-based process management of processes in the manufacturing industry

Abstract

This thesis is focused in the business sector and risk-based management in processes. The main goal of this work was to determine the form of risk-based management in processes in the manufacturing industry. The focus on risk-based management in processes is based on the current situation and at the same time it is recommended to focus efforts on this area from experts or the International Organization for Standardization in the form of published standards for the business environment. The research is focused on examining different approaches to risk-based process management. This thesis contains qualitative and quantitative. In addition to determining the form of risk-based management in processes in the manufacturing industry, the main research results also identify existing levels of the risk-based process management system, determine how to measure the maturity of the risk-based process management system and describe the mature risk-based process management system. The author also determined for the mature risk-based management system in processes of procedural scheme with regard to the necessary human resources, which is verified by experts from practice. And a demonstration of the scheme of monitoring key risk indicators in relation to process indicators in the selected process. Part of the results of this work is also a description of the current state of the risk management approach of companies in the manufacturing industry in their processes. The definition of the mature risk-based management system in processes is verified by a case study in a company with this established system.

Javed Mohsin, Ph.D.

Date of defence: 27. 1. 2021

Supervisor: doc. Ing. Zuzana Tučková, Ph.D.

Indicators of sustainable tourism and their application to Pakistan

Abstract

Tourism as a globally important sector and the world's fastest-growing industry is a source of job creation for millions of people and contributes to global GDP significantly. The role of tourism in the contemporary era is enormous and will be even more vital in the coming years. However, there are some downsides related to tourism, which demands serious attention for future sustainability to reap long-term benefits. Therefore, the researchers and po-

licymakers focused on sustainable tourism to get around and minimize the underlying negative impacts of tourism. However, previous studies contain research gaps regarding sustainability indicators: a) Careful assessment of the indicators is needed for higher validity and reliability and that has been overlooked. b) Traditional dimensions of sustainable tourism are unable to achieve a higher level of total variance explained; therefore, the new dimensions related to infrastructural sustainability and technological sustainability are important to consider for developing sustainable tourism. c) The development of a multidimensional sustainable tourism index with new dimensions and the use of an index for cross-location comparisons is undeveloped yet.

Jibril Abdul Bashiru, Ph.D.

Date of defence: 8. 7. 2021

Supervisor: doc. Ing. Miloslava Chovancová, Ph.D.

Understanding Customers' Constraints Towards E-Banking Engagement: Evidence from Retail Banks in Ghana

Abstract

Financial technology has come to stay. Considering the outbreak of Covid-19 pandemic, the emergence of electronic business is one of the most profound changes that has revolutionized the process of buying, selling, and exchange of products and services over the Internet. Given this, research on electronic banking (e-banking) has attracted several distinguished stakeholders including bankers, customers, regulators among others. The subtle issue has been triggered mainly by factors such as high efficiency, improved service delivery, low transaction cost, less time consumed among others. Though, extant literature has dwelled much on online banking transactions, particularly, concerning adoption/acceptance. Notwithstanding, these studies are mostly focused on the motivating factors that propel customers' intention to make use of the service. Similarly, in Sub-Sahara Africa, the literature on this theme regarding the motivating factors (stimuli) of Fintech adoption continues to receive scholars' attention, however, the reverse (constraints) towards the adoption barely exists in the literature. Against this background, the dissertation sought to fill in the missing gap by exploring

some socio-economic and perceived online risk factors regarding customers' constraints towards e-banking engagement amongst retail banking enterprises in Ghana.

Ing. **Michaela Kovalová**, Ph.D.

Date of defence: 8. 7. 2021

Supervisor: prof. Ing. David Tuček, Ph.D.

Methodology for performance improvement

Abstract

The dissertation theses are focused on the most important parts of the research, which dealt with the use of process management elements in Czech hospitals in order to create a methodology for implementing BPM in Czech hospitals and thus support increasing the efficiency of individual processes and the hospital as a whole organization. In the first part of the work, a literature research is performed analyzing the current state of Business Process Management and data from medical yearbooks. Furthermore, theses describe the set goals, the course of the research plan and the results. Last but not least, the benefits for science and practice are presented. The main goal of the work was to create a methodological procedure of the BPM implementation procedure for Czech hospitals, which should ensure their effective management and thus directly and indirectly increase the performance of internal processes and entire hospitals.

Ing. **Jana Němcová**, Ph.D.

Date of defence: 1. 11. 2021

Supervisor: doc. Ing. Pavla Staňková, Ph.D.

Key factors influencing the buying decision-making process of the Generation Y consumers on the wine market

Abstract

The dissertation thesis deals with the consumer buying behaviour of Generation Y on the Czech wine market. This issue is currently a very topical matter. The main goal of the dissertation thesis was to create a model of consumer behaviour of Generation Y on the wine market, based on the identification of key factors influencing the buying decision-making process of this target group on the wine market. Following the main goal of the thesis, five sub-goals were defined, the purpose of which was to analyse the buying decision-making process of Generation Y on the wine market, to identify key factors that have a crucial influence on Generation Y when choosing wine, to create key segments of Generation Y consumers based on factors influencing their buying decision-making process on the wine market, to identify differences between factors influencing conscious and unconscious perception during decision-making of Generation Y on the wine market and finally to identify marketing communication tools that have a decisive influence on Generation Y in the wine selection.

Ing. **Lucie Povolná**, Ph.D.

Date of defence: 27. 5. 2021

Supervisor: doc. Ing. Jena Švarcová, Ph.D.

The significance of selected indicators in a set of information important for the machine tools purchase

Abstract

The current development of industrial production is very dynamic and companies must be able to respond to changes. The dissertation focuses on the factors that influence purchasing decisions in B2B markets, specifically in the purchase of machinery. The thesis aims to find out whether selected leading indicators reflect the real economic development and to find out whether companies use leading indicators during their purchasing decisions in the conditions of the machine tool market in the Czech Republic.

Roland Stankalla, Ph.D.

Date of defence: 15. 7. 2021

Supervisor: prof. Ing. Felicita Chromjaková, PhD.

Conception of an effective Six Sigma belt deployment structure for manufacturing small and medium-sized enterprises

Abstract

The Six Sigma methodology creates many possibilities for radically improving process and product quality resulting in enhanced financial performances, customer satisfaction and bottom-line results. While Six Sigma was initially applied within large organizations, the interest of small and medium-sized enterprises in using this continuous improvement initiative is increasing. Due to the fact that a wide variety of small and medium-sized enterprises act as suppliers to larger enterprises and therefore taking over a substantial part in global supply chains, small and medium-sized enterprises are demanded to have robust quality processes in place as well as offer products and services of the highest quality. One of the most important critical success factors for the implementation of Six Sigma is the strong organizational infrastructure of process improvement specialists, also known as "Belt Hierarchy" or "Belt System" which originally consists of four core types of Six Sigma professionals: Master Black Belt, Black Belt, Green Belt and Yellow Belt. Since the traditional Six Sigma belt approach is not applicable in small and medium-sized enterprises due to a lack of human and financial resources as well as other organizational differences to larger enterprises, amendments are required when it is applied in small and medium-sized enterprises.

Degree Programme: ECONOMIC POLICY AND ADMINISTRATION

Degree Course: Finance

Ing. **David Homola**, Ph.D.

Date of defence: 27. 2. 2021

Supervisor: doc. Ing. Marie Paseková, Ph.D.

Predicting the occurrence of misstatements in financial statements

Abstract

The dissertation titled "Predicting the occurrence of misstatements in financial statements" deals with the quality of accounting information, which is presented to its users in the form of the financial statements. The thesis's main aim is to propose an approach for prediction of misstatement occurrence in financial statements presented by companies to maximise the usefulness of this information for the decision-making process of its users. This approach should help all types of possible users evaluate the reliability of information presented in financial statements and help them avoid incorrect decisions made based on unreliable data. This work should contribute to existing approaches focusing on the occurrence of the misstatements with a completely new approach to measurement, which is not purely dependent on financial variables. The information obtained during a detailed literature review of existing literature, which is further enhanced by the results of qualitative research conducted with individual users, is used to propose quantitative research between pro-profit organisations operating in the Czech Republic. Data obtained through quantitative research is analysed using statistical methods. The results of the analysis are used to construct a predictive model, which enables the prediction of misstatements' occurrence for companies operating in the Czech Republic.

