

Digestate processing – How to produce a high value fertiliser

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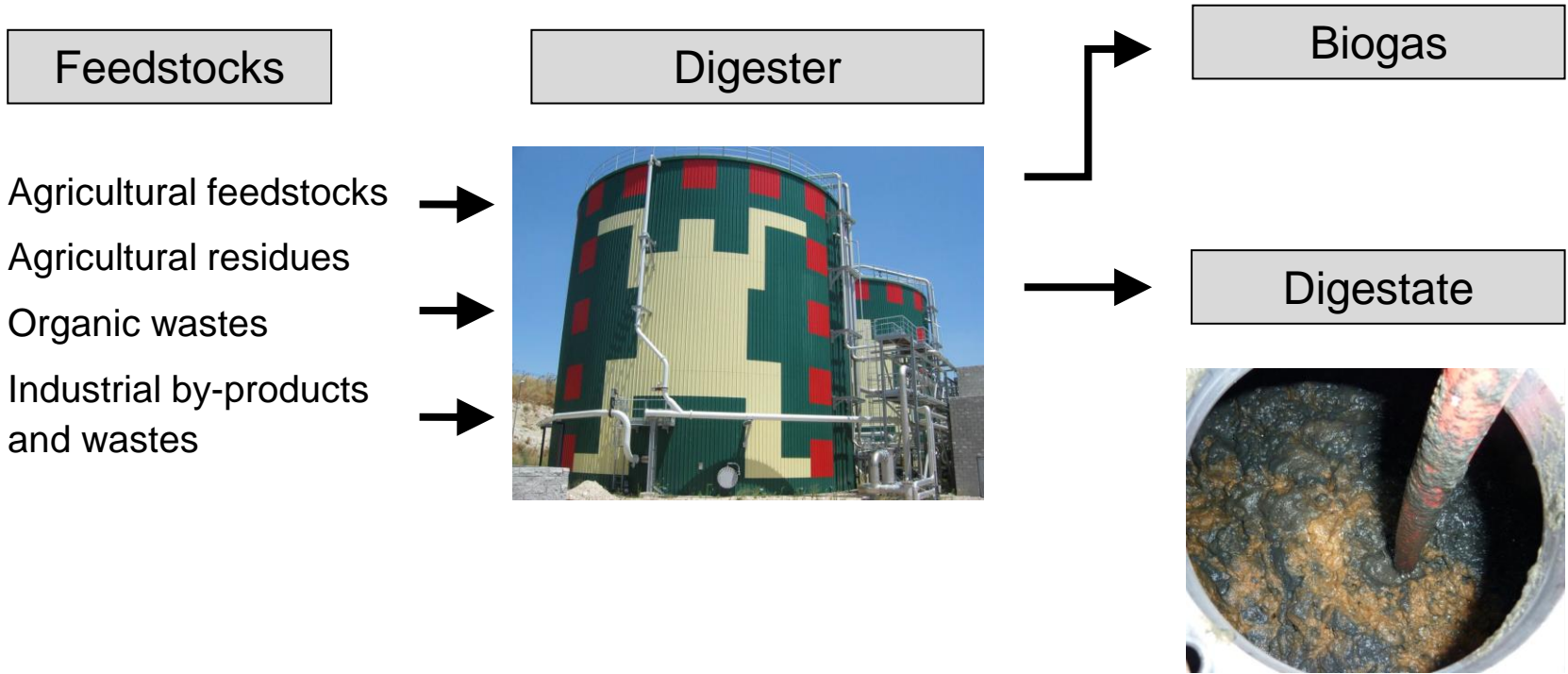
Bernhard Drosig and Werner Fuchs

Overview

- Background digestate / digestate processing
- Motivation - drivers and advantages
- Overview on technologies for digestate processing
- Which technologies / approaches make sense in which context
- Marketability of bio-based fertiliser products from digestate
- Conclusions



What is digestate in a biogas plant?





What is digestate processing?

Applying process technologies for ...

