Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2018-176-AC4, 2018

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Global Phosphorus Recovery for Agricultural Reuse" *by* Dirk-Jan D. Kok et al.

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Received and published: 25 May 2018

The authors would like to thank Prof. Dr. Udert for the constructive feedback provided in his concise review. In the text below, we would like to present our proposed strategy to adapt the manuscript with regards to the recommendations made and issues identified.

1. The referee notes the absence of sensitivity analysis. A sensitivity analysis is believed to be important especially considering the low efficiency of the phosphorus recovery technology analyzed in this study.

The authors are currently conducting a sensitivity analysis to include in the revised draft. In accordance the referee's recommendation, we will evaluate the model sensitivity to the recovery efficiency and discuss this with respect to the recovery efficiencies

of other recovery technologies based on data provided by Egle et al. (2016).

2. The referee recommends comparison of phosphorus recovery potential and demand balances with those of other studies.

To keep the article concise, and provided the many other products that merit in-depth evaluation and comparison, little attention was paid to evaluating the phosphorus recover potential and demand balances in the original manuscript. However, recognizing that it does form one of the integral components of the methodology that determines recovery feasibility and trade, we acknowledge that some comparison with other studies should be made. We will do so in the next revision of the manuscript.

3. The referee questions what role agricultural subsidies could play in influencing the crop market, and therefor phosphorus market.

Agricultural subsidies may be important in influencing crop market dynamics. If crop subsidy data at national or regional level is available (in reducing production cost ([$/t]) per crop type) then this could be quite simply incorporated into the model. A subsidy would result in an increase in a node's maximum bid price, making it more competitive in the market. This improvement would allow the model to not only differentiate 'purchasing power' based on low and high value crops, but also (realistically) between different agricultural regions and subsidy policies. This differentiation would be especially interesting for the far-future scenario, when phosphorus supply is limiting and agricultural demand is high. The current maximum bid price equation, however, is already very simple and does not account for many other regional differences (cost of equipment, labor wage, farmer living standards, work efficiency, subsidies etc.). Therefore the entire demand side requires reevaluation - something that is planned for future version of the model, but will likely not be feasible to include already in the next version of the manuscript.

4. The referee misses a comparison between costs and cost savings from struvite crystallization, where cost savings result from reduced struvite scaling maintenance

work. Also, the referee recommends to mention that P recovery from dry sanitation systems would also help to reduce environmental pollution, which is a value for society and would reduce the costs of the P fertilizer production.

The authors will present a brief overview of the costs and savings of struvite precipitation based on other literature in the revised version of the manuscript. With regards to the external costs and benefits of recovery, we would prefer to keep the manuscript purely monetary in terms of its economics but will be sure to emphasize the additional value environmental benefits (e.g. in terms of water use and pollution) that some recovery options may offer.

5. The referee remarks that the conclusion is more a summary of results than a conclusion emphasizing the significance of these results.

The authors agree that the current conclusion may be more appropriately titled 'summary', and will therefore change this in the revised draft. We will also draft a separate conclusion that emphasizes the significance of the results and highlights the issues that have to be addressed in phosphorus recycling in general.

6. The author lists a series of recommended changes with regards to language and formulae.

We are grateful for detailed feedback and will include all recommendations in our revision.

Furthermore, we would like to sincerely thank Prof. Dr. Udert for taking the time to provide a meaningful contribution to improving the manuscript. We will adapt the manuscript accordingly and look forward to any other comments should they come to mind.

Egle, L., Rechberger, H., Krampe, J. and Zessner, M. (2016) Phosphorus recovery from municipal wastewater: An integrated comparative technological, environmental and economic assessment of P recovery technologies. Science of the Total Environment

571, 522-542

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