1.3 Faculty of Applied Informatics

Degree Programme: ENGINEERING INFORMATICS

Degree Course: Automatic Control and Informatics

Ing. **Vít Štěpánek**, Ph.D.
Date of defence: 7. 9. 2021
Supervisor: prof. Mgr. Roman Jašek, Ph.D., DBA

Objectivization of treatment procedure using BCI technology

Abstract

Patients who have had a stroke may be affected by impaired mobility of the upper and lower limbs. Various rehabilitation techniques are involved in reducing these consequences. This work aims to design an information system architecture for objectifying the results of these techniques. The System uses the author´s proposed reference framework for collecting and

exchanging data related to an individual‘s brain activity. Data are obtained primarily using devices for sensing the patient´s brain activity and from rehabilitation devices. Secondly, these are data from primary and clinical research and records stored in patient information systems. The system provides the means to analyze this data and find hidden connections between them. This analysis can be used to objectify the benefits of individual rehabilitation techniques and improve the properties of brain activity sensing devices. The designed System is conceived as distributed and uses the method of containerization of applications.

Degree Programme: ENGINEERING INFORMATICS

Degree Course: Engineering Informatics

Ing. **Lukáš Králík**, Ph.D.
Date of defence: 7. 9. 2021
Supervisor: doc. Ing. Roman Šenkeřík, Ph.D.

Research and Development of Methodology for ITIL Tools Evaluation

Abstract

This thesis deals with tools for the management of information technologies according to the ITIL process framework. Only some tools are evaluated and certified even if the offer of tools is wide and the number of uncertified tools prevails. The orientation between ITIL tools is complicated regarding the certification process and the offered number of tools. Designed methodology for evaluation of ITIL tools should improve this situation. The methodology is based on multi-criteria decision-making and the statistical method called Elo rating. This unique combination allows flexible customization of methodology according to the individual needs of every company. Simultaneously, the methodology utilizes the check-list approach combined with other methods such as methods for determining criteria weights. This fact allows the tool's functionality to be taken into account based on evaluation criteria published by Axelos. Thus, the methodology does not depend only on one specific version of the ITIL process framework but can be adapted to every version.

Ing. **Adam Viktorin**, Ph.D.

Date of defence: 26. 8. 2021

Supervisor: doc. Ing. Roman Šenkeřík, Ph.D.

Control Parameter Adaptation in Differential Evolution

Abstract

This doctoral thesis describes the author´s research in the area of adaptive Differential Evolution variants for small-scale continuous single-objective optimization. The first part describes the topic of mathematical optimization and lists various problem domains according to the problem characteristics. Namely: number of objectives, input type, computational complexity, type of a search space, and problem scale. It also describes the area of metaheuristic optimization and Evolutionary Computation Techniques. The Differential Evolution algorithm variants and control parameter adaptivity are described in the next part of this work and it also provides the justification of selecting Success-History based Adaptive Differential Evolution algorithm as a basis for author´s research focus. A novel population dynamic analysis tool is proposed in the experimental part. This tool can be used for the development process of new metaheuristic techniques as well as for the analysis of the state-of-the-art methods. The experimental part also provides the proposal of multi?chaotic framework for parent selection for the Differential Evolution based algorithms and Distance based parameter adaptation, which can be implemented into adaptive variants of Differential Evolution algorithm to improve the balance between exploration and exploitation. The benefits of using Distance based parameter adaptation are shown on the improved jSO algorithm - DISH. The performance of both versions (jSO and DISH) is compared on the basis of Congress on Evolutionary Computation benchmark sets and shows that the DISH variant is more suitable for optimization problems of a larger scale. The practical use of the DISH algorithm is demonstrated on the operations research problem of finding optimal dislocation of waste-to-energy facilities in the Czech Republic. The improved DISH algorithm was able to provide comparable solutions for smaller instances of the problem and was also able to provide solutions for larger instances where traditional solvers failed. Through the above-mentioned results, it can be seen that even simple changes in algorithms´ inner dynamic can lead to significant improvements. Therefore, the research area of adaptive metaheuristics for optimization can benefit from knowledge gained through thorough algorithm analysis, which is the author´s chosen research direction for the future.

Ing. **Tomáš Vogeltanz**, Ph.D.
Date of defence: 6. 9. 2021
Supervisor: prof. Ing. Jiří Dvořák, DrSc.

Model Design of Unmanned Aerial Vehicle

Abstract

The main objective of this work is to design a mini-UAV model. For this purpose, it is necessary to create and describe a software solution for its design, analysis, modelling, and simulation. An experimental tail-sitter mini-UAV V-TS which combines two different modes of flight (horizontal and vertical) is also designed and analysed. The vertical mode is used for vertical take-off and landing of the mini-UAV. Results from two German projects (AVIGLE and SAGITTA) are used to validate and evaluate the accuracy of CFD software. A model of the experimental mini-UAV with a control system is created in the format of JSBSim flight dynamics model. Finally, simulations are performed for its dynamic response test.

Ing. **Petr Žáček**, Ph.D.
Date of defence: 7. 9. 2021
Supervisor: prof. Mgr. Roman Jašek, Ph.D., DBA

Design of the Polymorphous Structures in the Symmetric Cryptography

Abstract

The dissertation is focused on polymorphous structures in symmetric cryptography. The text includes an overview of symmetric cryptography of block ciphers and the actual state of that field. The main objectives are definition of the term polymorphic structures in symmetric cryptography, introducing examples of existing algorithms and principles based on definition. The work is further a set of results achieved under Doctoral Study and proposes a single encryption system based on describes and designed principles with emphasis to the polymorphic structures. The overal solution also includes the practical show of implementation of all proposed structures in a comprehensive polymorphous cryptographic system with a demonstration of functioning. The work further presents an evaluation of the design quality, including the testing of the system.

1.4 Faculty of Humanities

Degree Programme: PEDAGOGY

Degree Course: Pedagogy

Mgr. lic. **Renáta Matušů**, Ph.D.
Date of defence: 26. 8. 2021
Supervisor: doc. PhDr. Mgr. Jaroslav Balvín, CSc.

Verbal and Nonverbal Teacher Immediacy in Relation to Students' Learning

Abstract

The dissertation is devoted to the concept of interpersonal teacher immediacy, which is considered an important means of strengthening the perceived learning of students. This issue is first specified in terms of broader contexts representing the relationship level, in which the fundamental processes of interaction and communication between teacher and student take place. In the following section, attention is paid to the teacher, who with their assumptions initiates the mentioned processes and indicates their direction and quality. In this context, the definition and introduction of the theoretical background of the concept of teacher interpersonal immediacy come to the fore. The theoretical section concludes with the issue of perceived student learning, which, especially in foreign research, comes into connection with interpersonal immediacy by the teacher. The subject of the empirical section is a quantitative research survey. The aim was to examine in more detail the relationship between the interpersonal immediacy of the teacher and the perceived learning of pupils and to analyse the connection between the two phenomena with the characteristics of pupils and teachers. The research was focused on the higher levels in primary schools, where data was obtained from 868 pupils and 40 teachers from the sixth to ninth grades. Data analyses yielded several significant findings, which are discussed in the last section of this dissertation.

1.5 University Institute

Degree Programme: MATERIAL SCIENCES AND ENGINEERING

Degree Course: Biomaterials and Biocomposites

Ing. **Kateřina Skopalová**, Ph.D.
Date of defence: 26. 8. 2021
Supervisor: prof. Ing. Petr Humpolíček, Ph.D.

Interaction of stem cells with materials

Abstract

With the continuing progress in medicine, life expectancy is increasing. Today, due to more advanced technologies and a better understanding of biological systems, it is possible to treat even formerly incurable diseases. Requirements for the replacement of various organs and tissues that have been damaged are also increasing. Thus, in recent years, tissue engineering has primarily focused on the development of three-dimensional constructs - so-called scaffolds. To create such a construct, it is necessary to consider the material properties suitable for a given application, as well as important to select an appropriate cell line. Stem cells are often used in tissue engineering due to their ability to self-renew and differentiate into different cell types. Currently, material characteristics such as chemical composition and surface topography are known to influence stem cell behaviour. It is also necessary to pay attention to the presence of biochemical substances in the culture medium, which are added either purposefully (growth factors) or are released from the biomaterial. The subject of this research was to investigate the effect of the abovementioned properties of biomaterials on cell lines, such as mouse fibroblasts, embryonic stem cells, and induced pluripotent stem cells. All cell-material interactions were tested in vitro in cell culture laboratories.