- Partial processing
 - Reduction of quantity of digestate
 - or
 - Separation into individual fractions that can be handled, stored or valorised more easily

- Complete purification
 - Separation and concentration of the valuable ingredients (nutrients)
 - Purification of the remaining liquid fraction permitting reuse or direct discharge



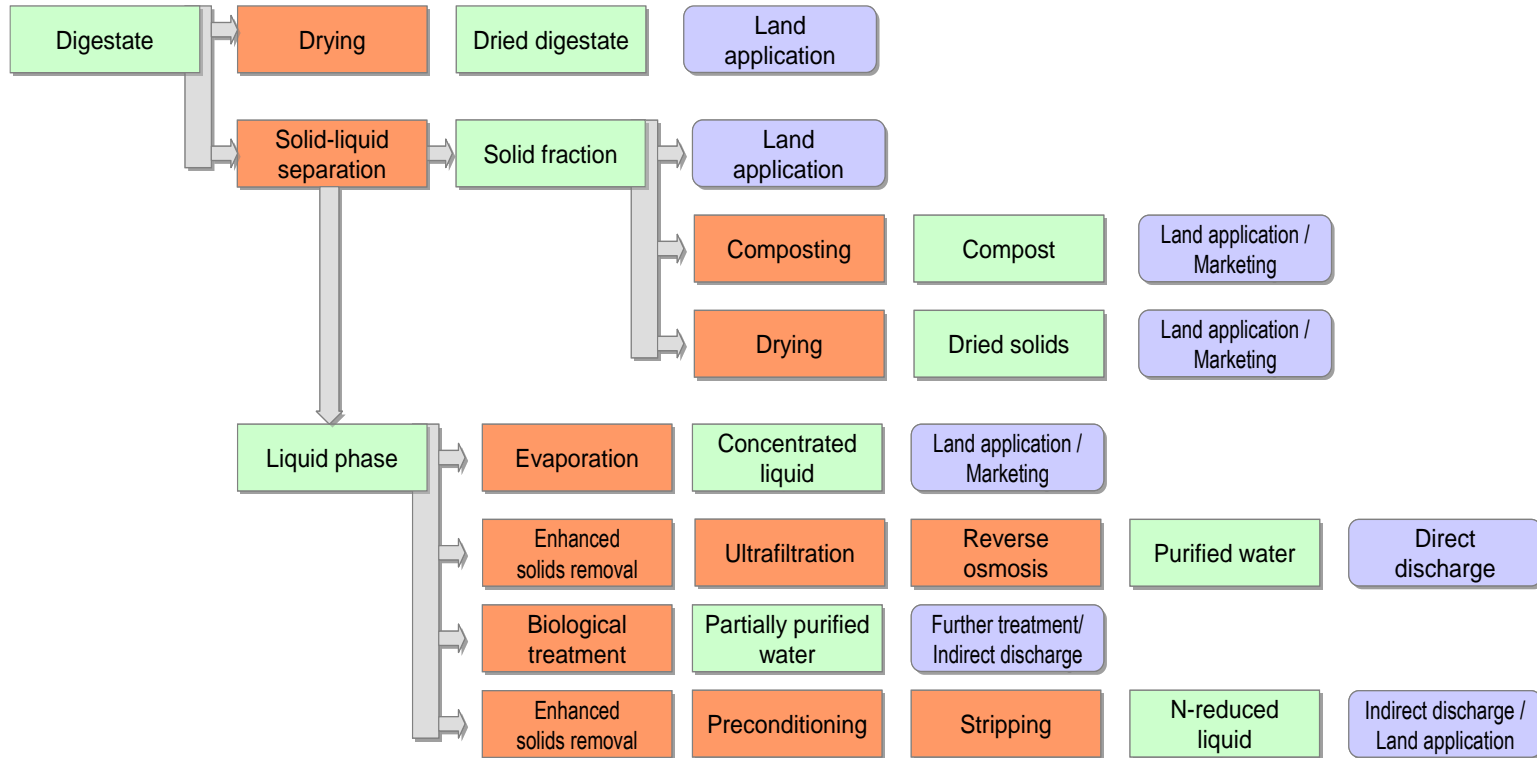


What are drivers for digestate processing / biofertiliser production

- Large-scale biogas plants with high digestate transportation costs
- Strong legal restrictions (N/P soil regulations, water protection areas)
- Large regional nutrient surplus (high amount of biogas plants / intensive animal husbandry)
- Existing (or highly promising) markets for standardised bio-fertilisers
- Re-use part of the digestate as process water

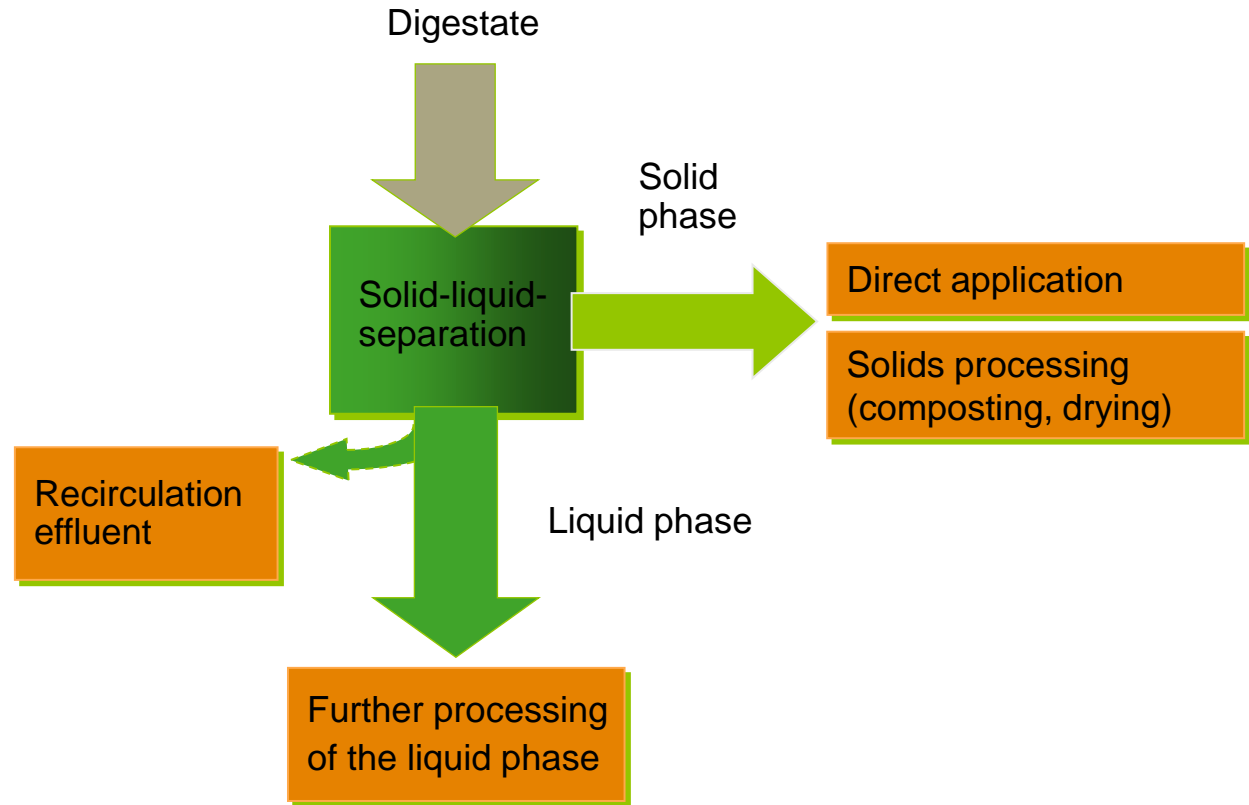
→ However, in many cases direct land application of digestate without treatment / processing remains the best solution!

Digestate processing - Technological approaches



→ More recently also struvite precipitation or thermo-chemical technologies (e.g. pyrolysis, hydrothermal processes) have become increasingly of interest

Solid-liquid separation – the first step in digestate processing





Why apply solid-liquid separation?

