

**I. IDENTIFICATION DATA**

<b>Thesis title:</b>	<b>Design of containerized technology for emission CO<sub>2</sub> conversion to methanol</b>
<b>Author's name:</b>	<b>Jonáš Gilík</b>
<b>Type of thesis :</b>	master
<b>Faculty/Institute:</b>	Faculty of Mechanical Engineering (FME)
<b>Department:</b>	Department of Process Engineering
<b>Thesis reviewer:</b>	Dr Radosław Ślęzak
<b>Reviewer's department:</b>	Lodz University of Technology, Faculty of Process and Environmental Engineering, Department of Bioprocess Engineering

**II. EVALUATION OF INDIVIDUAL CRITERIA**

<b>Assignment</b> <i>How demanding was the assigned project?</i>	<b>challenging</b>
The goal of this thesis was to carry out simulation in AspenPLUS of catalytic methanol synthesis from carbon dioxide and hydrogen. On the grounds of simulation results the Author designed small-scale (standard container) methanol synthesis plant. The work also includes economic analysis.	

<b>Fulfilment of assignment</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>	<b>fulfilled</b>
The final work fulfills the thesis's requirements. All tasks of the work were successfully solved.	

<b>Methodology</b> <i>Comment on the correctness of the approach and/or the solution methods.</i>	<b>correct</b>
The Author correctly reviewed scientific literature about catalytic methanol synthesis from carbon dioxide and hydrogen. Applied software (Aspen PLUS) for chemical process simulation is appropriate.	

<b>Technical level</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>	<b>B - very good.</b>
The technical level of the thesis is very good. The Author critically discussed information gained from scientific literature. Chemical process simulation in AspenPlus was explained clearly. The Author proved high skills to the solution of scientific problems.	

<b>Formal and language level, scope of thesis</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>	<b>B - very good.</b>
The thesis was written correctly and style of writing is coherent. Chapters of the work were presented in understandable form. The thesis of work is sufficiently extensive. The overall graphical level of the work is very good. List of physical quantities (symbols) and abbreviations in text are explained at the beginning of the thesis.	

<b>Selection of sources, citation correctness</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>	<b>B - very good.</b>
The Author used 26 relevant references in the work, in which 23 of them were in English. This literature is correctly chosen to receive information about catalytic methanol synthesis from carbon dioxide and hydrogen. Most of the cited literature has been published during last 3 years.	

### 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.*

The most valuable part of the work is critical discussion about received results from simulation in AspenPlus. The Author in chapter 4 checked calculation carried out in AspenPlus, which proves his extensive knowledge and designed small-scale methanol synthesis plant in work strengthens value of the thesis. The Author presented analysis of economical aspect of methanol synthesis.

### 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 defense of the student's work.*

The thesis describing catalytic methanol synthesis contains 93 pages of text, 17 pictures and 36 tables. In the first part of the diploma thesis (theoretical part) the Author described methanol synthesis from CO<sub>2</sub>. In the following chapters of thesis described catalysts and reactor used in methanol synthesis. The first part of the thesis is summarized in chapter 2.6 in which presented conditions for methanol synthesis. The second part of work (practical part) described simulation of methanol synthesis in AspenPlus software and used equipment. In this part the Author designed small-scale (standard container) methanol synthesis plant and presented economical analysis of container technology. In last chapter the Author presented conclusions. The received results of the thesis are useful for the future research on optimalization of methanol synthesis. The Author has extensive knowledge to analyse engineering problems. I recommend the presented diploma thesis for the defense.

Comments to the work:

- Pages 16, It would be advisable to provide in table 1 information about H/CO<sub>2</sub> ratio.
- Page 25, Abbreviation "ICI" wasn't explained.
- Page 26, Title of picture 4 should contain explanation of abbreviation a, b and c.
- Page 30, In picture 6 temperature of methanol is equal to -83°C. The abbreviation QC and QR should be explained.
- Page 30, "CO<sub>2</sub> equivalent" should be explained in text.
- Page 35, Assumption that temperature of cold medium in outlet from heating exchanger is very high (equal to 100°C). For atmospheric pressure this water is boiling.
- Page 46, Number of significant digits (e.g.  $\kappa=1,397109$  - four significant digits is enough (1,397))
- Page 64, More explanation of symbols is advisable.
- Pages 73-82, Instrumentation and fittings should be marked on diagram.

Questions for thesis defense:

1. Why mixture from reactor should be cooled to 35°C?
2. In what type of chemical process can we receive pure CO<sub>2</sub>?
3. Why pressure was adjusted to 5 bar in separator?
4. How many barrels for products from distillation column are needed in the container? Could you give volume of barrels?
5. What kind of demister will be used in separator?



## THESIS REVIEWER'S REPORT

6. Can we use waste heat (e.g. from cooler) in designed container plant? From which part of installation can we receive heat waste?
7. Where will be installed peristaltic pump?

The above comments and questions do not reduce the quality of the presented work.

The grade that I award for the thesis is **B - very good**.

Date: **23.8.2021**

Signature:

*Radosław Słomka*

