Closing the nutrient loop

Techniques for nutrient recovery from digestate & valorisation of end-products

Content

I. Background
II. Goal
III. Activities
IV. Results
V. Future?
Background

- Biogas industry in Europe expanding
- Product of fermentation – digestate – is used on land

**Digestate valorisation (and relating cost) determines profitability of biogas production!**


Background

Highly intensive regional livestock production

Circular economy/Biobased products/Resource use efficiency

Digestate nutrient recovery
How can we recover nutrients from digestate in such a way that:

1. The technology cost is reasonable
2. The end-products are valuable
3. The recovery pathway is more sustainable than the nutrient removal pathway

I. **Inventory of nutrient recovery technologies**
   - Selection of a promising technique for feasibility study

II. **Mapping potential market uptake of end-products & identifying legislative bottlenecks**
   - Promoting market uptake & finding solutions for legislative bottlenecks through extended trials (lab & full-scale)
III. Economic assessment of different digestate treatment options

Online webtool to evaluate different processing pathways according to input materials

IV. Sustainability assessment of different digestate treatment options

Results – inventory of technologies

More info: POSTER SESSION!
Results – feasibility study on promising technology

P is limiting nutrient for digestate spreading in Flanders

P is a “Critical Raw Material” in Europe

Focus on ready-to-market P recovery technology

Chosen: Fraunhofer technology for P-recovery through acidification and phosphorus precipitation – technical & economical evaluation with Flemish manure & digestate samples

Results – market study and promoting end-products

Table of content:

I. Physicochemical characterisation
II. Field trials
III. Interviews with potential end-users
   a. Agriculture
   b. Industry
   c. Domestic
IV. European legislative framework
V. Belgian & Flemish legislative framework
VI. Summary of economic & environmental assessment
V. How transferable is the digestate case within NWE?
Scientific field trials in a broad range of crops

Products characterised & used for fertilisation:

- Digestate as such
- Liquid fraction digestate after decanter
- RO Concentrate
- (Evaporated) effluent from biological treatment (+ CW)
- Struvite
- Scrubber water from acid air washer of digestate drying

Results: in comparison with artificial fertiliser + animal manure – equal yields & nitrate residues! More extended: Nutrient Recovery Case study report
I. What are the ideal circumstances for composting solid fraction of digestate?
II. Does composting increase the product quality?

Results: stability of SF is already high and hardly improved by composting.

Results – economical assessment

- Low demand and market price for digestate derivates is not in accordance with their real fertilizing and humus value
- If digestate needs to be treated the treatment costs can impede running a profitable biogas plant

Development of an online calculation tool – assist (future) biogas operators in their choice of digestate treatment pathway + direct calculation of the effect of type of input streams (biodegradable wastes) on costs of digestate treatment and disposal
Despite higher energy intensity and increased material use, the overall environmental burdens of digestate treatment systems were substantially lower than for direct spreading of the input digestate, mainly due to the reduced ammonia emissions.

Future?

1. Extended trials with Fraunhofer technology + pilot plant if successful
2. Upscaling field trials to full-scale pilot project with pro rato use of liquid fraction digestate

Current:

- 50% N from animal manure
- 50% N non-animal input
- Digestate with 100% animal nitrogen (< 170 kg N/ha)

Future (if pilot is successful):

- 50% N from animal manure
- 50% N non-animal input
- Digestate with 50% animal nitrogen (< 170 kg N/ha) + 50% non-animal nitrogen
Thank you for your attention