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Doctoral Dissertation - Review Report

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SEKCJA DS. NAUKI

28. 09. 2023

W P Ł Y N Ę Ł O

Title: Nuclear fuel recycling by distillation-based separation

This written report provides a detailed justification of my evaluation. It is based on the evaluation grid below. A set of comments/recommendations for minor revisions to the dissertation, provided for improvement and/or clarification purposes is also attached below.

Criteria for evaluation	Excellent	Very good	Good	Satisfactory	Unsatisfactory
1. Makes an original contribution to knowledge	X				
2. Advances knowledge in the field	X				
3. Is inline with norms of research	X				
4. Detail methodology and methods	X				
5. Reports results clearly		X			
6. Justify analyses and conclusions	X				
7. Implications are discussed		X			
8. Grammar, style, coherence is acceptable		X			

Comments

- Part I – Introduction – second paragraph: cost-effective is preferred over cheap and probably includes it. I suggest removing “cheap” (supply energy)
- Part I – Introduction – third paragraph: are there other indicators for usability of energy sources? Why EROI?
- Part I – Introduction – General: Contribution is clear and relevant.
- Part I – Introduction - Page 2, first paragraph: only one reference regarding common modern thermal separation processes, reference [48]. Any other reference to support your statement?
- Part I – Introduction – Page 2, first paragraph - spelling mistake “sepatation effort”
- Part I – Introduction – Page 2, second paragraph – please support the advantage of halogenation for distillation with references.
- On page 4: what about the cost of SiC or ZrC as potential materials for corrosion purposes?

- "Technical feasibility" strongly supports your contribution (on Page 5).
- On page 6: clarify the purpose of adding gaseous cesium. How does it work?
- On page 10: what would be the eventual advantage, if any, of using numerical optimization procedures? What would you look at?
- Distillation process well-explained.
- Thermodynamics/equilibrium well-justified & explained.
- Part III: Please rephrase the "linkage"/intro to the work items that have been carried out in the thesis.
- Page 44: "mixture LiCl-KCl are available in" ... are there any references missing?
- Page 44: What consequences would you expect by not considering the interaction behaviour?
- Page 49: good justification on VLE method.
- Page 51: good justification on pressure swing methods.
- Page 54: gewählt worden. Please translate.
- Page 56: Please agree on significant digits when presenting results in table 7. Any indicator of goodness of fit beyond standard deviation?
- Page 57: as explanations are purely hypothetical, how can you visualize the impact of separation as the dependence is away from ideality?
- Page 65, please correct spelling "Margeules"
- Page 65, ok with Margules approach.
- Page 70, total reflux well justified.
- Use of significant digits must be consistent in the entire text.
- Comparison well described on page 79.
- Page 88: solids separation indeed, should be considered as separated...
- Good material selection on page 91. Well-justified.
- Page 94/95: Any collateral emission/additional waste/effluent derived from the process? Any further environmental/safety aspects to be considered? Same for page 101 and beyond. Off gas... better introduction for your reader.

- Interesting remark around operating pressure to separate zirconium tetrachloride.
Process variables remarkably well explained, in detail.
- Please check abbreviations/spelling of thermodynamic systems in your conclusions.
- Good to emphasize thermodynamics as the basis for further works.
- In general: please check spelling mistakes.

My overall recommendation as an examiner is PASSED, which implies that this dissertation is ready to proceed to the oral defense.

Toronto, September 13th 2023.



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