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Energy conversion from biomass production

- EU-AgroBiogas

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Poster Presentations

Session II – Agro-Biogas

Start-up of semi-continously operated and completely stirred dry fermentation pilot-scale biogas reactor

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Biogas technologies meet the requirements of renewable energy production, reduced greenhouse gas emissions and production of organic fertilisers and soil conditioners. Biogas is produced during anaerobic digestion of organic matters. Methane included in biogas can be used for electricity and heat production on-site, in natural gas network or as traffic fuel. A farm can be self-supporting in heating energy and electricity and it can also produce energy for selling. Digestate contains all the nutrients present in raw material. Therefore, biogas technologies recover nutrients and carbon, and clearly reduce the smell of the manure and destroy pathogens and seeds of plants.

Most of the dry fermentation biogas plants in Europe are operated as a batch without any stirring. In Finland, there are only ten farm-scale biogas plants, and all of which are handling liquid slurry. However, there are several farms that are interested in dry manure system. The cold winter conditions in Finland set challenges to the technology.

In the year 2008, MTT Agrifood Research Finland built a pilot scale biogas reactor of 4.5 cubic meters situated in Sotkamo research station. The aim is to develop a completely stirred and semi-continuously operated biogas reactor that handles solid biomass. Also, working as a tool for development, the project disseminates information of the benefits of the biogas utilization. The project was funded by MTT and European Agricultural Fund for Rural Development (EAFRD).

The biogas reactor was built of (usual) steel. Only the gas tube is stainless steel. The reactor is situated in a half-warm space and the input silo is in a cold space. It is possible to heat the digester, the input silo and the repulsive tube. The content is stirred by a roller conveyer. The only input was solid manure with peat and straw litter. Later also field biomass and waste from fish cleaning will be added.

At the start, the reactor was filled by 3 m3 of solid manure and operated as a batch. No seed material was used. After six days biogas production increased rapidly and was as its highest during the 15th-21st day. Overall biogas production from 3 m3 of solid manure was nearly 80 m3 biogas during six weeks.

The continuous run was started right after the start-up run with an organic loading rate of 1 kg of volatile solids (VS)/m3d. The reactor was stirred 30 min per time twice a day. The reactor was fed and stirred five days a week. During the first three months the biogas production was steady, between 0.6-0.8 m3/d. The methane content of the biogas was 54-59 %. The overall methane gain was 25 m3/tn manure. During the process, the material transformed from solid to almost liquid. While the total solids (TS) of the input was 15-23 %, the TS of the residue was only 10-15 %.