Solid compost from biogas plant digestion residues – a new product

Figure 1. The prototype biogas plant in Järna. Photo: Winfried Schäfer.

On-farm biogas plants mainly digest slurry and the digestion residue is a liquid fertiliser. In contrast, farm-scale biogas plants for anaerobic digestion of solid manure are exceptional. However, more than 50 % of municipal biogas plants digest solid organic waste. The prototype on-farm biogas plant in Järna/Sweden produces beside heat also a solid manure compost and reduces simultaneously nitrogen losses. We present here the nitrogen content of dairy cattle solid manure treated anaerobically and aerobically.

Anaerobic digestion of solid organic matter

The process of anaerobic digestion of municipal waste often includes the separation of liquid from both organic input material and anaerobic digestion residues. The separation improves biogas productivity and generates organic solid manure for aerobic treatment before and after anaerobic digestion. The solid digestion residues are commercially available as manure and soil improvers for gardening. However, these techniques are too expensive for farm-scale plants.

A new prototype design

The Biodynamic Research Institute in Järna developed an on-farm biogas plant integrated within the highly self-supporting farm organism, Skilleby-Ytterneby. The prototype employs a new process technique: Dairy cattle manure and organic residues originating from the farm and the surrounding food processing units are digested in two different reactors, figure 1. The first reactor is continuously filled and discharged with solid manure from a stanchion barn. The organic matter contains 17.7 to 19.6 % total solids. The digestion residue is se-

parated into a liquid and a solid fraction. The liquid fraction is further digested in a methane reactor and the effluent is used as liquid fertiliser. The solid fraction is composted.

How we produced the compost

For the compost trials (from May to August 2004 and November 2004 to March 2005) samples of 50 l manure and 50 l solid fraction from the first reactor were aerobically digested (composted) at 15°C and 20°C respectively in the climate chamber of MTT/Vakola. The aerobic digestion took place in a bottomless 60 litre plastic container set on a wire mesh shelf. During the trial period, we turned the samples three times and added some water if necessary.

We got a new product

The dry matter content of the solid fraction is higher compared to manure and the composting process performs faster. The structure of the solid fraction compost looks different compared to the manure compost (figure 2) and the solid fraction compost smells better. The relative nitrogen content of input manure and output solid fraction is about the same. However, the total nitrogen content of the compost of the solid fraction is higher than of the compost from manure. Figure 3 shows the total nitrogen in kg/day before and after treatment. The anaerobic treatment converts most of the nitrogen into ammonium in the effluent.

The results show, that the biogas plant is a suitable tool not only for renewable energy production but also for designing organic fertilisers by varying anaerobic process parameters like load rate of the reactor, retention time and mechanical treatment before, within and after the anaerobic process. Detailed information about the biogas plant design and process technique is available in our research report deposited in the Organic eprints database: http://orgprints.org/6590/

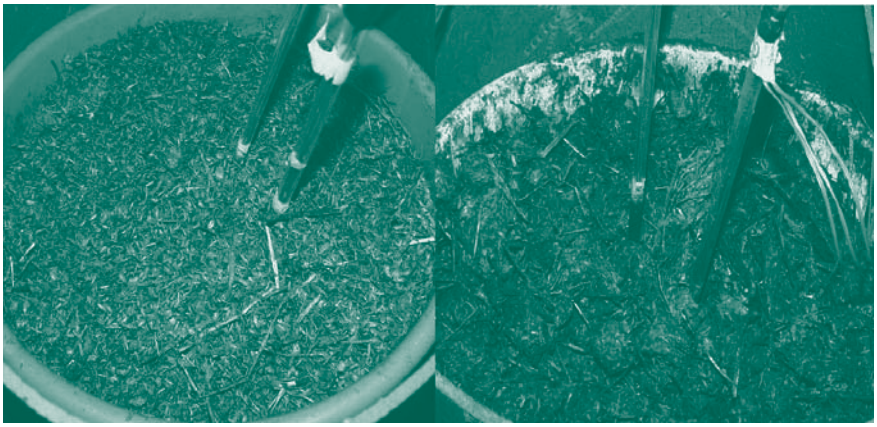

Figure 2. Compost trials: left: solid fraction, right: manure. Photo: Marja Lehto.

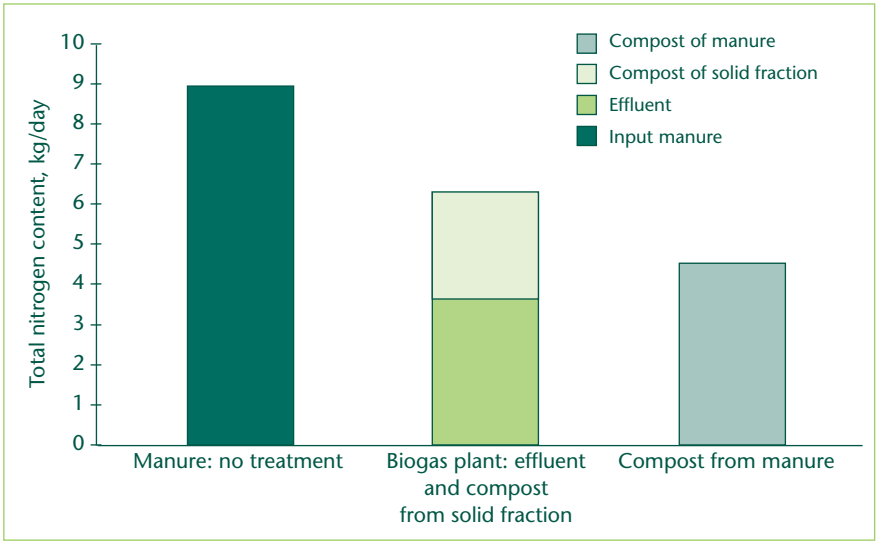

Figure 3. Total nitrogen content before and after anaerobic and aerobic treatment. The daily added organic material was 2000 kg manure, a mixture of faeces from 65 dairy cows, straw and oat husks.

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Literature

Schäfer, W., Lehto, M., Teye, F. 2006. Dry anaerobic digestion of organic residues on-farm - a feasibility study. Agrifood Research Reports 77: 98 p. www.mtt.fi/met/pdf/met77.pdf