Degree Programme: NANOTECHNOLOGY AND ADVANCED MATERIALS

Degree Course: Nanotechnology and Advanced Materials

Ing. **Erika Kutálková**, Ph.D.
Date of defence: 31. 8. 2021
Supervisor: doc. Ing. Michal Sedlačík, Ph.D.

Intelligent Electrorheological Fluids

Abstract

In recent years, so-called intelligent fluids form a significant target of focus of the development of the industry and many scientific groups, as they seem to be very auspicious material of the future due to their unique properties when an external stimuli, such as an electric field, is applied. Electrorheological fluids have already been widely utilized, especially as vibration damping devices in mechanical engineering and medicine. However, there are still several issues that limit their application in everyday life. Some of the current electrorheological materials demonstrate rapid sedimentation of dispersed particles and achieve insignificant electrorheological performance. Therefore, this thesis is focused on preparing and investigating suitable materials to improve sedimentation stability as well as the electrorheological effect of such fluids. It is necessary to find a required balance between excellent sedimentation stability and electrorheological performance that corresponds with the intended application. Morphology, size, electrical conductivity, and other properties of the particles influence overall the system's behavior. Thus, the previously mentioned issues above can be eliminated by modifying some of these factors and are properly discussed in this thesis.

2 DEFENDED HABILITATION THESES

In 2021, 6 habilitation theses were defended: 4 at the Faculty of Technology and 2 at the Faculty of Management and Economics.

2.1 Faculty of Technology

Course: Technology of Macromolecular Compounds

doc. Ing. **Zdenka Capáková**, Ph.D.

Appointed with effect from: 1st June 2021

Conducting Polymer Scaffolds – the Technology of Preparation and Cyto-compatibility

Abstract

This habilitation thesis summarises studies performed on conducting polymers, especially polyaniline and polypyrrole, during more than ten years of research. In the course of time, various procedures for polymer synthesis and a number of modification techniques were employed, giving rise to a wide variety of conducting materials or their composites. Prepared conducting polymers and their composites were deeply characterized in terms of their material properties, with special interest paid to their surface properties. The thesis also sums up unique and original results documenting improvements in the cytocompatibility of these conducting polymers and composites. Especially the composites with biopolymers are unique in terms of their cytocompatibility. The new knowledge gained in this field resulted in the preparation of cytocompatible conducting scaffolds with target applications in tissue engineering.

doc. Ing. **Antonín Minařík**, Ph.D.

Appointed with effect from: 1st February 2021

Technology of Structured Surfaces Preparation

Abstract

This work deals with the possibilities of phase separation, flow and etching processes application for the preparation of structured surfaces. Methods based on direct modification of urfaces and on the deposition of cover layers ara discussed here. The surfaces of polystyrene, hyaluronan and silk protein were treated by phase separation. The effect of self-organized fluid flows is discussed for hydroxyethyl cellulose and hyaluronan. Silicon and aluminium surfaces were modified with etching processes. In order to create specific physical conditions during the surface treatment proces, several devices were contructed, enabling the control of temperature gradients, drying rate and dosing of etching mixtures.

From the experimental results of previous works stems that with the help of the newly developed devices and properly set proces parameters, it is possible to prepare a whole new range of original surface reliefs with dimension from hundreds of micrometers to units of nanometers. These methods can be used for both crystalline and amorphous materials. The prepared hierarchical surfaces open new application possibilities of selected materials in th field of biomaterial and tissue engineering.

doc. Ing. **Jana Sedlaříková**, Ph.D.

Appointed with effect from: 1st June 2021

Polymers as Carriers of Active Agents

Abstract

The habilitation thesis presents the topics of active polymer systems that could prevent the risk of microbial infections and contaminations. The introductory part reviews the potential forms of carriers, active molecules, as well as the characterization techniques of prepared systems. The second part is devoted to author's contribution to the subject covering the problems of antimicrobial polymer carriers based on both synthetic and natural polymers in the form of solutions, films, thin layers and nanofibrous membranes. The main goal of the commented research papers was to overview the approaches leading to the design of functional, cost effective and environmentally friendly polymer systems applicable in the food, cosmetic, medical or water treatment industry.

Course: Food Technology

doc. Ing. **Richardos Nikolaos Salek**, Ph.D.

Appointed with effect from: 1st October 2021

Factors affecting the functional properties of processed cheeses

Abstract

The scope of the current work was to explain the importance of emulsifying salts, natural cheese (type and maturity degree) and selected technological properties during processed cheese production. Firstly, principles of emulsifying salts action in the system or processed cheese were described. The work was focused on phosphate- and citrate-based emulsifying salts. The role of solely applied phosphates and citrate (sodium salts) also was discussed. Additionally, more complicated systems consisted of binary and ternary mixtures of phosphate and/or citrate emulsifying salts were also described. Moreover, in the habilitation thesis are described basic/general natural cheese-making processing steps. In addition, selected natural cheese varieties (Edam, Mozzarella, Swiss-type, Cheddar and white brined cheeses, respectively), specific producing steps and their typical characteristics are presented, since these varieties are among the most applicable cheese types during the industrial production of processed cheese. Furthermore, the impact of natural cheese maturity degree (or in other words its intact casein content) on the resultant processed cheese properties (mainly textural and rheological characteristics) is also mentioned. On the whole, the effect of divergent cheese varieties on the above-mentioned properties of processed cheese is also described. Furthermore, the impact of selected target processing parameters (dry matter content, fat in dry matter content) and specific technological characteristics (melting temperature, holding time, speed of agitation) on processed cheese properties was discussed. On the whole, the habilitation thesis aimed to summarize the existing knowledge in the field of characteristics of raw materials for the production of processed cheeses, production technology of these products and factors influencing the consistency (a parameter described mainly by textural and rheological properties) of processed cheeses. Based on the results of the current thesis, it is possible to provide a more comprehensive point of view of the importance of the com-

position of a mixture of raw ingredients (including natural cheese, emulsifying salts – phosphates and/or citrates) and processing parameters in influencing the textural and rheological properties of processed cheeses.

2.2 Faculty of Management and Economics

Course: Management and Business Economics

doc. Ing. **Michaela Kotková Stříteská**, Ph.D.

Appointed with effect from: 1st November 2021

Corporate culture as a key factor for efficient functioning of the performance measurement and management system

Abstract

Previous research has focused mainly on performance measurement's technical elements and has paid too little attention to performance management's behavioural aspects. At the same time, the consistency between the performance measurement system and the organizational environment is crucial. It is, therefore, necessary to pay attention to the factors that affect and create this consistency. In today's dynamic environment, the performance measurement and management system usage's ultimate goal has to be organizational learning and improvement rather than control and command. An adequately set corporate culture is considered a critical factor contributing to a change of performance management a measurement understanding. Therefore, this habitation thesis is focused on examining the relationship between corporate culture and the performance measurement and management system. A key attributes of corporate culture focused on performance, learning, and improvement are identified and characterized using mixed research strategies. All research findings are finally summarized in a conceptual framework.

doc. Ing. **Jana Matošková**, Ph.D.

Appointed with effect from: 1st November 2021

HRM practices for facilitating employees' knowledge sharing

Abstract:

Knowledge sharing is one of the factors that enhance organizational competitiveness. The aim of the habilitation was to identify how to facilitate knowledge sharing among employees by setting HRM activities. The following dimensions of knowledge sharing in the organization were identified and examined: general information flow in the organization, supporting knowledge sharing, and knowledge documentation. A simple regression analysis shows that the setting of HRM activities is significant for prediction of the extent of knowledge sharing in the organization. Additionally, a significant indirect impact of HRM activities on the extent of knowledge sharing was found; it was mediated by the frequency of the use of instruments for knowledge sharing among employees, the extent in which superiors' managerial style is in accordance with so-called knowledge-oriented leadership, the extent in which employees have characteristics that facilitate knowledge sharing in the organization, and the extent of employee motivation for sharing knowledge. According to the findings, the following practices belong to the desirable ones to facilitate knowledge sharing in the organization: 1) supporting employees' responsibility for the results of their work, 2) job variability, 3) identification and retention of key employees, 4) supporting employees' development, 5) setting a reward system for employees in such a way that it is interlinked with their knowledge sharing, and 6) checking out the characteristics desirable for knowledge sharing in the process of employee selection.

