DEPARTMENT OF PROCESS ENGINEERING
FACULTY OF MECHANICAL ENGINEERING, CZECH TECHNICAL UNIVERSITY IN PRAGUE

Topics of Bachelor Thesis

Study Programme:

Engineering – Power and Process Technology

Scope to Process Technology

Academic Year: 2020/2021

Supervisor	Topic
assoc. prof. Ing. Karel Petera, Ph.D.	**Modeling light distribution** This work aims at description and assessment of available numerical methods used for simulations of light propagation in systems like photobioreactors. The light is the key factor of algae growth and its permeability decreases with increasing density of algae culture. The light intensity decreases with increasing distance from the illuminated wall in general. It can be affected by the hydrodynamics of the given system which is determined by the geometry and operational parameters. Light is electromagnetic radiation in principle therefore radiation models (focused on visible part of electromagnetic spectrum) can be used in its description. A proper model when describing such systems is very important in the design.
assoc. prof. Ing. Jan Skočilas, Ph.D.	**Measurement of particle paramaters** Physical properties of the particular material are important characteristics for the designing of the equipment for the particle treatment. The aims of the bachelor thesis are literature search, proposal of measurement methods, measurement realization, data evaluation for properties of specific particular material. The objective of investigation is the ceramic material which is produced in the rotary kiln. Parameters of particles interactions are important for the design and the operation of the rotary kiln.
assoc. prof. Ing. Jan Skočilas, Ph.D.	**Rheology of viscoelastic material** The identification of flow properties of investigated material, especially when the material exhibits Non-Newtonian behavior, which is usual for food, is preceding key step in design of the equipment determined for material transport, e.g. in pipes. The aim of the work is assessment of the viscoelastic properties of the collagen matter in the capillary rheometer. The assessment of viscoelastic parameters of collagen matter will be performed by observation of the phenomena “Die swell” known also as “Extrudate swell” or “Barus effect”. This effect is manifested by swelling of the

	outer dimension of the product compare to dimension of the capillary die. Based on the image analysis of dimensions of the product in the vicinity of die it is possible to determine swell ratio, from which the viscoelastic properties are possible to obtain.
Ing. Jiří Moravec, Ph.D.	**Measuring system for rheological experiments with suspensions** The aim of the work is to propose an experimental equipment, which would enable to measure flow properties of liquids and suspensions. The measuring system should consist of a cup and rotor in form of an impeller and should be applicable for mounting on rheometer Rheotec RC20. The work should contain basic literature search about impellers which are used for such purpose and the methodology of measurement. The main part will be aimed on design of the whole measuring system, especially the measuring cup. Complete drawing documentation should be prepared for both parts – measuring cup and impeller. Experimental part of work can be added to verify the design of the new sensor.
Ing. Jiří Moravec, Ph.D.	**Impellers for measurement of rheological properties** The aim of the work is to find stirrers which could be used for experimental measurements of flow properties of different substances and describe their process properties. In the first step, a literature search focused on stirrers and their process parameters should be carried out. The goal is to find, what types of stirrers are suitable for rheological measurements with suspension especially (based on power and suspension characteristics). In the second step, power characteristics should be determined for each chosen type of stirrer and its configuration in a measuring cup (vessel). The obtained data should be compared to the results of a literature search and the best measuring system stirrer – impeller suitable for flow properties measurement should be proposed.
Ing. Jiří Moravec, Ph.D.	**Power characteristics of impellers at low liquid level** The topic is aimed on experimental observation of behavior of different impellers during draining of liquid from a tank. Especially, a power consumption of impellers in such situation should be studied. The work has to be done experimentally, but a CFD description of the flow in a vessel at low liquid level can be also added (depending on student's choice). More types of impellers should be studied in the work.
Ing. Jiří Moravec, Ph.D.	Free topic supervisor: Ing. Jiří Moravec, Ph.D. I offer supervision of bachelor thesis with own topic prepared by student. The topic can be focused on any field of process engineering (engineering or computa-

