

**THE MINUTES OF THE PHD STUDY BOARD MEETING ON
PHD STUDY PROGRAM - ENGINEERING OF AGRICULTURAL TECHNOLOGICAL
SYSTEMS (EATS)**

The PhD Board meeting of the PhD study program - Engineering of Agricultural Technological Systems- was held in person on January 25th, 2024, at 9:00 am in the Consultation Room at the Faculty of Engineering, CZU.

The attendance list is enclosed.

AGENDA:

1. Welcome and introduction by prof. Herak (The Head of the PhD Board).
2. Presentation on Progress of the Dissertation Research by the PhD Students.
3. Approval of the Progress of the PhD Study Program – EATS
 - a. *Mr Vijay Chandan:* The PhD Board recommended to the PhD student to continue the PhD study program – EATS.
4. Approval of the Drafts of New Dissertation Topics
 - a. All dissertation topics listed below were unanimously approved.

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| 5. PhD Program | Engineering of Agricultural Technological Systems |
| Supervisor | Doc. Ing. Abraham Kabutey, Ph.D. |
| Department | Mechanical Engineering |
| Topic | Cold and hot pressing of oils from selected edible oilseeds and their sensory, chemical, spectral characteristics and fatty acids compositions |
| Annotation | Some edible oilseeds will be selected based on literature information. Their oils will be extracted using the mechanical screw press/linear press at laboratory and heating temperatures. The nutritional value and sensory characteristics of edible oils are compromised by rancidity development leading to spoilage. The sensory qualities of oil include color, brightness, smell, flavor and aroma as well as the age of oil which are influenced by several factors during the production process. The sensory qualities of the extracted oils will be evaluated by using a combination of sensory and analytical methods. The chemical properties namely peroxide value, acid value, iodine value and free fatty acid among others will be examined by means of a titration procedure. The quality of oil is also determined by its fatty acid composition which will be analysed using appropriate instrumentation. The UV-Vis spectroscopy associated with multivariate data analysis will be used to analyse the extracted oils |

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| | including their absorption spectra profiles within specified wavelength range. Quality oil parameters need to be established to preserve consumer awareness and safety. |
| Compliance with targets of EATS study program | The dissertation thesis is within the EATS study programme and Agriculture 4.0. to aid in the design of efficient drying technology for processing agricultural products in developing countries. |

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| PhD Program | Engineering of Agricultural Technological Systems |
| Supervisor | Doc. Ing. Abraham Kabutey, Ph.D. |
| Department | Mechanical Engineering |
| Topic | Mechanical and rheological properties of bulk pumpkin seeds under quasi-static and dynamic loadings. |
| Annotation | Whether the static mechanical test techniques can be extended to evaluate bulk oilseeds processing performance under dynamic loading conditions is a vital research hypothesis which needs to be investigated. The research is seeking to obtain adequate information on both the experimental and theoretical concepts of the mechanical and rheological properties of bulk pumpkin seeds of different varieties under quasi-static and dynamic tests using the universal compression testing machine. Quasi-static and dynamic compression experiments of bulk pumpkin seeds will be conducted at different heating temperatures and pressing rates. The influence of heating temperatures and pressing rates on the mechanical and rheological properties of bulk pumpkin seeds under quasi-static and dynamic loadings will be examined. Multivariate data techniques will be employed to analyse the determined responses. |
| Compliance with targets of EATS study program | The dissertation thesis is within the EATS study programme and Agriculture 4.0. to aid in the design of efficient technology for processing oilseeds in the rural areas of developing countries. |

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| PhD Program | Engineering of Agricultural Technological Systems |
| Supervisor | Doc. Ing. Abraham Kabutey, Ph.D. |
| Department | Mechanical Engineering |
| Topic | Experiments, modelling and optimisation of performance parameters of selected oilseeds oil extraction process |
| Annotation | Mechanical pressing is generally preferred and widely used for oil extraction from oilseeds because of its great advantage of producing high-quality oil. In the literature, there is still the need to conduct further research to understand its complexities (moisture content, extraction time, pressing temperature, speed, applied pressure, diameter of pressing vessel, friction between the seeds and the walls of the pressing vessel and plunger, nozzle sizes, pressing heads or heating sleeves diameter, press cylinders sizes and screw pitch diameter) which thus affect the pressing process in terms of oil extraction efficiency and energy requirement. These factors, however, can be understood first under the laboratory scale based on appropriate experimental designs, statistical techniques, and optimisation concepts. |