3 QUALIFYING LECTURES FOR PROFESSORSHIP

3.1 Faculty of Technology

Course: Technology of Macromolecular Compounds

prof. Ing. **Jarmila Vilčáková**, Ph.D.

Qualifying Lecture for Professorship in front of the Scientific Board of TBU in Zlín: 5th October 2021
Appointed with effect from: 15th December 2021

Shielding efficiency by polymer composites with electromagnetic properties

Abstract

The papers included in the Thesis for appointment as a Full Professor contain the results of fundamental and applied research of composites based on conducting and magnetic particles embedded in a polymer matrix. The research directions are summarized in three chapters. The first part deal with the influence of concentration, size, distribution of particles and preparation technologies on conductivity of polymer composites. This chapter has become a knowledge potential in the design of suitable absorbers of electromagnetic ratidation with dielectric losses. The second chapter deals with the issue of electromagnetic compatibility and its division into two basic areas: 1) biological and 2) technical systems. The third chapter concerns polymer composites where magnetic losses are dominant and, by using frequency selective elements, very thin broadband absorbers of the millimeters thickness can be achieved.

Course: Food Technology

prof. RNDr. **Leona Buňková**, Ph.D.

Qualifying Lecture for Professorship in front of the Scientific Board of TBU in Zlín: 23rd February 2021
Appointed with effect from: 8th May 2021

Production of biogenic amines in foods, and factors affecting their formation

Abstract

The thesis is focused to the occurrence of biogenic amines in selected foods and beverages, as well as factors that may affect their formation. The first part deals with the properties and formation of biogenic amines. The second part describes the decarboxylase activity of microorganisms, both starter cultures, non-starter bacteria and technologically undesirable (contaminating) microorganisms that have been isolated from food. The last part summarizes information on the occurrence of biogenic amines in dairy products, fish, beer and wine.

prof. Ing. **Stanislav Obruča**, Ph.D.

Qualifying Lecture for Professorship in front of the Scientific Board of TBU in Zlín: 5th October 2021
Appointed with effect from: 15th December 2021

Conversion of food industry wastes into microbial metabolities with high added value

Abstract

The submited thesis deals with selected strategies for the valorization of food industry wastes. The main focus is on the utilization of wastes such as used cooking oils or spent coffee grains for the production of polyhydroxyalkanoates and other valuable microbial metabolites within a concept of biorefinery which enables maximal valorization and complete utilization of the food industry waste. Last but not least, the thesis also describes the employment for extremophiles for the valorization of food industry wastes expeicially from the perspective of the production of polyhydroxyalkanoates.

Course: Tools and Processes

prof. Ing. **Michal Staněk**, Ph.D.

Qualifying Lecture for Professorship in front of the Scientific Board of TBU in Zlín: 23rd February 2021
Appointed with effect from: 8th May 2021

Influence of tool, material and process on the quality of injection molded products

Abstract

Injection molding technology has been one of the most progressive methods of polymer processing in recent years. The advancements can be seen not only in the numerous new polymer materials and the manners in which they are modified, but also in the software and hardware tools capable of optimizing the manufacturing process. The goal of these theses is to prepare a thorough overview of research activity centred on the problematic of tool design in the field of injection molding.

One of the most important phases of the injection molding cycle is the melt transportation, be it in the runner system or the cavity itself. For the experiments, test plates enabling the change in construction parameters together with the parameters of the injection molding machine and its peripheral equipments were designed and subsequently manufactured.

The largest timeframe was devoted to the influence of mold's surface roughness on the fluidity of the polymer melt. A portion of the work was also given to the problematic of rubber compound injection mold. The investigations in this area were concerned with flowability and the optimization of the manufacturing cycle through the construction modifications of the injection mold.

Great part of the content encompassed in the submitted theses was either published in scientific journals, which can be found in WoS and SCOPUS databases, or presented at international conferences. Some of the results are also protected as intellectual property (patents, utility model).

4 IMPORTANT SCIENTIFIC AND SPECIALIZED ASSIGNMENTS

4.1 Projectst financed by the Czech Science Foundation (GACR)

In 2021, 13 projects financed by the Czech Science Foundation were implemented at the TBU in Zlín. Total eligible costs amounted CZK 14,078 thousand for TBU in Zlín in 2021.

4.1.1 Faculty of Technology

Junior grants

GJ20-27735Y Nanotechnologies in flow-through electrochemical sensors apllied in environmental engineering
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Jaroslav Filip
Implementation period: 2020 - 2021

Total project cost (CZK thous.):	3 268
Total project cost – TBU (CZK thous.):	3 268
Project cost of TBU in 2021 (CZK thous.):	1 634

Standard projects

GA21-09174S Viscoelastic non-isothermal modeling of film extrusion process for membranes production including flow induced crystallization
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Martin Zatloukal
Implementation period: 2021 - 2023

Total project cost (CZK thous.):	7 809
Total project cost – TBU (CZK thous.):	7 809
Project cost of TBU in 2021 (CZK thous.):	2 543

4.1.2 Faculty of Management and Economics

Standard projects

GA17-13518S Determinants of budgeting and performance measurement systems design and impact of these systems on organizational behavior and organizational perform
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Boris Popesko
Implementation period: 2017 – 2021

Total project cost (CZK thous.):	3 354
Total project cost – TBU (CZK thous.):	1 716
Project cost of TBU in 2021 (CZK thous.):	0

4.1.3 Faculty of Humanities

Standard projects

GA17-04816S The Dynamics of Self-Regulation in Socially Excluded Pupils
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Karla Hrbáčková
Implementation period: 2017 - 2021

Total project cost (CZK thous.):	1 872
Total project cost – TBU (CZK thous.):	1 872
Project cost of TBU in 2021 (CZK thous.):	0

GA19-00987S Blind Spots in Non-Formal Education of Adults in the Czech Republic: Non-Participants and their Social Worlds
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Jan Kalenda
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	3 023
Total project cost – TBU (CZK thous.):	3 023
Project cost of TBU in 2021 (CZK thous.):	856

4.1.4 Faculty of Applied Informatics

Junior grants

GJ20-00091Y Development of Sustainable Waste Management: Methods and Operations Research Perspectives
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Dušan Hrabec
Implementation period: 2020 - 2022

Total project cost (CZK thous.):	3 327
Total project cost – TBU (CZK thous.):	3 327
Project cost of TBU in 2021 (CZK thous.):	1 112

LA grants

GF21-45465L Metaheuristic-based parametric optimization of time-delay models and control systems
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Libor Pekař
Implementation period: 2021 - 2024

Total project cost (CZK thous.):	4 652
Total project cost – TBU (CZK thous.):	4 652
Project cost of TBU in 2021 (CZK thous.):	337

4.1.5 University Institute

Standard projects

GA19-16861S Interaction of biomaterials with stem cells under in vivo simulated conditions

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Petr Humpolíček
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	7 496
Total project cost – TBU (CZK thous.):	4 555
Project cost of TBU in 2021 (CZK thous.):	1 526

GA19-17457S Manufacturing and analysis of flexible piezoelectric layers for smart engineering

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Miroslav Mrlík
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	8 641
Total project cost – TBU (CZK thous.):	2 820
Project cost of TBU in 2021 (CZK thous.):	952

GA19-23513S Towards New Electroluminescent Materials: Borane Cluster Compounds in Thin Polymer Films within an Electric Field

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Ivo Kuřitka
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	5 317
Total project cost – TBU (CZK thous.):	5 317
Project cost of TBU in 2021 (CZK thous.):	1 762

GA19-23647S Investigation of Correlation Among Cation Distribution, Particle Size and Physical Properties of Intelligent Spinel Ferrite Nanomaterials

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Raghvendra Singh Yadav
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	4 878
Total project cost – TBU (CZK thous.):	4 878
Project cost of TBU in 2021 (CZK thous.):	1 614

GA20-28732S Colloidal systems for topical formulations. Pickering emulsions and polymer based colloids

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Petr Humpolíček
Implementation period: 2020 - 2022

Total project cost (CZK thous.):	4 978
Total project cost – TBU (CZK thous.):	4 978
Project cost of TBU in 2021 (CZK thous.):	1 742

Projects where TBU acts as a co-investigator

GA17-10813S Novel plasma polymers with tunable stability and permeability
Principal investigator: Charles University in Prague
Project investigator on behalf of TBU: Marián Lehocký
Implementation period: 2017 - 2021

Total project cost (CZK thous.):	7 608
Total project cost – TBU (CZK thous.):	3 144
Project cost of TBU in 2021 (CZK thous.):	0

4.2 Projects financed by the Ministry of Industry and Trade of the Czech Republic

In 2021, 21 projects financed by the Ministry of Industry and Trade of the Czech Republic were implemented at the TBU in Zlín. Total eligible costs amounted CZK 12,048 thousand for TBU in Zlín in 2021.