	tional design of equipment, balancing of processes, experimental works, computational fluid dynamics, etc.). The final topic and goals of work are prepared after consultation with the student.
Ing. Jaromír Štancl, Ph.D.	**Design of pasteurization equipment with direct ohmic heating** The aim of this work is to become familiar with procedures for thermal treatment of food materials. The literature review should be focused on principle of direct ohmic heating for thermal processing of foods and the construction of industrially used ohmic heating pasteurization devices. Based on acquired knowledge the basic design of the ohmic heating pasteurization device for aseptic processing of fruit or vegetable juices or purees (quarter to pilot plant scale) would be made.
Ing. Jaromír Štancl, Ph.D.	**Measuring the electrical conductivity of solid foods** The aim of this work is to become familiar with procedures for measuring the electrical conductivity of food materials in the form of literature review focused on methods of measuring the electrical conductivity of various substances. Based on acquired knowledge experimentally determine the dependence of the electrical conductivity of selected food material on temperature, moisture content or frequency.
Ing. Michal Netušil, Ph.D.	**Air filtration** Research focused on the filtration of air pollutants. Testing of real filter elements. Evaluation of tests and recommendations for filtration of air pollutants.
Ing. Stanislav Solnař	**Static vs. dynamic methods** In experimental measurements, we can encounter two types of measurement methods, static or dynamic. Static methods are usually characterized by their transferability, but they are time consuming. Dynamic methods, on the other hand, are very fast and allow you to get a large amount of information in a very short time. Prepare experimental measurements, where you will compare both methods on the selected geometry.
Ing. Stanislav Solnař	**Measurement of radiative heat flux** Measuring the heat flow in a solid wall is a fairly mastered engineering task. But what will happen when measuring heat flux in liquids and gases? And what if I need to measure the incident heat flux on the wall (eg from the sun)? Prepare a research on the topic of measuring radiative heat flux and prepare a design of a measuring element.
Ing. Stanislav Solnař	**Heat exchangers in PC** Increasing the performance of our PCs also goes hand in hand with higher heat dissipation. A very modern method of cooling individual parts is the use of a water

	circuit with heat exchangers. Design and experimentally measure the power and loss characteristics of your own heat exchanger.
Ing. Viktor Vajc	**CIP cleaning for production lines** Study methods and procedures of CIP (clean-in-place) cleaning of apparatuses, pipelines and other equipment of production lines. For a chosen line, draw a PID diagram of an automatic CIP cleaning system including suitable cleaning media, pumps, MaR and operating parameters of the system. Suggest modifications for one of the apparatuses in the line which are necessary in order to switch from manual to CIP cleaning. Create drawings for such an adjustment.
Ing. Viktor Vajc	**Ecological refrigerants** Several often-used refrigerants were banned due to the actions taken in order to slow down global warming and depletion of the ozone layer. These refrigerants were replaced by more ecologic and environment-friendly alternatives. Create a survey dealing with current state and future prognosis in the branch of industrial refrigerants. Compare important refrigerants which were used in the past with their contemporary alternatives. Focus on comparison of thermophysical, ecological and economical parameters of these refrigerants. Design a cooling system for a chosen technical application. Compare the operation of the designed system with several suitable refrigerants.
Ing. Mgr. Vojtěch Bělohlav	**Mixing of the culture medium in a flat panel photobioreactor** Design the component for culture medium homogenization in flat panel photobioreactor. Prepare a literature and patent review of existing design variants for mixing and homogenization of culture medium in cultivation systems. Based on the critical review, select the most suitable design that could be implemented on an industrial scale. Develop a basic design and 3D model of the component for pilot-plant photobioreactor.
Ing. Mgr. Vojtěch Bělohlav	**Aeration of cultivation systems for the production of 3rd generation biomass** The aim of this work is to compare the operating costs of aeration of cultivation systems for the processing of 3rd generation biomass. Prepare a literature and industrial review of the operating conditions of existing technologies and design variants of systems using a mixture of air and pure CO2, or waste CO2. Based on a critical review, make a comparison of the operating costs of the selected variants. Define the amount and composition of aeration gas for the selected design of the cultivation system.
Ing. Mgr. Vojtěch Bělohlav	**Effective methods of microalgae harvesting**

	Harvesting and dewatering is one of the key unit of the 3rd generation biomass production technology, which significantly affects the economic aspect of the whole technology. The aim of this work is to prepare a literature and industrial review of existing technologies and design variants for microalgae harvesting. Based on a critical review, select the most suitable technologies that could be implemented on an industrial scale. Define basic design and operating parameters for the selected technology. Based on the selected parameters, a basic design of the selected technology will be developed.
Ing. Martina Hladíková	**Flocculation and Biopolymers** Flocculation is a widely applied technology mainly used for wastewater treatment. So-called coagulants are also commonly used, then, the process is called coagulation. Whereas coagulants are usually metal salts, flocculants may be of organic or inorganic origin. The organic ones are often referred to as biopolymers. The major advantage is related to their recycling, biodegradability and they do not induce contamination of the medium as well. The aim of the thesis is to focus on the field of biopolymers applied during flocculation, not only for wastewater treatment, and their essential modifications before the entire process. The student should also acquaint with fundamental definitions (colloid, stability, destabilization, coagulation, etc.) to get a full overview of the topic.
Ing. Martina Hladíková	**Substitutes for Plastics** With a growing amount of plastic waste, new materials are emerged, which can be easily composted. The aim of the thesis is to focus on the field of substitutes for plastics, eventually of the processes, which make the recycling of plastics easier, and the manufacturing processes and technologies of these substitutes. The thesis should also consider the methods of their (plastics, substitutes) recycling, eventually the problems related to their recycling. The student should also acquaint with fundamental definitions to get a full overview of the topic.