ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE

REVIEW OF THE FINAL THESIS

I. IDENTIFICATION DATA

Title:	**Environmental-friendly technology for cellulosic fiber extraction for biorefinery**
Author:	**Bc. Salman AZIZOV**
Type of the thesis:	Master thesis (diploma thesis)
Faculty/department:	Faculty of Mechanical Engineering
Department:	Department of Process Engineering
Reviewer:	Ing. Jaromír Štancl, Ph.D.
Reviewer's place of employment:	FME CTU in Prague - Department of Process Engineering

II. CRITERIA EVALUATION

Thesis assignment — **Average**

Difficulty evaluation of the thesis assignment.

The presented work focuses on evaluation of potential of cellulosic fibers as a raw material of bioplastics or biocomposites. The work contains literature survey of technologies for cellulosic fiber extraction from cellulosic wastes. The main part of the presented work performs techno-economical study of promising technology of the biorefinery for cellulosic fibre extraction process. From my point of view, the topic of the presented thesis is a typical engineering task for a mechanical engineer. I see the difficulty of the thesis assignment as average and adequate for a master's degree graduate.

Fulfilment of thesis´s assignment — **Fulfilled**

Evaluate, whether the proposed final work fulfils the assignment. Comment where appropriate, points of reference that were not fully met, or if the work is extended compared to assignment. If the assignment is also not completely fulfilled, try to assess the importance, impact and possibly cause various deficiencies.

The main task of presented thesis was to design technology for cellulosic fibre extraction and to perform techno-economical study of this technology (to design PFD and PID flowsheets, mass and energy balances and economical evaluation). All goals given by master thesis assignment were fulfilled and discussed in individual chapters in detail.

The chosen solution procedure — **Correct**

Assess whether the student has chosen the correct procedure or method of solution.

The author of the work chooses the correct procedure for solving the given task. I have no fundamental reservations about the chosen solution procedure.

Professional level — **B – very good**

Assess the expertise level of thesis, using knowledge gained from the study of scientific literature, documentation and utilization of data obtained from practice.

The professional level of the presented thesis and all performed calculations is very good. In my opinion, the author of the work has clearly demonstrated the ability to solve given engineering task. There are some errors in mass and energy balancing and in economical evaluation (detailed in comments below).

Formal and language level — **A - excellent**

Assess formal correctness of the thesis and the typographical and linguistic aspects of the thesis.

The presented thesis contains all the necessary formal requirements. The work is written very readily and well organized, it is appropriately and logically structured into the chapters. I consider its typographic and graphical level to be on very high level.

Selection of sources, citation correctness and bibliography	**A - excellent**
Comment the student's activity during the acquisition and use of learning materials to solve the thesis. Characterize the selection of sources. Assess whether the student made use of all relevant sources. Verify that adopted information is properly distinguished from student´s results and considerations, whether citation forms are corresponding with ethics, whether bibliographic citations are complete and finally whether all citation are in accordance with the practices and standards.	
Author used 39 relevant references in the text of his thesis. Citations in the text and their format listed in the bibliography are in accordance with the European Copyright Act No. 121/2000 and even with all the citation practices. Only in the introduction author combines abbreviated and full (author-year) citation style.	

Other comments
Comment the level achieved major results of the final work, e.g. the level of theoretical results, or the functional level of technical solutions, publication outlets, experimental skills, etc.
From my point of view the author of the presented work has clearly demonstrated the ability to solve given engineering task. I consider the submitted work as very good. But the work contains some errors in performed mass and energy and economical evaluation. For example, the energy balance is not done in detail. The identified problems are summarized below.

III. FINAL EVALUATION, QUESTIONS FOR THESIS DEFENSE AND PROPOSAL OF CLASSIFICATION

Summarize aspects of the thesis that most influenced your final evaluation.

The presented work (in the range of 62 pages of text, 29 figures, 8 tables and 14 appendices) focuses on quite new technology of using lignocellulosic waste materials for cellulosic fibre production. The introduction part of the thesis was focused on quality literature survey of evaluation a potential of lignocellulosic waste as a raw material for cellulosic fibre production (suitable materials, its potential and technological setup). In the main part of his work, the author designed the block diagram for suitable technology and proposed PID and PFD charts. The designed technological setup of cellulosic fibre production technology is environmental friendly where waste water from extraction technology is used to produce biogas by anaerobic digestion which is then used energetically in cogeneration unit to produce heat necessary for cellulosic fibre drying process and electrical energy to partly supply the other equipment in proposed technology.
In the final part of the thesis, author prepared the necessary mass and energy balances of the proposed technology and its economical evaluation (estimation of investment cost, profits, operating costs and evaluation of simple payback period and discounted payback period). Although the performed balances contain some minor errors, the results of the thesis are very interesting and promising and could be very useful for other future works.

I consider the submitted work as very good. From my point of view the author of the presented work has clearly demonstrated the ability to solve given engineering task. I recommend the presented diploma thesis for the defense.

Comments to the work:

- Page 1 – annotation - the annotation should not only be a summary of the assignment but should be a summary of the whole work (specify objectives, summarize what has been done and state the main conclusions)
- Page 7 – use of 2 different citation styles - the citation style should be unified throughout the work

- Page 25 – the abbreviation WWTP in the fig. 2.9. is not explained or mentioned in the list of used abbreviations
- Page 33 – there is no stream 5 on inlet into the S-103 in fig. 4.3. Probably mentioned stream 7.
- Page 37 – equation 4.3 – there is an error in calculation. 0,03x2,47 + 0,03 = 0,104 not 0,23.
- Page 42 – equation 4.18 – the temperature is calculated from eq. 4.18 not heat.
- Page 46 – equation 4.24 – Q_t is not mentioned in the list of used symbols.
- Page 49 – tab. 5.1 – evaluated IRR parameter should be mentioned too.
- Page 52 – list of symbols is not complete.
- Economy evaluation part – the assumptions for economic evaluation like a tax rate and depreciation of assets should be commented in thesis main text, not only in the appendix.
- Appendix - errors in PFD diagram tables - input is not equal to output. Mass and energy balances should be made more detailed.

Other minor comments are highlighted in the printed thesis.

Questions for thesis defense:

- Page 32 – fig. 4.3: Is it possible to use the steam from stream 7 to use for heating the reactor R-102? Will the steam have same parameters (temperature, pressure) as a heating stem from steam generator (stream 5)?
- Page 37 – equation 4.3 – the calculation seems to contain error. Please explain and comment the effect of this error on other mass balance calculations.
- Page 38 – equation 4.7 – is it correct? Please, explain in more detail the energy balance of cyclone (expander) S-103.
- Page 46 – equation 4.24 is not correct! You can't add together kWh with kW! Please explain. The calculated Q is total used energy in plant and was used for calculation operating costs. Have You considered the efficiency to produce steam in steam generator? Why did you not consider the energy consumption of other sub-units like energy consumption of ventilators (especially for dryer), pumps, belts etc. in the calculation? Please explain. What was the unit price of purchased energy?
- Page 48 – You report the payback period 24 year. From fig. 4.12/ page 47 I can read payback period 20 years. Please explain.
- Page 49 tab. 5.1 and page 51 – Payback period in years is simple payback time or real (discounted) payback time? Please explain. Please indicate IRR parameter.

The above comments and questions do not reduce the quality of the presented work. Due to the professional level and the high quality of the submitted diploma thesis, I evaluate the work by the grade:

B – very good

Date: 31.8.2017

Signature: Ing. Jaromír Štancl, Ph.D.