Digestate treatment systems
for nutrient recovery

Concentration of biogas plants digesting energy crops, manure and organic waste in the areas of intensive livestock farming has led to local surplus of digestate in some regions of Europe e.g. Flanders. In such regions treatment of digestate is implemented, to avoid negative consequences of excess nutrients on fields. The results of economic and environmental analysis of several digestate treatment technologies from Flanders (using different inputs) are presented below together with study based optimising measures.

Analysed treatment systems

Composting

Input: Digestate solid fraction (26% DM)

Drying & Pelletizing

Input: Mix of raw digestate with dried digestate (56% DM)

Drying

Input: Raw digestate (10% DM)

Ammonia stripping & Drying

Input: Raw digestate (11% DM)

Biological treatment, Reverse osmosis & Drying

Input: Raw digestate (10% DM)

*literature based LCA assessment, no economic assessment was conducted for this plant

Economic facts & challenges

- Low demand for products derived from digestate treatment and their extremely low market price are not in accordance with their real fertilizing and humus value.
- In the current market situation, the treatment costs for stackable pre-dried digestate (plants A and B) could be covered by selling treatment products even if less than 50% of the fertilizing value were to be returned.
- Treatment of the raw digestate (plant C&E) cannot be financed from the output revenues only, even if they would be sold at the market price reflecting the real fertilizing value of its components.
- In the regions, in which, due to nutrient surplus in the agricultural soils, the authorities try to prevent an additional nutrient flow from raw digestate via digestate treatment (and export), it can be necessary either to financially support the treatment plants or to introduce digestate disposal fees ("gate fees") to assure existence basis for the treatment systems.

Treatmet system:	A	B	C	E
Treatment costs in €/t input	6	13-14	9-14	14-15
Treatment costs in €/t output	8	17-19	74-109	216-246
Fertilizing value in €/t output	21	55	70	51

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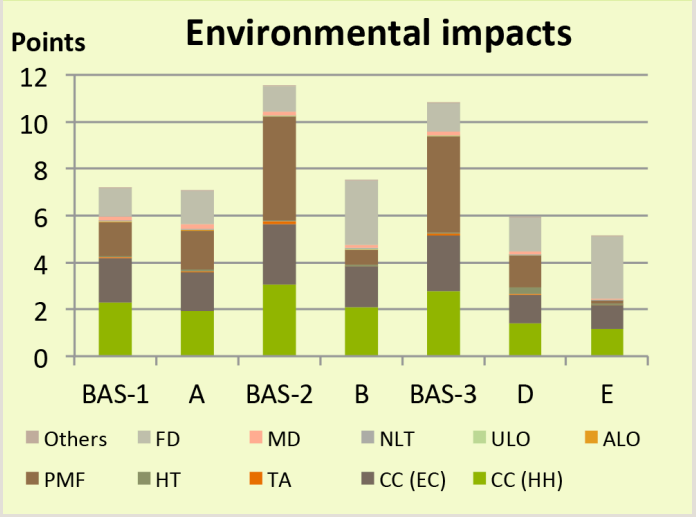
Environmental implications

- Treated products contribute to less environmental emissions, can be easier transported, but may also help close the natural nutrient cycle by substituting mineral fertilizers.**
- Despite the higher impact in terms of resource depletion, linked to increased energy and mineral use, the overall environmental burdens related to digestate treatment in all the systems except for composting were substantially lower than for direct spreading of the input digestate, mainly due to the important reductions in air emissions linked to ammonia.
- The increase in energy intensity when introducing conversion technologies appears to have marginal impact as compared to the environmental benefits in other environmental dimensions.
- Digestate treatment via composting in total does not contribute to reductions of environmental impacts as compared to direct spreading.

**substitution of mineral fertilizer is not included in the study



CC (HH) – Climate change human health; **CC (EQ)** - Climate change ecosystem quality; **TA** – Terrestrial acidification; **HT** – Human toxicity; **PFM** – Particulate matter formation, **ALO** – Agricultural land occupation, **ULO** – Urban land occupation; **NLT** – Natural land transformation; **MD** – Metal depletion; **FD** – Fossil depletion

BAS-1, BAS-2, BAS-3 - Baseline scenarios (direct digestate spreading)

Improving environmental performance

- For particular installations, impacts linked to energy use may be substantially reduced through changes in the energy source
- Use of surface incorporation or injection allows reducing total environmental impacts but mainly for the systems using solely raw digestate as the input (if a balanced weighting of the damage categories is considered)
- Treatment of not pre-treated digestate allows achieving the best environmental profits in comparison to direct spreading of raw digestate

Optimizing cash flows

The energy costs may constitute 23-43% and the investment costs 14-26% of the total costs. Use of the locally sourced energy and involving of local companies in the site construction can contribute to the local binding of 72-94% of the whole invested capital. Additionally, digestate treatment plants contribute to the regional development through creation of stable green jobs.

Literature for more details:

Golkowska et al. (2013): Assessing the treatment costs and the fertilizing value of the output products in digestate treatment systems, Water Science & Technology, 69(3), 656-662

Vázquez-Rowe et al. (2015): Environmental assessment of digestate treatment technologies using LCA methodology, Waste Management, in press.

Golkowska et al. (2015): Life Cycle Assessment on selected processes of nutrient recovery from digestate. In: Meers & Velthof (Eds.) The recovery and use of mineral nutrients from organic residues, Wiley, in preparation.

ARBOR case study report (2015): Nutrient recovery from digestate

Carbor Biomass for Energy

Investing in Opportunities

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