Universidad de Valladolid

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Departamento de Ingeniería Química y Tecnología del Medio Ambiente

Subject: Evaluation report of the Thesis of Aleksandra Gesicka to obtain the PhD Degree at Poznan University of Technology.

Title of the PhD Thesis: Conversion of methane into selected polyhydroxyalkanoates with the use of methanotrophic microorganisms

Reviewer: Raul Muñoz Torre

Position: Full Professor

Institution: University of Valladolid (Spain)

Relevance of the Topic

The thesis addresses two of the most relevant environmental problems of the World in this 21st century: climate change caused by greenhouse emissions and plastic pollution. The solution proposed, based on the optimization of biotechnologies to convert methane into biodegradable polymers, is considered technically suitable and sustainable. Therefore, the topic of the thesis is highly relevant.

Quality and structure of the PhD Thesis document

The thesis is well structured, with a short introduction and outline of the thesis in chapter 1, a state of the art review on methane bioconversion into added value products in chapter 2, and three experimental works (chapters 3-5) involving the enrichment and characterization of PHA accumulating microbial communities, the optimization of co-substrate addition and continuous operation under several valeric acid supply and pH strategies, and feedback accumulation of PHA via pure and mixed cultures. Finally, section 6 provides a summary of the experimental studies and presents the perspectives of the technology. The quality of the English usage is very satisfactory, with very few typos along the entire document:

1.4 Thesis outline

"study the microbial composition and process conditions influence.." Something is missing in this clause.

Chapter 2

Right column of Table 2.1-2.7. "Reference" instead of "Reference"
Page 39. It should read "..genes, respectively, and are commonly"

Chapter 3

Page 59. "and cultured" instead of "and culture"
Page 60 "gas chromatograph" instead of "gas chromatography"
Page 66. The text should read "and biomass. In the present work…"

Chapter 4

Page 99. "..between 10-30%" should read "..between 10% and 30%"
Page 99. The first paragraph is written in single space.

Section 6.4

Page 135. "should be considered" instead of "should considered"

In addition, the quality of the figures and Tables is considered professional and satisfactory

Objectives and hypothesis

The objectives proposed are relevant and novel in the field of greenhouse gas bioconversion into added value bioproducts, and were defined in a very clear and precise manner in Chapter 1. The hypothesis proposed in novel and well grounded on the existing experimental findings.

Methodology

The methodology used is well aligned with the objectives proposed. The experiments were defined and described in a very systematic way, and in appropriate experimental set-ups, combining enrichments and optimization in serum bottles (where multiple conditions can be tested simultaneously) under batch conditions, with experiments in bioreactors under continuous and fed-batch operation. The sampling and analytical procedures used are considered adequate for the analyses conducted in this thesis.

Results and Discussion

The results obtained in chapters 3-5 are novel and relevant in the field, and represent an advance in the state of the art of PHBV production from methane and additional co-substrates. The discussion of the empirical results is well grounded on the empirical observations and recent literature findings. The contents of PHA and 3HV fractions are high compared to literature studies.

References

Both the introduction section and chapters 2-5 are grounded on a systematic and detailed literature review based on more than 215 recent references.

Summary and conclusions of the evaluation report

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Based on the high environmental relevance of the topic addressed, the correct experimental design and experiment execution, proficient presentation and relevance of the results obtained and comprehensive discussion conducted in chapters 3-6, I confirm that the presented doctoral dissertation entitled “Conversion of methane into selected polyhydroxyalkanoates with the use of methanotrophic microorganisms” by Aleksandra Gesicka, under the supervision of prof. Piotr Oleskowicz-Popiel and Dr. Mateusz Lezyk, is in the scope of the Discipline of Environmental Engineering, Mining and Energy, and fulfils all the requirements set out in the Art. 187 (sec. 1-4) of the Act of July 20th, 2018 on the Law on Higher Education and Science (Journal of Laws of 2023, item 742).

Therefore, I kindly ask the members of the Scientific Council of the Discipline of Environmental Engineering, Mining and Energy of the Poznan University of Technology to admit the doctoral dissertation by Aleksandra Gesicka to the next stage of the doctoral procedure.

Raúl Muñoz Torre

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