SYSTEMIC – NUTRIENT RECOVERY FROM ANAEROBIC DIGESTATE OF BIOWASTE: TECHNICAL ASSESSMENT OF FULL SCALE INSTALLATIONS THROUGHOUT EUROPE

Claudio Brienza[1], Ivona Sigurnjak[1], Evi Michels[1], Ute Bauermeister[2], Erik Meers[1]

[1]Laboratory of Analytical Chemistry and Applied Ecochemistry, Faculty of Bioscience Engineering, Ghent, Belgium
Author for correspondance: claudio.brienza@ugent.be
[2]Gesellschaft für nachhaltige Stoffnutzung mbH, Halle, Germany

1. Problem statement

- Production of N and P fertilizers currently relies on non-renewable resources
- Synthetic N fertilizer production (via Haber-Bosch process) uses 1-2% of the world energy consumption[1]
- P is identified by the European Commission as a Critical Raw Material whose recycling is becoming essential to reduce dependency on mineral reserves[2]
- Due to stringent manure application rates on an arable land manure surplus is currently transported to nutrient deficient regions, leading to higher transport costs and CO_2 emissions
- In contrast, farmers need to buy synthetic fertilizers in order to meet the NP requirements of crops

2. SYSTEMIC's solution

BIOWASTE AS A RESOURCE FOR MINERAL NUTRIENTS AND ORGANIC FERTILIZER.

At 5 large-scale anaerobic digestion plants SYSTEMIC implements new approaches for the valorization of biowaste, relying on separation and implementation of innovative recovery technologies.

Benas (GNS) Demonstration plant (Ottersberg, Germany)

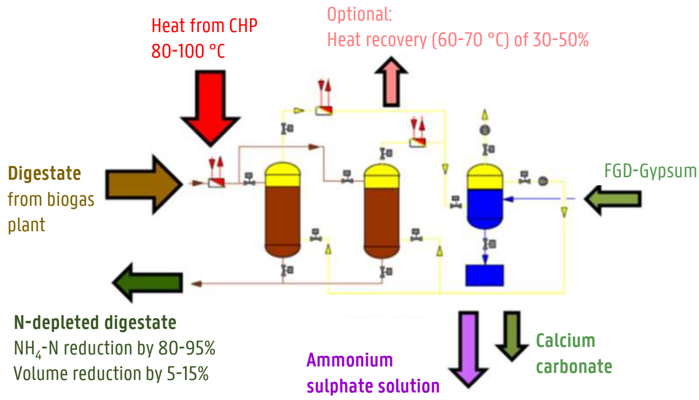
3. Demonstration installations

Name	Capacity and main feedstock	Products
Groot Zevert Vergisting (GZV) , the Netherlands	100 000 tonnes pig slurry	Biogas, ammonium sulphate, mineral concentrates, calcium phosphate, organic soil improvers
AM Power, Belgium	180 000 tonnes manure, food waste	Biogas, mineral concentrates, organic fertilizer
Acqua & Sole, Italy	120 000 tonnes sewage sludge	Biogas, ammonium sulphate, organic fertilizers
Fridays, UK	40 000 tonnes poultry litter	Liquefied biogas, liquid CO_2, ammonium sulphate, organic fertilizer
Benas (GNS), Germany	80 000 tonnes corn silage, poultry litter	Biogas, ammonium sulphate calcium carbonate, organic fertilizer, fibers

4. SYSTEMIC's technology

Ammonia stripping and scrubbing:

In a packed bed tower, NH_3 is transferred from digestate to the gas phase by increasing pH and temperature. NH_3 is then transferred into an air scrubber where it is absorbed from the gas to the liquid phase usually by means of acids (H_2SO_4 or HNO_3) or gypsum. Depending on the used acid, the recovered products are ammonium sulphate or ammonium nitrate, both valuable N fertilizers[3].

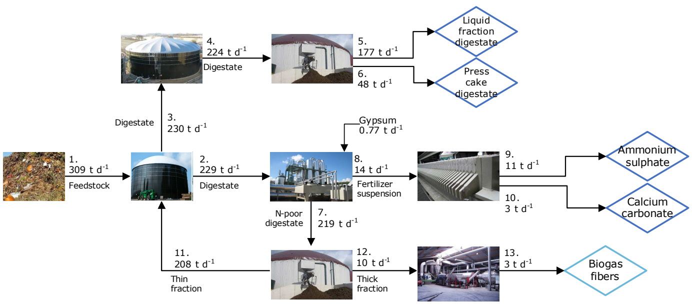


5. Technical innovation at the demonstration plants

Implementation, monitoring and optimization of recovery technologies will include:

- Setting up Demonstration plants (technical scheme and specifications, building and testing of the installation at full scale)
- Monitoring demonstration plants (mass and energy balances, demo plant optimization, product monitoring)
- Product composition/quality (performance of field trials) and environmental impact assessment

6. Nutrient recovery cascade at Benas



Benas (GNS) Demonstration plant (Ottersberg, Germany)

7. SYSTEMIC recovered products

	Ammonium sulphate	Calcium carbonate	Biogas fibers
pH	7,5	7,5	5-7
Dry matter (DM)	25%	70-80%	50-90%
Organic dry matter (oDM)	0%	0%	85-90%
Ammonium nitrogen (NH_4-N)	4-5%	1-2%	0%
Sulphur (S)	5-6%	1-2%	-
Calcium oxide (CaO)	-	30-35%	-

References

[1] Worrell et al. (2009). Industrial energy efficiency and climate mitigation. Journal of Energy efficiency.

[2] European Commission, 2010. Critical Raw Materials for the EU. Report of the Ad-hoc Working Group on Defining Critical Raw Materials. European Commission, Enterprise and Industry.

[3] Vaneeckhaute et. al. (2017). Nutrient Recovery from Digestate: Systematic Technology Review and Product Classification. Journal of Waste and biomass valorisation.