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| Compliance with targets of EATS study program | The dissertation thesis is within the EATS study programme and Agriculture 4.0. to aid in the design of efficient technology for processing oilseeds in the rural areas of developing countries. |
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| PhD Program | Engineering of Agricultural Technological Systems |
| Supervisor | Doc. Ing. Abraham Kabutey, Ph.D. |
| Department | Mechanical Engineering |
| Topic | Application of machine learning algorithms for describing drying kinetics of selected agricultural products. |
| Annotation | The drying of agricultural produce entails a complex thermal process in which simultaneous heat and mass transfer occur. The process ensures the reduction of moisture content in the agricultural product to extend the shelf life. The drying kinetics of a product depends on various factors such as hot air-speed, initial moisture content, final moisture content, relative humidity, temperature, dimensions, form, composition, external surface, intermittence, pressure, and porosity, among others. Kinetic modelling of process parameters by employing supervised machine learning models such as linear regression, K-means clustering, support vector machine among others is very useful in food processing. |
| Compliance with targets of EATS study program | The dissertation thesis is within the EATS study programme and Agriculture 4.0. to aid in the design of efficient drying technology for processing agricultural products in developing countries. |

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| PhD Program | Engineering of Agricultural Technological Systems |
| Supervisor | Rajesh Mishra |
| Department | Material Science and Manufacturing Technology |
| Topic | Agro waste processing and utilisation in green composites/nanocomposites |
| Annotation | The topic deals with reuse and recycling of agro waste products including fibrous wastes to be used as reinforcement in green composite materials. Further, the nanoscale refinement of cellulose derived from such material will be used to enhance the mechanical, thermomechanical and other functional performances. The theoretical models and numerical analysis will be done to predict selected mechanical performance of the material. The results will be compared with experimental samples developed with similar specifications. |
| Compliance with targets of the EATS study program | The topic is inline with the study program EATS, Industry-4.0/5.0, Agriculture-4.0/5.0. |

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| PhD Program | Engineering of Agricultural Technological Systems |
| Supervisor | Rajesh Mishra |
| Department | Material Science and Manufacturing Technology |
| Topic | Biopolymers based degradable composite food packaging material |

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| Annotation | The research aims at developing a new generation of packaging materials derived from biopolymers and reinforced with nanocrystalline cellulose so as to make it degradable at the end of life while retaining its basic functionality. The biopolymers will be based on Polyvinyl alcohol (PVA), Polylactic acid (PLA), bacterial cellulose etc. The nanocellulose will be derived from agro waste fibrous materials. A nontoxic top-down approach based on planetary ball milling will be involved to derive nanocrystalline cellulose from waste fibers. The mechanical, chemical recycling of the new packaging materials used in the food packaging industry will be achieved. The balance between the mechanical and chemical stability while protecting the content and at the same time easy and environment friendly degradation/recycling at the end of life will be investigated. |
| Compliance with targets of the EATS study program | The topic is inline with the study program EATS, Industry-4.0/5.0, Agriculture-4.0/5.0. |

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| PhD Program | Engineering of Agricultural Technological Systems |
| Supervisor | Prof. Ing. David Herák, Ph.D. |
| Department | Mechanical Engineering |
| Topic | Utilisation of the finite element method to describe the mechanical behavior of oilseeds under compression loading |
| Annotation | The dissertation thesis aims to create comprehensive models of the mechanical behaviour of oilseeds using the finite element method. These models will describe the mechanical behaviour of the bulk seeds under compression loading, the relaxation behaviour, the creep behaviour, as well as the oil points. Models should be used to create the "digital twin of the seed", which will show the same mechanical and physical behaviour as the real oilseed in the context of oilseed pressing. Models should be created using the ANSYS system. |
| Compliance with targets of the EATS study program | The topic fits into the essence of the idea of Industry 4.0 and Agriculture 4.0, respectively. |

6. Any other business

Further discussions focused on strengthening international cooperation related to the PhD study program.

Prague, January 25th, 2024

prof. Ing. David Herák, Ph.D.

Head of PhD Board