Co-fermentation of biogenic waste in sewage treatment plants

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The Emschergenossenschaft (Emscher Cooperative Association) and Lippeverband (Lippe Association) are two large water management associations in Germany. In total, 3.6 million inhabitants live in the association areas; for wastewater treatment about 1.2 million population equivalents PE1)[1] are added from industry. In the 59 wastewater treatment plants some 100,000 t DM/DR of sewage sludge are produced annually which are disposed of, to approx. 80 %, thermally. The remaining quantity of sewage sludge is utilised agriculturally within the region.

The greatest part of the raw sludge produced with both associations is aerobically stabilised, as is fundamentally common in the Federal Republic of Germany. In the digesters a part of the organic matter of the raw sludge is degraded at between 35°C and 37°C (mesophilic operation) under hermetically sealed conditions and converted into digester gas. Through the use of this gas in a combined heating plant, electrical and thermal energy can be generated both of which can be well used in the wastewater treatment plant. Electricity is required for almost all parts and the machinery in the wastewater treatment plant, heat energy mainly for the heating of the digesters and operational buildings. Thus some 30 to 50 % of the internal need for electrical energy and very nearly 100 % of the required heating can be generated within the wastewater treatment plants.

Through co-fermentation, i.e. through the joint treatment of biogenic wastes (co-substrates) in the digesters of the wastewater treatment plant, the digester gas production can be in-creased considerably. Depending on the type and quantity of the co-substrates added, gas generation can increase so strongly that a self-sufficient energy level for the operation of the wastewater treatment plant can be realised and excess energy can be passed to the grid or to third parties.

With co-fermentation the biogenic wastes, following a preparation step (separation of impurities and, if required, comminution), are fed into the digesters either together with the sewage sludge or as a separate stream.

For the joint anaerobic treatment with the raw sludge in a wastewater treatment plant a number of biogenic wastes are suitable. Table 1 contains a small selection of biogenic waste usable for co-fermentation.

Table 1: Biogenic wastes which are suitable for co-fermentation

Description of waste	**Source of waste**
Separately collected biowastes	Private households (bio-waste bins)
Contents of grease traps, flotation sludge	Slaughterhouses, meat processing, canteens, large-scale catering establishments, foodstuffs industry
Storage time-expired foodstuffs	Production and trade
Food scraps, kitchen waste	Canteens, large-scale catering establishments, restaurants
Starch sludge	Potato, rice and maize starch production
Dough/pastry wastes	Bread factories, pasta production
Fruit, grain and potato distillery wash	Alcohol distilleries
Market wastes	Central and weekly markets

[1] PE = Standard calculation value per inhabition for the sludge production amount from population and industry

Since 2004, in the Lippeverband wastewater treatment plant in Hamm, about 6,500 Mg/a of flotation sludge and stomach contents from a neighbouring slaughterhouse have been treated jointly in the digesters. In the three digesters, each of 4,000 m³ volume, the sewage sludge from ca. 230,000 PE was stabilised. The digester gas produced was utilised by a combined heating plant, the stabilised sludge conditioned with lime/iron, dewatered by means of chamber filter presses and subsequently used in agriculture.

The acceptance of the co-substrates in the wastewater treatment plant is very simple via an existing one-time raw sludge thickener, which is operated as a thoroughly mixed raw sludge storage tank before digestion. The delivered co-substrates are passed directly into this storage tank and mixed together with the raw sludge.

Figure 1 shows the gas production of the digesters. 2002, in which the digestion process was operated with sewage sludge only, is selected as reference year. It becomes clear that in 2004, due to the addition of co-substrates, a significant increase of the digester gas production could be achieved. In total the additional production was about 50 % compared with 2002.

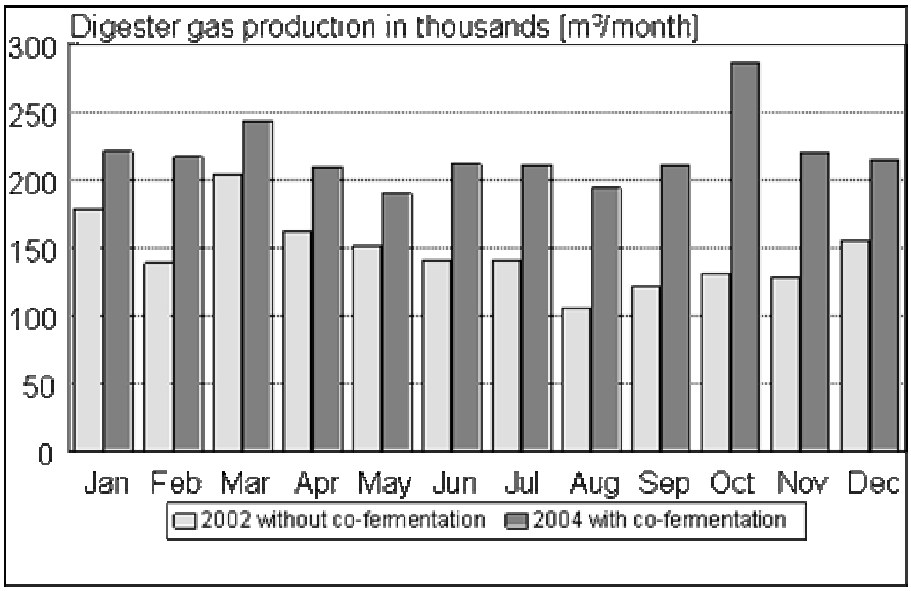

Figure 1: Digester gas production

The large-scale experiences up until now have been very positive.

On the subject of co-fermentation there is comprehensive experience available at the Emschergenossenschaft and Lippeverband. In the example presented over two years flotation sludge containing fats and stomach contents from a neighbouring slaughterhouse have been processed as co-substrates in the wastewater treatment plant of the city of Hamm. It has been shown that the fermentation of even these biogenic wastes is possible without problem and that the gas production can be significantly increased. Accordingly, the economic efficiency of the process under the given constraints has very rapidly improved.