

Digestate processing, existing technologies and ongoing development

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Anaerobic digestion is widely used as an important source of renewable energy. With the increasing number and capacity of biogas plants also adequate processing technologies for the digestate – the residue from anaerobic digestion – are gaining attention. This approach is also called “digestate upgrading”, as it is mainly aimed at increasing the nutrient concentration and thereby the value of the digestate. In addition, a nutrient poor liquid is produced which can be either reused as process water or when applied on agricultural lands, due to the reduced nutrient concentrations, much less area is required. By membrane purification it is even possible to produce process water which is clean enough to be directly discharged to a receiving stream. A wide range of technologies is available for digestate processing:

Mechanical separation of solids: screw press, decanter centrifuge

Further solids separation: vibrating screen, curved screen, flocculation/precipitation, flotation, filters

Utilisation and stabilisation of the separated solids: composting, drying

Concentration of the liquid phase: membrane separation, evaporation

Additional processes for nitrogen recovery/removal: ammonia stripping, biological processes, ion-exchange, struvite precipitation, extractive membranes

The field of digestate processing is still quite new and limited information about the performance of different technologies at industrial scale is available. Digestate processing is gaining importance since digestate utilisation can become an important bottleneck when increasing biogas production. In addition, the production of renewable fertiliser from digestate is increasingly of interest to replace fossil fertilisers. However, it has to be stated that direct land application of the digestate on the surrounding agricultural areas of a biogas plant is normally the best and cheapest approach, in order to close the nutrient cycle. Highly sophisticated digestate processing like membrane processes are very expensive and make only sense if the digestate has to be transported large distances due to a regional nutrient surplus or for example in water protection areas where the land application of digestate is limited. Simple solid-liquid separation processes like screw presses or decanter centrifuges are more often applied. They are much cheaper than the sophisticated approaches and reasons for their application can be various: The liquid phase can be reused as process water and thereby reduce freshwater input. In addition, the total amount of digestate is reduced, so that less storage and land application costs arise. Sometimes, if storage facilities are available for the solids for free, this can also be an incentive.

The variety of possible products from digestate is diverse. Closest to conventional fertilisers are products gained by ammonia stripping such as ammonium sulphate or ammonium water. Compost is also a frequently used fertiliser, making composting of digestate a reasonable approach. In addition, the legal issues of using digestate compost as fertiliser are already clarified in several countries. Another option is to produce dried digestate pellets, which are marketed for example in garden centers. Currently it is still difficult to achieve an economic income from digestate products on the market.