4.2.1 Faculty of Technology

Projects where TBU acts as a co-investigator

The Operational Programme Enterprise and Innovations for Competitiveness (OP PIK)

EG17_107/0012417 MIOMOVE
Principal investigator: HD GEO s.r.o.
Project investigator on behalf of TBU: Petr Slobodian
Implementation period: 2017 – 2021

Total project cost (CZK thous.):	18 269
Total project cost – TBU (CZK thous.):	4 511
Project cost of TBU in 2021 (CZK thous.):	2 114

EG20_321/0024951 Development of an automated calibration process by implementing innovative features

Principal investigator: PRIMA BILAVČÍK, s. r. o.
Project investigator on behalf of TBU: Milena Kubišová / Vladimír Pata
Implementation period: 2021 2023

Total project cost (CZK thous.):	29 140
Total project cost – TBU (CZK thous.):	3 284
Project cost of TBU in 2021 (CZK thous.):	3 284

4.2.2 Faculty of Management and Economics

Projects where TBU acts as a co-investigator

The Operational Programme Enterprise and Innovations for Competitiveness (OP PIK)

EG17_107/0011225 Smart factory in a factory environment
Principal investigator: ALPS Electric Czech, s.r.o.
Project investigator on behalf of TBU: Aleš Gregar
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	21 602
Total project cost – TBU (CZK thous.):	2 610
Project cost of TBU in 2021 (CZK thous.):	963

EG20_321/0024555 Cost modelling - software for modelling business cost flows using the TD-ABC method
Principal investigator: INEKON SYSTEMS s. r. o.
Project investigator on behalf of TBU: Petr Novák
Implementation period: 2021 - 2022

Total project cost (CZK thous.):	9 617
Total project cost – TBU (CZK thous.):	1 272
Project cost of TBU in 2021 (CZK thous.):	0

4.2.3 Faculty of Applied Informatics

The Operational Programme Enterprise and Innovations for Competitiveness (OP PIK)

Projects where TBU acts as a co-investigator

EG15_019/0004635 E-Line Fuel Dispenser
Principal investigator: Adast Systems, a. s.
Project investigator on behalf of TBU: Tomáš Dulík
Implementation period: 2015 - 2021

Total project cost (CZK thous.):	27 205
Total project cost – TBU (CZK thous.):	2 070
Project cost of TBU in 2021 (CZK thous.):	0

EG16_084/0009949 Research and development of advanced LED luminaires for industrial use
Principal investigator: TREVOS, a. s.
Project investigator on behalf of TBU: Miroslav Maňas
Implementation period: 2017 – 2020

Total project cost (CZK thous.):	18 582
Total project cost – TBU (CZK thous.):	3 074
Project cost of TBU in 2021 (CZK thous.):	1 098

EG16_084/0010327 Security system for airport vehicle navigation and communication
Principal investigator: Masaryk University
Project investigator on behalf of TBU: Vojtěch Křesálek
Implementation period: 2018 – 2021

Total project cost (CZK thous.):	35 515

Total project cost – TBU (CZK thous.): 3 697
Project cost of TBU in 2021 (CZK thous.): 0

EG17_107/0012477 Expert system for custom products manufacturing companies with Industry 4.0 support
Principal investigator: CATHEDRAL Software, s.r.o.
Project investigator on behalf of TBU: Tomáš Dulík
Implementation period: 2017 – 2021
Total project cost (CZK thous.): 8 142
Total project cost – TBU (CZK thous.): 4 066
Project cost of TBU in 2021 (CZK thous.): 2 023

EG17_107/0012503 Research and development of eHealth Integrated Telemedicine Application Platform
Principal investigator: Euro Enterprise Development s. r. o.
Project investigator on behalf of TBU: Roman Jašek
Implementation period: 2018 – 2021
Total project cost (CZK thous.): 15 710
Total project cost – TBU (CZK thous.): 1 569
Project cost of TBU in 2021 (CZK thous.): 354

CZ.01.1.02/0.0/0.0/19_262/0020111 Navigation and tracking system TEVOGS 3.0
Principal investigator: Techniserv, spol. s. r. o.
Project investigator on behalf of TBU: Tomáš Dulík
Implementation period: 2020 – 2022
Total project cost (CZK thous.): 31 000
Total project cost – TBU (CZK thous.): 5 750
Project cost of TBU in 2021 (CZK thous.): 2 300

EG19_262/0020292 Expert system for custom manufacturing companies with artificial intelligence support
Principal investigator: CATHEDRAL Software, s.r.o.
Project investigator on behalf of TBU: Tomáš Dulík
Implementation period: 2020 – 2023
Total project cost (CZK thous.): 17 521
Total project cost – TBU (CZK thous.): 6 803
Project cost of TBU in 2021 (CZK thous.): 0

EG20_321/0023675 Research and Development of an Automatic Emulsification Line of Semi-finished Radial and Diagonal Tires of Large Dimensions
Principal investigator: Prozax Otrokovice s. r. o.
Project investigator on behalf of TBU: Vladimír Vašek
Implementation period: 2020 – 2022
Total project cost (CZK thous.): 57 692
Total project cost – TBU (CZK thous.): 6 069
Project cost of TBU in 2021 (CZK thous.): 0

EG20_321/0023805 Robotized Camera Workplace for Measuring and Checking Shape Defects of Forgings and Workpieces Using Artificial Intelligence

Principal investigator: VIVA CV s. r. o.
Project investigator on behalf of TBU: Vladimír Vašek
Implementation period: 2020 – 2023
Total project cost (CZK thous.): 14 302
Total project cost – TBU (CZK thous.): 7 114
Project cost of TBU in 2021 (CZK thous.): 0

EG20_321/0023870 Development of a new unmanned system for monitoring and control of environmental management
Principal investigator: AIRMOBIS s. r. o.
Project investigator on behalf of TBU: Zuzana Komínková Oplatková
Implementation period: 2020 – 2021
Total project cost (CZK thous.): 17 518
Total project cost – TBU (CZK thous.): 4 709
Project cost of TBU in 2021 (CZK thous.): 0

CZ.01.1.02/0.0/0.0/21_374/0026739 NETDIRECT S.R.O. - BLOCKCHAIN TECHNOLOGIE IN BUSINESS INTELIGENCE (BI) APLICATION
Principal investigator: NetDirect s.r.o.
Project investigator on behalf of TBU: Radek Vala
Implementation period: 2021 – 2023
Total project cost (CZK thous.): 14 918
Total project cost – TBU (CZK thous.): 1 852
Project cost of TBU in 2021 (CZK thous.): 0

TRIO Programme

FV40233 Research and development of processes of microbial hydrolysis for the preparation of components with high biological value
Principal investigator: KORTAN spol. s r.o.
Project investigator on behalf of TBU: Karel Kolomazník
Implementation period: 2019 – 2022
Total project cost (CZK thous.): 27 171
Total project cost – TBU (CZK thous.): 2 682
Project cost of TBU in 2021 (CZK thous.): 682

4.2.4 University Institute

The Operational Programme Enterprise and Innovations for Competitiveness (OP PIK)

Projects where TBU acts as a co-investigator

EG20_321/0024533 Design LED luminaire with homogeneous emitting surface
Principal investigator: LAMBERGA s. r. o.
Project investigator on behalf of TBU: Petr Sáha
Implementation period: 2021 - 2023
Total project cost (CZK thous.): 10 493

Total project cost – TBU (CZK thous.):	1 800
Project cost of TBU in 2021 (CZK thous.):	0

