Project *brief*

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Rural urban partnership (RUN): Life cycle assessment of multi nutrient recovery

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- **Kitchen waste and blackwater as a source for phosphorous recovery**
- **Supporting nutrient recovery process development by life cycle assessment**
- **The global warming potential is further reduced when scaling up from laboratory to technical scale**

Background and Aims

The use of fertilizers is essential for sufficient food and feed production. The need for nitrogen (N), phosphorus (P) and potassium (K) must be supplemented by energy-intensive N fertilizers and resource-limited mineral fertilizers such as potassium salts and raw phosphate. Cascade treatment of household wastewater and biowaste is in line with the Circular Economy Action Plan, which advocates the recovery of nutrients from waste streams. Recovered nutrients from municipal wastewater can be reused in neighboring rural areas, as a starting point for an urban-rural nutrient partnership.

Key questions

Is the recovery of N, K and especially P from kitchen waste and black water ecologically sound? Can the application of life cycle assessment (LCA) support the development of Rural Urban Nutrient (RUN) technology in the scale-up phase? What are the ecological hotspots and how can they be reduced?

Results

All environmental impacts of P recovered on a laboratory scale were significantly higher than those of conventional mineral P fertilizers. Critical factors influencing the global warming potential were identified and used as a starting point for optimizing the technical details. On a technical scale, with a scaling factor of 100 compared to the laboratory scale, the global warming potential of the recovered P_2O_5 was negative.

This is mainly due to the credits from the electricity generated by cogeneration and the production of N fertilizer. The same applies to the depletion of fossil resources (see figure).

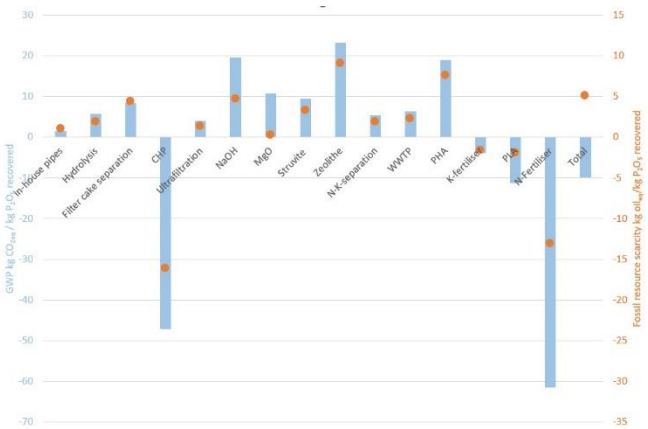

Figure: Greenhouse effect and resource scarcity of P_2O_5 recovered on a technical scale. (Source: Stichnothe et al., 2024, see footnote).

Conclusions

The LCA proved to be a very powerful tool for determining and improving the environmental performance of the RUN technology. The first upscaling from laboratory scale to technical scale led to significantly lower environmental impacts, especially with regard to climate change.

Further information

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