- To reduce the amount of digestate by using recirculation effluent instead of fresh water
- Pretreatment step for further processing of the liquid phase
- Areas for digestate land application are available, but there is a regional surplus on phosphorous



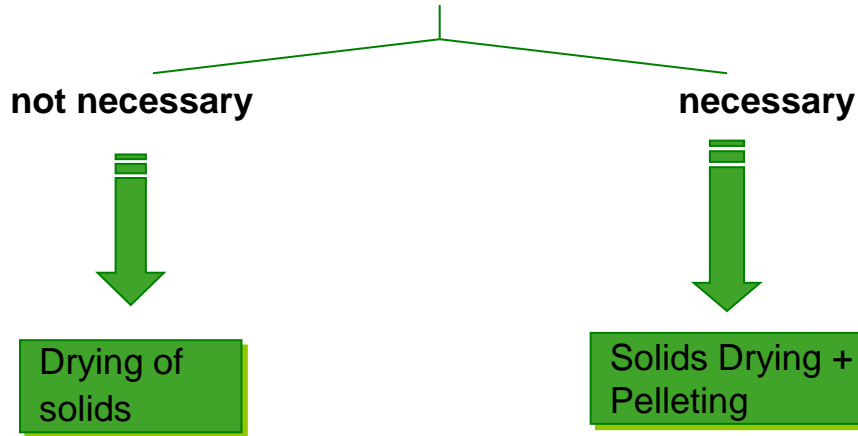
Solid liquid separation



Why drying of the solid phase?



- Surplus of thermal energy
- No local utilisation of the solid fraction
- An improvement of the marketability of the solids is ...



Why ammonia stripping?

- Surplus of thermal energy
- Not enough area is available due to high nitrogen load
- Limited storage facilities
- Produced nutrient concentrate can be applied when plants can best utilise it



Ammonia Stripping



Why complete purification by aerobic treatment OR membrane processes?



- Practically no area for land application is available, the export of the nutrients is necessary
- Local wastewater treatment plant with enough additional capacity is ...

available



Co-treatment of liquid fraction in wastewater treatment plant

not available



Complete purification by membrane technology

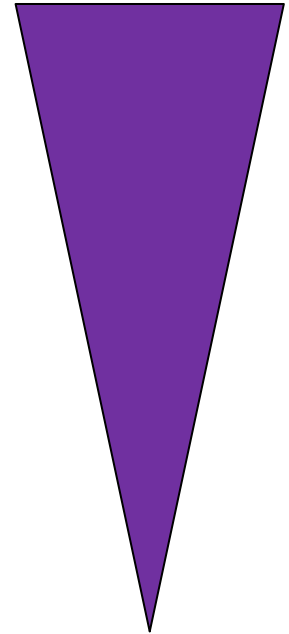


Marketability of possible biofertiliser products from digestate (European perspective)



Market available

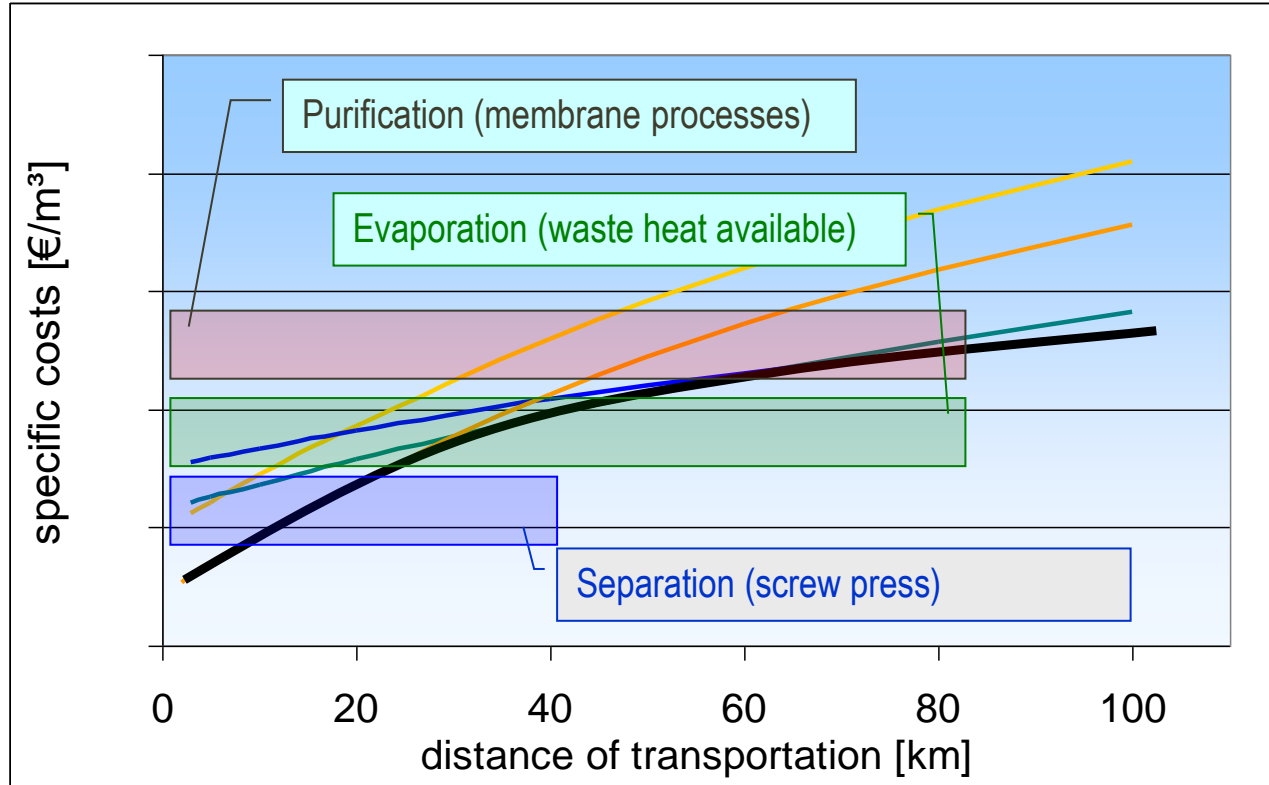
- Digestate compost (solids/fibre fraction, P-rich)
- Struvite from precipitation ($\text{MAP} - \text{NH}_4\text{MgPO}_4 \cdot 6\text{H}_2\text{O}$)
- Dried digestate pellets (solids/fibre fraction, P-rich)
- Ammonium sulphate solution (N-fertiliser after NH_3 -stripping)
- Liquid nutrient concentrate (membrane, evaporation)



No market available

→ The bottleneck is often the establishment of the market for digestate products

Overview on digestate processing costs



→ Processing costs compared to transport due to legal application limits (e.g. EU Nitrate directive) without taking into account a revenue for the fertiliser

IEA Bioenergy report on digestate processing



Nutrient Recovery by Biogas Digestate Processing

IEA Bioenergy

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SUMMARY

This report reviews various approaches for processing of biogas plant digestate for the purpose of nutrient recovery. It covers both established and emerging technologies and assesses technical performance and where possible economics. Techniques for nutrient recovery from digestate are developing rapidly and aim to improve nutrient management in agriculture and in waste treatment systems.

The report is aimed at biogas plant developers and operators as well as agriculture policy makers and was produced by IEA Bioenergy Task 37. IEA Bioenergy Task 37 addresses challenges related to the economic and environmental sustainability of biogas production and utilisation.



https://www.iea-biogas.net/files/daten-redaktion/download/Technical%20Brochures/NUTRIENT_RECOVERY_RZ_web2.pdf



Conclusions

- Most digestate processing approaches are only feasible in large-scale biogas plants
- The main reason for investing in digestate processing technology is often the lack of available agricultural area for land application
- A large number of different technologies and processing concepts are available depending on the local requirements
- Challenge to establish a market for digestate fertiliser products
- Check legal situation for digestate products from waste material
- The ideal solutions depend strongly on local conditions and requirements

Thank you for your attention!!!



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