EG20_321/0025211 Research and optimization of anticorrosive pigments multiplying the protection of metal surfaces with emphasis on their environmental and rational economic efficiency
Principal investigator: ROKOSPOL, a. s.
Project investigator on behalf of TBU: Michal Machovský
Implementation period: 2021 - 2023

Total project cost (CZK thous.):	45 690
Total project cost – TBU (CZK thous.):	5 588
Project cost of TBU in 2021 (CZK thous.):	0

TRIO Programme

Projects where TBU acts as a co-investigator

FV30048 New additives for multifunctional modification of polymer surfaces
Principal investigator: Synthesia, a.s.
Project investigator on behalf of TBU: Vladimír Sedlařík
Implementation period: 2018 - 2021

Total project cost (CZK thous.):	19 978
Total project cost – TBU (CZK thous.):	3 200
Project cost of TBU in 2021 (CZK thous.):	1 252

FV40377 Research and development of a biocompatible material for controlled drug release and transport into the cornea
Principal investigator: GEMINI eye clinic, a. s.
Project investigator on behalf of TBU: Pavel Urbánek
Implementation period: 2019 - 2022

Total project cost (CZK thous.):	10 152
Total project cost – TBU (CZK thous.):	3 095
Project cost of TBU in 2021 (CZK thous.):	754

4.3 Projects financed by the Ministry of Education, Youth and Sports of the Czech Republic

In 2021, 11 projects financed by the Ministry of Education, Youth and Sports of the Czech Republic were implemented at the TBU in Zlín. Total eligible costs amounted CZK 6,750 thousand for TBU in Zlín in 2021.

4.3.1 Faculty of Management and Economics

INTER-EXCELLENCE Programme (2016 – 2024)

LTC20047 Regional development and public policy under creative economy: Mapping, knowledge sharing and management of New Working Spaces in the Czech Republic
Project investigator on behalf of TBU: Pavel Bednář
Implementation period: 2020 - 2023
Total project cost (CZK thous.): 3 620
Total project cost – TBU (CZK thous.): 3 620
Project cost of TBU in 2021 (CZK thous.): 1 098

MOBILITY Programme

8J19UA010 EU Environmental Policy on Solid Domestic Waste Management and its Implementation in Ukraine and the Czech Republic
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Jiří Zícha
Implementation period: 2019 - 2021
Total project cost (CZK thous.): 162
Total project cost – TBU (CZK thous.): 162
Project cost of TBU in 2021 (CZK thous.): 54

4.3.2 Faculty of Applied Informatics

MOBILITY Programme

8JCH1001 Optimization of consumption water, electric power and heat in the processes in which raw hide is transformed into leather
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Dagmar Janáčová
Implementation period: 2019 - 2021
Total project cost (CZK thous.): 298
Total project cost – TBU (CZK thous.): 298
Project cost of TBU in 2021 (CZK thous.): 149

INTER EUREKA Programme

LTE2019003 FERTI-MAIZE foliar fertilizer for maize based on protein by-products
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Karel Kolomazník
Implementation period: 2019 - 2022
Total project cost (CZK thous.): 4 920
Total project cost – TBU (CZK thous.): 1 584
Project cost of TBU in 2021 (CZK thous.): 472

4.3.3 University Institute

MOBILITY Programme

8JPL19031 Development of novel additives for thermoplastic processing of biodegradable polymers
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Vladimír Sedlařík
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	165
Total project cost – TBU (CZK thous.):	165
Project cost of TBU in 2021 (CZK thous.):	80

8J20PL026 Biodegradable polymer nanocomposite systems with improved thermal and mechanical properties
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Martina Pummerová
Implementation period: 2020 - 2022

Total project cost (CZK thous.):	120
Total project cost – TBU (CZK thous.):	120
Project cost of TBU in 2021 (CZK thous.):	60

INTER EXCELLENCE - INTER ACTION Programme

LTAB19019 Preparation of nano- and micro-structured materials using self-organized protein fibrillar systems
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Antonín Minařík
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	1 170
Total project cost – TBU (CZK thous.):	1 170
Project cost of TBU in 2021 (CZK thous.):	390

LTAUSA19066 A study of polymeric memristors based on methacrylate polymers with pendant carbazole moieties
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Jarmila Vilčáková
Implementation period: 2020 - 2022

Total project cost (CZK thous.):	5 756
Total project cost – TBU (CZK thous.):	2 850
Project cost of TBU in 2021 (CZK thous.):	950

INTER EXCELLENCE - INTER TRANSFER Programme

LTT20005 Collaboration with the EASE association on the development of a hybrid supercapacitor
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Petr Sáha

Implementation period: 2020 - 2022
Total project cost (CZK thous.): 4 913
Total project cost – TBU (CZK thous.): 4 913
Project cost of TBU in 2021 (CZK thous.): 1 739

LTT20010 Surface functionalized glass: Concept of heterostructured nanoparticles inspired by arteficial photosynthesis
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Michal Machovský
Implementation period: 2020 - 2024
Total project cost (CZK thous.): 7 765
Total project cost – TBU (CZK thous.): 7 765
Project cost of TBU in 2021 (CZK thous.): 1 610

Programme for Funding Multilateral Scientific and Technological Cooperation in the Danube Region

8X20041 Design and preparation of multifunctional magnetic nanoparticles for cancer cell detection / Development of biocompatible multifunctional magnetic nanoparticles and evaluation of their diagnostic and therapeutic potential for the application in oncology
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Jarmila Vilčáková
Implementation period: 2020 - 2022
Total project cost (CZK thous.): 296
Total project cost – TBU (CZK thous.): 296
Project cost of TBU in 2021 (CZK thous.): 148

4.4 Projects financed by the Ministry of the Interior of the Czech Republic

In 2021, 4 projects financed by the Ministry of the Interior of the Czech Republic was implemented at the TBU in Zlín. Total eligible costs amounted CZK 4,989 thousand for TBU in Zlín in 2021.

4.4.1 Faculty of Applied Informatics

Security Research Programme in the Czech Republic 2015 - 2022

VI20192022134 System of more accurate prediction of convective precipitation over the regional territorial unit
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: David Šaur
Implementation period: 2019 - 2022
Total project cost (CZK thous.): 13 273

Total project cost – TBU (CZK thous.):	7 887
Project cost of TBU in 2021 (CZK thous.):	2 429

VI20192021163 Built-up and operation development of security systems at mass events
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Dora Lapková
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	2 118
Total project cost – TBU (CZK thous.):	2 118
Project cost of TBU in 2021 (CZK thous.):	876

Projects where TBU acts as a co-investigator

VI20192022118 Soft targets protection in the security environment of the Czech Republic
Principal investigator: VUT Brno
Project investigator on behalf of TBU: Martin Hromada
Implementation period: 2019 - 2022

Total project cost (CZK thous.):	16 781
Total project cost – TBU (CZK thous.):	2 989
Project cost of TBU in 2021 (CZK thous.):	889

4.4.2 Faculty of Logistic and Crisis Management

Security Research Programme in the Czech Republic 2015 - 2022

VI04000080 Crisis Logistics Information Platform
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Jakub Rak
Implementation period: 2021 - 2022

Total project cost (CZK thous.):	5 696
Total project cost – TBU (CZK thous.):	1 736
Project cost of TBU in 2021 (CZK thous.):	795

4.5 Projects financed by the Ministry of Agriculture of the Czech Republic

In 2021, 3 projects financed by the Ministry of Agriculture of the Czech Republic was implemented at the TBU in Zlín. Total eligible costs amounted CZK 2,816 thousand for TBU in Zlín in 2021.

