

## I. IDENTIFICATION DATA

<b>Thesis title:</b>	<b>Separation of microalgae from culture medium using flocculant.</b>
<b>Author's name:</b>	<b>Lucie Scholleová</b>
<b>Type of thesis :</b>	bachelor
<b>Faculty/Institute:</b>	Faculty of Mechanical Engineering (FME)
<b>Department:</b>	Department of Process Engineering
<b>Thesis reviewer:</b>	Assoc. Prof. Ing. Lukáš Krátký, Ph.D.
<b>Reviewer's department:</b>	FME CTU in Prague, Department of Process Engineering

## II. EVALUATION OF INDIVIDUAL CRITERIA

<b>Assignment</b>	<b>ordinarily challenging</b>
<i>How demanding was the assigned project?</i>	
The assignment dealt with the elaboration of the review and with carrying out the basic experimental works.	

<b>Fulfilment of assignment</b>	<b>fulfilled with major objections</b>
<i>How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.</i>	
The assignment was fulfilled with major objections. For example, there is no review of the problem (just general process description in individual equipment not fitted to the problem for microalgal separation), the number of experiments is very low, and basic design and operating parameters are not precisely defined.	

<b>Methodology</b>	<b>correct</b>
<i>Comment on the correctness of the approach and/or the solution methods.</i>	
The author's approach and applied experimental research techniques were correct.	

<b>Technical level</b>	<b>E - sufficient.</b>
<i>Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?</i>	
The technical level of the thesis is very poor. The summary regarding the state of the art in applying given equipment for microalgal separation is missing. Moreover, some proposed equations and their validity are disputable in this part. The author presents only seven experiments on flocculation, i.e. 4x PWG54, 3x CWE35. The methodology is correct. No efficiency evaluation for flocculant application is suggested, as the assignment demands. Basic design and operational parameters are not fully defined. No block of the process flow scheme is presented. The chapter overviews the geometrical configuration for the circular settler, lamella settler and decanter centrifuge without any demonstrative calculation, sometimes with strange values.	

<b>Formal and language level, scope of thesis</b>	<b>C - good.</b>
<i>Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?</i>	
The thesis contains all the necessary formal requirements. The text is written understandably. The author should avoid writing from the first-person perspective and limit additional words to clarify the text. Font styling and spacing are not uniform. Figure 12 is not well formatted.	

<b>Selection of sources, citation correctness</b>	<b>C - good.</b>
<i>Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?</i>	
The author used 72 relevant references in the text. The manuscript's citations and format listed in the bibliography follow the European Copyright Act No. 121/2000 but do not accept the citation practices (the book must have an ISBN, website	

the date of the citation). In addition, the reference style using researchers' names is incorrect in the text. Plagiarism Checker Grammarly also checked the thesis with no detection of plagiarism.

### **Additional commentary and evaluation (optional)**

*Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.*

Please insert your comments here.

### **III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE**

*Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defence of the student's work.*

The topic itself is currently globally attractive and has the potential to reach the high-ranked bachelor thesis. Nevertheless, the thesis is not profoundly elaborated. The first ten pages of overall forty ones describe the problem of biorefinery, and photobioreactors, i.e. it is out of the topic.

The review presents the equipment for microalgal separation out of the cultivation batch. I appreciate the theoretical overview of process equations and sketches for individual settlers and centrifuges. But I entirely miss the summary regarding state of the art on process configuration for microalgal harvesting and separation. Professionally literature, review and research papers serve plenty of information on the topic, but nothing is presented (what was done, which results, the rate of thickening for which microalgal species). Moreover, some proposed equations and their validity are disputable in this part.

The experimental part deals with identifying the sedimentation velocities of a given pathway and evaluating the efficiency for flocculant application. Nevertheless, no deep and systematic experiments are shown. The author presents only seven experiments on flocculation, i.e. 4x PWG54 and 3x CWE35. The methodology is correct. No efficiency evaluation for flocculant application is suggested, as the assignment demands.

The chapter on basic design and operational parameters is very poor in information. No block of the process flow scheme is presented. The chapter overviews the geometrical configuration for the circular settler, lamella settler and decanter centrifuge without any demonstrative calculation. Strange values are sometimes given as tasks for the defence.

The grade that I award for the thesis is **E - sufficient**.

#### **Question for defence:**

1. Present the typical process characteristics of harvesting and dewatering technologies that are not directly listed in the thesis. I.e. microalgal size and shape, batch temperature, batch acidity, initial concentration of microalgae in an aqueous batch, and the targeted value for microalgal thickening.
2. Clarify the Eq(3) and Eq(10) – meaning of equation members, dimension analysis, and limits in applicability.
3. Regarding Fig.12, can you discuss your explanation or reasons for the different curve shapes of the trials?
4. Clarify the method of how the dosing amount of flocculant was selected. Discuss all the results with available research papers (the agreement in flocculant amount dosing, recovery efficiency). Is your dosing general or limited by batch characteristics (temperature, acidity, algal strain, mixing intensity, environmental friendliness)?



## THESIS REVIEWER'S REPORT

5. Regarding one of the aims, present your efficiency evaluation for flocculant application, e.g., recovery efficiency or concentration factor.
6. Describe your technology design as sequence steps from microalgal aqueous batch on initial concentration to targeted thickened batch.
7. Demonstrate the process design of circular settler for sedimentation velocity without flocculants. Define and calculate its height.
8. Demonstrate the process design of the decanter centrifuge for sedimentation velocity with flocculants. Is the length of the centrifuge realistic?

Date: **23.1.2023**

Signature: