

I. IDENTIFICATION DATA

Title:	Waste gasification technology
Author:	Rahim Jalilov
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
<i>Difficulty evaluation of the thesis assignment.</i> From my point of view, the topic of the presented thesis is a typical engineering task for an engineer in the field of technology projecting. I see the difficulty of the thesis assignment as average and adequate for a master's degree graduate.	

Fulfilment of thesis's assignment	Fulfilled with greater reservations
<i>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.</i> The task of presented work was to discuss the potential of waste processing by gasification, to prepare a review that scopes to summarize current knowledge about gasification (technical set up and scale and process parameters), to perform technoeconomical study of selected technology (prepare PFD, mass and energy balances, economical evaluation, what-if analysis) and to discuss the possibility of syngas utilization as a raw material to produce chemicals and advanced biofuels. Most of the goals given by master thesis assignment were fulfilled and discussed in individual chapters (although for some goals it may be somewhat debatable). But the discussion of the potential of waste processing by gasification is not mentioned in the presented work!	

The chosen solution procedure	Correct
<i>Assess whether the student has chosen the correct procedure or method of solution.</i> I have no fundamental reservations about the chosen solution procedure. The presented work focuses on waste gasification technology to produce syngas from biomass. The literature research is mainly focused on biomass as a source of energy, properties of syngas, gasification systems, market survey of the biomass availability and syngas, and finally on gasification technology. Presented "theoretical part" (literature research) should be more deeply focused on gasification technology and technological parameters according to the thesis's assignment. The market survey of the feedstock discuss only the availability the biomass (especially wood and wood wastes) as a feedstock to the syngas production but the possibility of the other (non-wood, non-biomass) wastes is not discussed. In the "practical" part of the presented work, the student has created the PFD of the syngas technology with the wood waste or wood pellets as a feedstock to the gasification technology. The student also compiled the mass and energy balances of the technology and economical evaluation of the project.	

Professional level	E – sufficient
<i>Assess the expertise level of thesis, using knowledge gained from the study of scientific literature, documentation and utilization of data obtained from practice.</i>	
The professional level of the presented thesis is rather weaker. In my opinion, the author of the work has demonstrated the ability to find appropriate and necessary information in available literature. However, in my opinion, the author should more discussed acquired knowledge from literature – some parts were written with the style of copy and paste from the cited source. There are many bigger or smaller errors in the practical part of the presented work – especially in energy balances and economical evaluation. In my opinion, the author of the thesis has barely proved his ability to solve the assigned engineering task in the field of projecting new technology independently.	
Formal and language level	
B – very good	
<i>Assess formal correctness of the thesis and the typographical and linguistic aspects of the thesis.</i>	
The presented thesis contains all the necessary formal requirements. The work is written readily and quite well organized; it is appropriately and logically structured into the chapters. I consider its typographic and graphical level to be very good.	
Selection of sources, citation correctness and bibliography	E - sufficient
<i>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.</i>	
Author used 28 relevant references in the text of his thesis. Citations in the text and their format listed in the bibliography are in accordance with all the citation practices. However, many citations are missing in some parts of the presented work. It is so difficult to distinguish the author's own thoughts from information taken from literature. Some of the information has been taken over to the text from the source by the style copy and paste.	
Other comments	
<i>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.</i>	
The assignment of the work was not entirely satisfied. There are many errors in the practical part of the work.	

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

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

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

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The professional level of the presented thesis is rather weaker. In my opinion, the author of the work has demonstrated the ability to find appropriate and necessary information in available literature. However, in my opinion, the author should more discussed acquired knowledge from literature. There are many bigger or smaller errors in the practical part of the presented work – especially in energy balances and economical evaluation.

In my opinion, the assignment of the work was not entirely satisfied. Most of the goals given by master thesis assignment were fulfilled and discussed in individual chapters (although for some goals it may be somewhat debatable). But the discussion of the potential of waste processing by gasification is not mentioned in the presented work – mentioned is only the availability of the biomass or wood wastes!

Although I find the presented work to be weaker, the presented work has its benefit mainly in the field of summarisation of the necessary information for projecting this type of technology in form of PFD. Despite the mentioned problems of the work (missing citations, missing the discussion of waste potential for gasification, errors in balances and economical evaluation) I recommend the presented diploma thesis for the defense.

Comments to the work:

- Page 1 – annotation should summarize the content of the work. The purpose of the annotation is not only to summarize the goals of the work.
- Page 11 – Gasification agents – there is mentioned fig. 3 in the text, but fig. 3 is missing. There is presented table “Industrially used gasification processes” as a Fig. 3 on page 8, but where are the gasification agents?
- Page 15 – Again mentioned figure 3 – probably meant Fig. 8?
- Page 18 – missing citations. source of the information?
- Page 21 – MPa/Hr ???
- Page 7-25 – missing citations (source of the information)
- Page 30 – see table XX ??? There is no table XX in the text.
- Page 33 – results given by equation 1 is valid only for dry biomass. What about moisture content in biomass?
- Page 33 – Gasifier reactor – temperature: why directly 875 °C – citation?
- Page 35 - c_p – the unit is kJ/(kg.K) not Kj/kg K.
- Page 36 – unit is 15W/(m².K) not 15W/m² K
- Page 38 – to 210 degrees? of °C or °F ???
- Page 38 – Hvap = 23 MJ/kg
- Page 38 – the enthalpy balance of syngas cooler is wrong
- Page 45 – Be careful – www.alibaba.com is selling second hand devices !
- Page 47 – Figure 21 - the cash-flow is wrong – same page 48
- Page 49 – ROI is not good parameter (does not reflect time value of the money) – better use NPV or IRR
- Page 56 – Figure 23 - the cash-flow is wrong

Other minor comments are highlighted in the printed thesis.

Questions for thesis defense:

- Is it possible to process other wastes by Syngas technology, like municipal waste, used tires, plastics etc?
- Page 30 – “12 % of all gasifier after leaving cyclone filtration it recirculated back to gasifier...” Why directly 12 %? Please explain.
- Page 33 –the balance in equation 1. Is it correct? What about the steam as an input to the R101? Why the temperature is directly 875 °C? Please explain.
- Page 34 – Please explain how the LHV of syngas was estimated/calculated.
- Page 38 – is the balance in equation 5 correct? Please explain the balance and results of syngas cooler/steam generator.
- Page 38 – please explain the calculation of the compression temperature increase and calculation of the shaft work of the compressor.
- Page 46 – please explain table 20. How the revenues from sale was calculated? Where are the costs for steam and electricity? What about depreciation of technology? Why the presented cumulative CF in fig. 21 starts in point 0? Why is the lifetime of the project only 10 years (according to the fig. 21)?

- I am missing the calculation of net present value - NPV and internal rate of return IRR (parameters based on discounted cashflow with respecting time value of the money) in the economical evaluation. Please explain and present the results of NPV and IRR.

Due to the quality of the submitted diploma thesis, problems with citations and to the fact that the thesis assignment was not fulfilled I evaluate the work by the grade:

E – sufficient

Date: 28.8.2018

Signature: Ing. Jaromír Štancl, Ph.D., v. r.