4.5.1 Faculty of Technology

Projects where TBU acts as a co-investigator

ZEMĚ Programme

QK1710156 New approaches and methods of analysis to ensure the quality, safety and health perfection of cheeses, the optimization of their manufacturing and the perfection of hygiene and sanitation together with the lowering of environmental load by waste water

Principal investigator: Výzkumný ústav mlékárenský s. r.o.
Project investigator on behalf of TBU: František Buňka
Implementation period: 2017 - 2021

Total project cost (CZK thous.):	18 838
Total project cost – TBU (CZK thous.):	3 252
Project cost of TBU in 2021 (CZK thous.):	512

QK1920190 Meat cooking loss: effect of fresh meat characteristics, cooking technology and parameters of cooking

Principal investigator: Veterinární a farmaceutická univerzita Brno
Project investigator on behalf of TBU: Robert Gál
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	6 488
Total project cost – TBU (CZK thous.):	2 937
Project cost of TBU in 2021 (CZK thous.):	819

4.5.2 University Institute

ZEMĚ Programme

QK1910392 Environmentally friendly soil conservation materials for the crop production intensification based on renewable resource

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Vladimír Sedlařík
Implementation period: 2019 - 2023

Total project cost (CZK thous.):	16 511
Total project cost – TBU (CZK thous.):	6 952
Project cost of TBU in 2021 (CZK thous.):	1 485

4.6 Projects financed by the Technology Agency of the Czech Republic

In 2021, 29 projects financed by the Technology Agency of the Czech Republic were implemented at the TBU in Zlín. Total eligible costs amounted CZK 37,381 thousand for TBU in Zlín in 2021.

4.6.1 Faculty of Technology

THÉTA Programme

TK03020129 Rubber sealing materials development for hermetic systems of nuclear power plants
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Simona Mrkvičková
Implementation period: 2020 - 2024
Total project cost (CZK thous.): 17 022
Total project cost – TBU (CZK thous.): 4 526
Project cost of TBU in 2021 (CZK thous.): 1 241

Projects where TBU acts as a co-investigator

TK01030054 Controlled biological methane production in situ
Principal investigator: EPS biotechnology, s. r. o.
Project investigator on behalf of TBU: Marek Koutný
Implementation period: 2018 - 2022
Total project cost (CZK thous.): 15 464
Total project cost – TBU (CZK thous.): 3 490
Project cost of TBU in 2021 (CZK thous.): 756

ZÉTA Programme

Projects where TBU acts as a co-investigator

TJ04000226 Combined procedure of elimination of chloroacetanilide pesticides from contaminated water and soil
Principal investigator: Univerzita Pardubice
Project investigator on behalf of TBU: Štěpán Vinter
Implementation period: 2020 - 2022
Total project cost (CZK thous.): 8 053
Total project cost – TBU (CZK thous.): 2 002
Project cost of TBU in 2021 (CZK thous.): 1 053

4.6.2 Faculty of Management and Economics

ZÉTA Programme

TJ02000339 Knowledge of Behavioral Economics and its Application at the Level of Municipalities and Regions in the Czech Republic
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Filip Kučera
Implementation period: 2019 - 2021
Total project cost (CZK thous.): 1 927
Total project cost – TBU (CZK thous.): 1 763
Project cost of TBU in 2021 (CZK thous.): 484

ÉTA Programme

TL03000319 Economics and ethics of foreign investors in the Czech Republic

Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Adriana Knápková
Implementation period: 2020 - 2023
Total project cost (CZK thous.): 4 753
Total project cost – TBU (CZK thous.): 4 753
Project cost of TBU in 2021 (CZK thous.): 1 597

TL03000525 Design of a Model of Metropolitan Areas in the Czech Republic affected by depopulation
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Pavel Bednář
Implementation period: 2020 - 2022
Total project cost (CZK thous.): 8 428
Total project cost – TBU (CZK thous.): 1 489
Project cost of TBU in 2021 (CZK thous.): 544

TL03000737 Use of behavioral economics to society activation to achieve financial safety by using banking products
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Lubor Homolka
Implementation period: 2020 - 2022
Total project cost (CZK thous.): 1 072
Total project cost – TBU (CZK thous.): 1 014
Project cost of TBU in 2021 (CZK thous.): 518

TL05000328 Setting the market price for the financial transactions while using the arm's length principle
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: David Homolka
Implementation period: 2021 - 2023
Total project cost (CZK thous.): 3 460
Total project cost – TBU (CZK thous.): 172
Project cost of TBU in 2021 (CZK thous.): 43

Projects where TBU acts as a co-investigator

TJ01000191 Innovation of tourism management systems by means of process management tools
Principal investigator: ZČU Plzeň
Project investigator on behalf of TBU: Zuzana Tučková
Implementation period: 2018 - 2022
Total project cost (CZK thous.): 11 933
Total project cost – TBU (CZK thous.): 1 387
Project cost of TBU in 2021 (CZK thous.): 357

TREND Programme

Projects where TBU acts as a co-investigator

FW03010562 New software tool for export support of small and medium-sized Czech companies
Principal investigator: NetDirect s.r.o.
Project investigator on behalf of TBU: Jiří Bejtkovský
Implementation period: 2021 - 2023
Total project cost (CZK thous: 14 971
Total project cost – TBU (CZK thous.): 1 799
Project cost of TBU in 2021 (CZK thous.): 549

FW03010194 Development of a system for monitoring and evaluation of selected risk factors of the physical load of work operations in the context of Industry 4.0.
Principal investigator: Incontio Ltd.
Project investigator on behalf of TBU: David Tuček
Implementation period: 2021 - 2024
Total project cost (CZK thous: 18 474
Total project cost – TBU (CZK thous.): 3 084
Project cost of TBU in 2021 (CZK thous.): 781

4.6.3 Faculty of Multimedia and Communications

ÉTA Programme

TL03000367 USING VIRTUAL REALITY IN ART: CREATING AN EXPERIENCE IN THE WORLD OF FANTASY AND INSPIRATION OF KAREL ZEMAN
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Peter Štarchoň
Implementation period: 2020 - 2022
Total project cost (CZK thous.): 9 817
Total project cost – TBU (CZK thous.): 2 208
Project cost of TBU in 2021 (CZK thous.): 798

4.6.4 Faculty of Applied Informatics

EPSILON Programme

Projects where TBU acts as a co-investigator

TH04010377 Development of methods of identification and protection of soft targets within transport infrastructure to increase their security and resistance to terrorist threats
Principal investigator: VUT Brno
Project investigator on behalf of TBU: Dora Lapková
Implementation period: 2019 - 2022
Total project cost (CZK thous.): 10 701
Total project cost – TBU (CZK thous.): 5 224

Project cost of TBU in 2021 (CZK thous.): 1 417

TREND Programme

Projects where TBU acts as a co-investigator

FW01010381 Intelligent robotic protection of the health of the hydroponic greenhouse ecosystem
Principal investigator: NWT a. s.
Project investigator on behalf of TBU: Roman Jašek
Implementation period: 2020 - 2023
Total project cost (CZK thous.): 38 006
Total project cost – TBU (CZK thous.): 19 810
Project cost of TBU in 2021 (CZK thous.): 4 813

4.6.5 Faculty of Humanities

ÉTA Programme

TL03000191 Labelling of intellectually gifted children at school environment
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Eva Machů
Implementation period: 2020 - 2023
Total project cost (CZK thous.): 3 645
Total project cost – TBU (CZK thous.): 3 645
Project cost of TBU in 2021 (CZK thous.): 1 111

4.6.6 Faculty of Logistic and Crisis Management

ÉTA Programme

TL03000007 Strengthening rural resilience through the mobilisation of local actors and landowners
Principal investigator: TBU in Zlín
Project investigator on behalf of TBU: Jiří Lehejček
Implementation period: 2020 - 2023
Total project cost (CZK thous.): 9 089
Total project cost – TBU (CZK thous.): 2 342
Project cost of TBU in 2021 (CZK thous.): 517

4.6.7 University Institute

EPSILON Programme

Projects where TBU acts as a co-investigator

TH03020117 Conductive materials and their application for antistatic and dissipative treatment of the paper and polymeric products
Principal investigator: Centrum organické chemie s. r. o.
Project investigator on behalf of TBU: Vladimír Sedlařík
Implementation period: 2018-2021

Total project cost (CZK thous.):	19 910
Total project cost – TBU (CZK thous.):	2 800
Project cost of TBU in 2021 (CZK thous.):	700

TH04020466 REAKTIN - Longfiber composites for serial production
Principal investigator: 5M s. r. o.
Project investigator on behalf of TBU: Tomáš Sedláček
Implementation period: 2019-2022

Total project cost (CZK thous.):	10 074
Total project cost – TBU (CZK thous.):	2 065
Project cost of TBU in 2021 (CZK thous.):	596

GAMA2 Programme

TG03010052 Commercialization at the Tomas Bata University in Zlin II
Project investigator on behalf of TBU: Miroslava Komínková
Implementation period: 2020 - 2022

Total project cost (CZK thous.):	11 099
Total project cost – TBU (CZK thous.):	11 099
Project cost of TBU in 2021 (CZK thous.):	3 934

M-ERA.NET Programme

TH71020006 Li-ion BAttery-SupErcapacitor Hybrid Device
Project investigator on behalf of TBU: Petr Sáha
Implementation period: 2020 - 2023

Total project cost (CZK thous.):	2 036
Total project cost – TBU (CZK thous.):	2 036
Project cost of TBU in 2021 (CZK thous.):	695

Projects where TBU acts as a co-investigator

TH71020005 Bioactive injectable hydrogels for soft tissue regeneration after reconstructive maxillofacial surgeries INJECT-BIO
Principal investigator: Riga Technical University
Project investigator on behalf of TBU: Nabanita Saha
Implementation period: 2020 2023

Total project cost (CZK thous.):	1 534
Total project cost – TBU (CZK thous.):	1 534
Project cost of TBU in 2021 (CZK thous.):	489

THÉTA Programme

TK03030157 Next generation all-solid-state Li-ion batteries
Project investigator on behalf of TBU: Petr Sáha
Implementation period: 2020 - 2025
Total project cost (CZK thous.): 24 607
Total project cost – TBU (CZK thous.): 24 607
Project cost of TBU in 2021 (CZK thous.): 4 319

TREND Programme

Projects where TBU acts as a co-investigator

FW01010588 Filters for removal of biologically active molecules from the drinking water
Principal investigator: Nedform s. r. o.
Project investigator on behalf of TBU: Vladimír Sedlařík
Implementation period: 2020 - 2022
Total project cost (CZK thous.): 11 003
Total project cost – TBU (CZK thous.): 4 371
Project cost of TBU in 2021 (CZK thous.): 1 725

FW01010620 Research and development of materials and technology of small batch production of structural and sealing elements
Principal investigator: G 3, s.r.o.
Project investigator on behalf of TBU: Michal Machovský
Implementation period: 2020 - 2023
Total project cost (CZK thous.): 20 096
Total project cost – TBU (CZK thous.): 5 009
Project cost of TBU in 2021 (CZK thous.): 1 376

FW01010327 Advanced polymer and composite materials for additive manufacturing
Principal investigator: SPA 2000 s. r. o.
Project investigator on behalf of TBU: Jarmila Vilčáková
Implementation period: 2020 - 2024
Total project cost (CZK thous.): 18 134
Total project cost – TBU (CZK thous.): 4 376
Project cost of TBU in 2021 (CZK thous.): 1 094

FW03010006 Permanent protection of touch screens to prevent the deposition of organic pollutants on their surface
Principal investigator: FORTES interactive, s.r.o.
Project investigator on behalf of TBU: Martina Pummerová
Implementation period: 2021 - 2024
Total project cost (CZK thous.): 29 579
Total project cost – TBU (CZK thous.): 5 200
Project cost of TBU in 2021 (CZK thous.): 1 300

FW03010465 Technological production scrap as an innovative material source in a process of production of nonwoven textile
Principal investigator: PFNonwovens Czech s.r.o.
Project investigator on behalf of TBU: Tomáš Sedláček
Implementation period: 2021 - 2024

Total project cost (CZK thous.):	66 383
Total project cost – TBU (CZK thous.):	13 180
Project cost of TBU in 2021 (CZK thous.):	3 250

ZÉTA Programme

TJ02000125 Hi-tech footwear skin
Project investigator on behalf of TBU: Zuzana Bahulová
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	6 496
Total project cost – TBU (CZK thous.):	5 756
Project cost of TBU in 2021 (CZK thous.):	1 201

TJ02000269 Nanostructured filtration materials for elimination of arsenic in water
Project investigator on behalf of TBU: Eva Domincová Bergerová
Implementation period: 2019 - 2021

Total project cost (CZK thous.):	2 297
Total project cost – TBU (CZK thous.):	1 624
Project cost of TBU in 2021 (CZK thous.):	123

4.7 Projects financed by the Ministry of Culture

In 2021, 1 project financed by the Ministry of Culture was implemented at the TBU in Zlín.

Total eligible costs amounted CZK 4,017 thousand for TBU in Zlín in 2021.

4.7.1 Faculty of Multimedia Communications

NAKI II Programme

Projects where TBU acts as a co-investigator

DG18P02OVV059 Designers in the Czech Lands and the Czechoslovak Machinery Industry
Principal investigator: National Technical Museum
Project investigator on behalf of TBU: Zdeno Kolesár
Implementation period: 2018 - 2022

Total project cost (CZK thous.):	23 206
Total project cost – TBU (CZK thous.):	11 080
Project cost of TBU in 2021 (CZK thous.):	4 017

4.8 Projects financed by European Commission

In 2021, 2 projects financed by Europena Commission was implemented at the TBU in Zlín.

Total eligible costs amounted CZK 1,812 thousand for TBU in Zlín in 2021.

4.8.1 Faculty of Technology

Horizon 2020 Programme

Strategies of circular Economy and Advanced bio-based solutions to keep our Lands and seas alIVE from plastics contamination (SEALIVE)

Project investigator on behalf of TBU: Marek Koutný	
Implementation period: 2019 – 2023	
Total project cost (CZK thous.):	282 111
Total project cost – TBU (CZK thous.):	8 128
Project cost of TBU in 2021 (CZK thous.):	1 644

Horizon Europe Programme

Storage Research Infrastructure Eco-Systém StoRIES

Project investigator on behalf of TBU: Petr Sáha	
Implementation period: 2021- 2025	
Total project cost – TBU (CZK thous.):	336
Project cost of TBU in 2021 (CZK thous.):	168

4.9 PROJECTS – SUMMARY

Number of projects implemented in 2021

Component part / Provider	European Commission	Czech Science Foundation	Ministry of Culture	Ministry of Industry and trade of the Czech		Ministry of Education, Youth and Sports of the Czech Republic	Ministry of the Interior of the Czech Republic	Ministry of Agriculture of the Czech Republic	Technology Agency of the Czech Republic	Total
				MIT total	Operational Programme projects					
Faculty of Technology	1	2	0	3	3	0	0	2	3	11
Faculty of Management and Economics	0	1	0	2	2	2	0	0	8	13
Faculty of Multimedia Communications	0	0	1	0	0	0	0	0	1	2
Faculty of Applied Informatics	0	2	0	12	11	2	3	0	2	21
Faculty of Humanities	0	2	0	0	0	0	0	0	1	3
Faculty of Logistics and Crisis Management	0	0	0	0	0	0	1	0	1	2
TBU Library	0	0	0	0	0	0	0	0	0	0
University Institute	1	6	0	4	2	7	0	1	13	32
Rectorate	0	0	0	0	0	0	0	0	0	0
TBU total	2	13	1	21	18	11	4	3	29	84

Total costs acknowledged for TBU in Zlín in 2021 za UTB (in CZK thousands)

Component part / Provider	European Commission	Czech Science Foundation	Ministry of Culture	Ministry of Industry and trade of the Czech		Ministry of Education, Youth and Sports of the Czech Republic	Ministry of the Interior of the Czech Republic	Ministry of Agriculture of the Czech Republic	Technology Agency of the Czech Republic	Total
				MIT total	Operational Programme projects					
Faculty of Technology	1 644	4 177	0	2 622	2 622	0	0	1 331	3050	12 824
Faculty of Management and Economics	0	0	0	963	963	1 152	0	0	4 873	6 988
Faculty of Multimedia Communications	0	0	4 017	0	0	0	0	0	798	4 815
Faculty of Applied Informatics	0	1 449	0	6 457	5 775	621	4 194	0	6 230	18 951
Faculty of Humanities	0	856	0	0	0	0	0	0	1111	1 967
Faculty of Logistics and Crisis Management	0	0	0	0	0	0	795	0	517	1 312
TBU Library	0	0	0	0	0	0	0	0	0	0
University Institute	168	7 596	0	2 006	0	4 977	0	1 485	20802	37 034
Rectorate	0	0	0	0	0	0	0	0	0	0
TBU total	1 812	14 078	4 017	12 048	9 360	6 750	4 989	2 816	37 381	83 891

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The publication was not checked for language or editorial