

From Waste to Resource: Optimizing Phosphorus and Methane Recovery from Cattle Manure



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Motivation

Phosphorus (P) is typically sourced from non-renewable phosphate rock, and its uncontrolled release causes environmental issues like eutrophication. Animal manure is the largest secondary source of P which can be recovered and reused^[1]. The Netherlands produces 74 million tons of animal manure annually, of which 61.2 million tons come from cattle as represented in Fig. 1^[2].

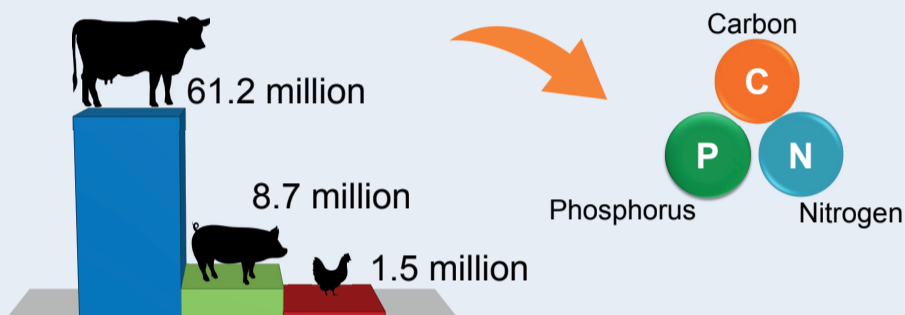


Fig. 1. Manure production in the Netherlands (tons per year) [2]

Therefore, it is crucial to focus on the recovery of P from sources such as cattle manure to prevent the depletion of natural reserves. This project aims to develop a technology that simultaneously recovers calcium phosphate (CaP) and methane (CH₄) within the same reactor. The recovered CaP can be used as fertilizer, while the CH₄ can be an energy source on the farm. The goal is to design a sustainable system that reuses the resources in the manure for on-farm use by using natural principles and the microorganisms already present in cattle manure (Fig. 2).

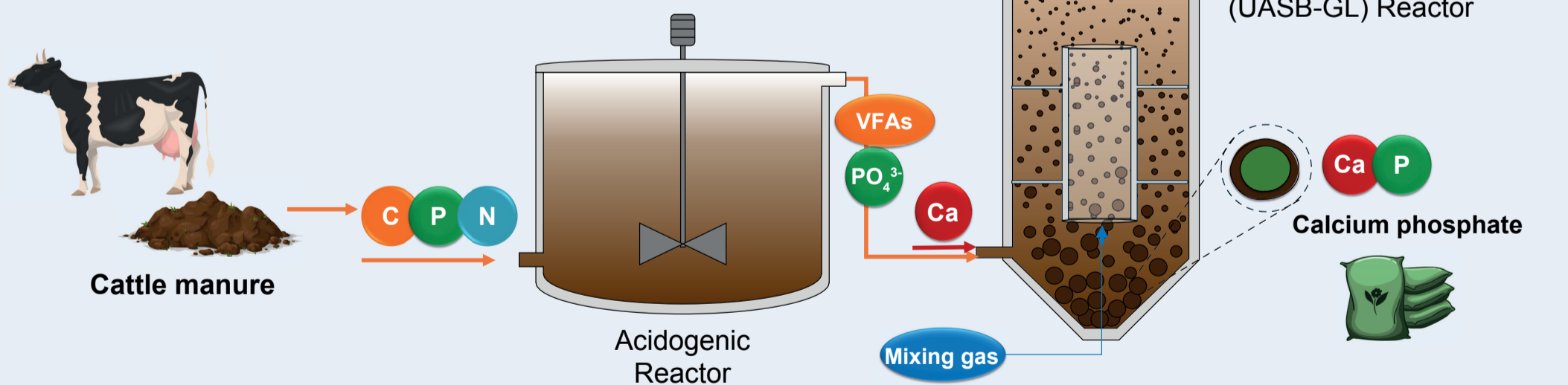


Fig. 2. Proposed phosphorus and methane recovery system

Research goals

- Enhancing technology for efficient P and CH₄ recovery from cattle manure by using natural principles and the microorganisms already present in cattle manure.
- Developing strategies to tackle limited P availability and high inorganic carbon simultaneously.
- Boosting the efficiency and sustainability of manure management through advanced recovery technologies, contributing to better nutrient recycling and waste treatment practices.

References

- [1] D. Cordell, and S. White., *Agronomy* 3(1) (2013) 86-116. CBS
- [2] Statline, *Livestock on agricultural holdings*, (2023).
- [3] C. Schott. et al., *Chemical Engineering Journal* 460 (2023)