



*Professor Ewa Wojciechowska MSc, PhD, Dsc
Chairperson of the Council of Environmental Engineering, Mining and Energy
Discipline
Dean of the Civil and Environmental Faculty
Gdańsk University of Technology*

Evaluation Report for PhD Thesis by Dominika Derwis

Thesis title: THE IMPACT OF SULFUR TRANSFORMATIONS ON NITROGEN REMOVAL PROCESSES IN SYSTEMS WITH GRANULAR SLUDGE

General comments: The dissertation addresses an important aspect of the fundamental relevance in integration biological sulphur cycle into carbon (C) and nitrogen (N) removal from wastewater.

The research reviewed the conceptual and practical frameworks for integrating sulphur cycling—particularly sulphate reduction and sulphide oxidation—into biological nitrogen removal systems and then carried out systematically designed experiments to evaluate the interactions between different S-N systems in both performance and microbial level. This is an original contribution to advance the knowledge in understanding the sulphur transformations on nitrogen removal processes in wastewater systems. This research is timely needed to advance the knowledge gaps in this field. The research methodology, a combination of microbial analysis and engineering laboratory experimental tests, is appropriate for this study. The results generated from this thesis is interesting and shed lights to the understanding of interactions between sulphur and nitrogen compounds via different metabolic pathways carried out by different functional groups. The knowledge generated from this dissertation is not only relevant to wastewater field but also a broader filed, i.e soil and marine science, which also involved the nitrogen and sulphur cycles.

The thesis includes 7 chapters, with 4 published chapters in journal papers already (1 as a comprehensive review and the other three as technical ones). This level of achievement is exceptional. In addition, the PhD candidate also has published another 15 publications either as co-authors or lead authors, participated 7 conferences during the study. This is a great achievement which should be highlighted and recommended.

The overall thesis is clear and easy to follow however, some minor adjustment/discussion can be further improved to improve the clarify in the thesis part. I recommend awarding the degree after address below comments.

1. Introduction: Page 19, second last paragraph. It mentioned that careful control of S and C inputs should be considered to avoid the accumulation of intermediate compounds, how about the operational aspects to achieve this?
 2. Objective and scope: Page 21. I would suggest adding a summary of research gaps and research questions/objectives session before talking about the research objectives.
 3. In the methodology chapter, I understand that this is a summary of the overall methodology that was adopted in the experimental results chapters. It's a bit difficult to understand the design without looking at the each individual result chapter I feel. Some suggestions for minor changes: (1) Page 24, Figure 1a, change it to "photo of the reactor set-up, and for 1b) schematic drawing; (2) Page 25, 3.3, "...with DO levels kept below 0.2mg O₂/L, promoting anaerobic conditions for... ". Since anaerobic condition is not just no DO, but with without Nox or Sox as electron acceptors, otherwise it should be called "anoxic condition". Could you clarify it's anaerobic or anoxic? Also, does this applied to all three series? (3) Page 26, 3.3.1, "NH₄ and NO₂ were dosed in typical proportions for the conventical anammox process (1.3)", what does 1.3 refers to?
 4. Chapter 5. (1) I understand the results are summative/selected results from each published papers, but I feel it's a bit difficult to understand the specific figure/result in its current way without flipping through the later published papers. E.g, on Page 33. It very challenging to understand the results in figure 3 without having figure 2 although it was mentioned in the first sentence. Also on page 37, figure 5, it was not easy to understand the feeding design logic presented in this one without reading the whole published paper. For figure 5(e), it was mentioned it was a figure S2 from paper IV, again, very confusing and can't find the supplementary material in this thesis unless go to the on-line version. (2) page 38, 5.2 It mentioned that "over the next 60 days, the adaptation process accelerated, resulting in", is it possible to explain a bit here – why and what factor stimulated such acceleration? Looks like it's increase in feed of SO₄²⁻? (3) page 40, first paragraph "The additional of COD in SBR2 stimulated both heterotrophic and autotrophic transformation". I don't quite get this, as in figure 5d, it seems that the COD line is flat after Day 45. (4)Page 40, last paragraph, when found *Thauera* is more enriched, why? Is the denitrification role mentioned for
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Thauera been identified directly using experiment? Is it using its internal stored carbon source or external carbon source?

5. Chapter 6. Could you give a few more discussion on the implications of this work to practical operation?
6. For published paper II, "Integration of the sulphate reduction and anammox processes for enhancing sustainable nitrogen removal in granular sludge reactors", figure 1 was designed to change influent every 15-20 days. Just wondering what's the SRT of the system? How to determine the "stable status" after each change of the feed concentration?

The above comments are only minor ones, as stated previously, this is an outstanding PhD thesis, and I recommend awarding the degree after minor revision.

Yours sincerely,



Professor Liu YE

BE, PhD, GC(Higher Ed.), FRSC, FIWA (*she/her*)

GHG Research Group (Urban Water) Leader | Director of international
School of Chemical Engineering
The University of Queensland
Brisbane Qld 4072 Australia
T +61 7 3365 4152 M +61 468 813 929
E l.ye@uq.edu.au W <https://researchers.uq.edu.au/researcher/2122>
