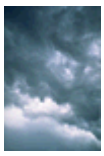

R&D Project Biogas production as an element of a cyclical process in agriculture by incorporating external sewage and waste

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1. Summary

The R&D Project, which was commissioned by the "Amt der Steiermärkischen Landesregierung - FA1c/Abfallwirtschaft" and the "FA1a/Allgemeine Angelegenheiten der Technik und des Umweltschutzes" (Styrian Provincial Government - FA - Fachabteilung - Specialised Department 1c/Waste Management and Specialised Department 1a/General Matters relating to Technology and Environmental Protection), is documented in two partial reports and a summarising deliberation. Partial Report 1, "Fermenter Operation", shows the assessment of fermenter operation in four selected facilities in terms of technology and epidemic related hygiene. Partial Report 2, "Residue Recycling", describes the execution and results of storage tests made with the fermentation residues of the four facilities, including investigations into parameters of the residues that deal with plant cultivation and pedology. The third part of the report, "Summarising Deliberations", - which is based upon the results of the R&D Project, - summarises a selection of suggestions, recommendations and requirements (in terms of process technology, operational and hygienic issues) for future work in this field.

2. Starting Position

In Styria some biogas facilities already are operated in agriculture, residues from agriculture (droppings, liquid manure, straw) as well as waste that is not produced in farming being used for biogas production. This technology is aimed at winning thermal and electric energy. The anaerobic fermentation process leaves a fermentation residue to be disposed of or recycled. In the sense of the cyclical process in agriculture, feeding this fermentation residue to surfaces used by the own farm is useful and viable, which is definitely confirmed by experience made up to now.

In view of the conditions prevalent in terms of process technology and operational issues as well as economic requirements, it often seems appropriate to use residual materials other than liquid manure - e. g. those produced in municipal waste disposal, in catering trade, sewage water from households and waste from food production - as input materials or co-substrates.

Due to the size of biogas facilities that are technically and economically justifiable and due to the fact that the farms often are far away, the integration of internal sewage water into anaerobic fermentation is interesting.

3. Pocedure

In the course of the overall project, four biogas facilities were studied. These facilities are fed with different basic substrates, namely
- pig droppings
- cattle droppings
- pig and cattle droppings
- chicken droppings

and process a large range of co-substrates, such as
- slaughtering waste
- fat separator contents
- frying fat
- flotation material from cheesemaking

- leftovers (catering trade)
- grass clippings
- sewage water produced in farming and externally

The material flow of these facilities was sampled three times for each facility. In this context, samples were taken of
- the input materials (substrates and co-substrates)
- the fermenter contents about 5 weeks later (appr. according to the average recycling time in the fermenter to be expected)
- the contents of the ultimate store for the collected fermentation residues about 9 weeks later

All the samples were analysed - properties, composition of the organic and anorganic substances - and subjected to a comprehensive test in terms of epidemic related hygiene. The samples from the ultiamte stores were additionally studied as to their recyclability - plant compatibility, ground compatibility, nutrient shares, pollutants (see Partial Report "Residue Recycling").

4. Goals

The project is aimed at studying four facilities in Styria to

- check different input materials for the anaerobic process as to their quality and suitability
- visualise the process by showing the performance and quality of production, the emission potential as well as the process specific hygienisation effects and their boundary conditions
- verify the usefulness of feeding fermentation residues to agricultural soil (in this context, the fermentation residues should be analysed for pollutants, plant compatibility, ground compatibility, the quality of the nutrient shares as well as the justifiability in terms of epidemic related hygiene

Such studies are particularly important in view of the new design of the Styrian Ground Protection Act and Sewage Sludge Regulation as well as of regulation for the recycling of organic residues from biological processes.

In the course of the present project, the following results were targeted:

- showing the standard of hygienisation in biogas facilities as well as of the process immanent hygienisation potential
- stating conditions for feeding sewage water from private households into biogas production and checking the implementation
- using waste and sewage water from agriculture, the communes as well as trade and industry as co-substrates of biogas production while considering the process conditions and the emission potential
- showing the possible fields of application for fermentation residues in agriculture

5. Result / Benefits

Biogas production has been established as a matured process technology in some fields of application, (e. g. for municipal sewage treatment).

Using biogas in the cyclical process in agriculture by using a considerable part of co-substrates that are not produced by the farms themselves updates tasks for whose solution hardly any practical experience is available, examples being:

- Whereas it has, up to now, mostly been a matter of adapting a process for gas generation from a certain substrate, the agricultural biogas facility is to be able to get co-substrates from an extremely large range of materials with various properties and compositions - from flotation material from cheesemaking to sewerage, from cattle paunch to leftovers. These materials are to be mechanically separated and pretreated in the facility and to be subjected to methane fermentation along with droppings and liquid manure left by breeding animals
- The selection of the co-substrates is to stay variable. This means that it should be possible to select the co-substrates as to make sure that a certain composition of the fermentation residues can be reached or kept at least approximatively
- The quality of the fermentation residues is an important goal in terms of process technology. For the residues, there are practically no alternatiove recycling or disposal options.
- The only acceptable cost objectives are electric energy (with a tariff that is graduated over time) and usable waste heat. A corresponding assessment of the improvement in the quality of the residues does not seem possible at the moment.

Under such conditions, "pioneer facilities" are being developed. The design and operation of these facilities partly are quite different, depending on the constellation of substrates and co-substrates available. The further development of successful types of such facilities, which mainly refers to operational matters, will, in the near future, be more important than developments in process technology, which would create types of facilities whose application is more universal.

The current problem definitely is the fact that this new type of cyclical process has a risk potential in terms of epidemic related hygiene. A binding formulation of the requirements placed in connection with epidemic related hygiene would not only be an important basis for the gradual adaptation of existing facilities to a justifiable standard in terms of epidemic related hygiene but would also help to put the existing "co-substrate market" - which is largely uncontrolled - on the right track.

The assessment of co-substrates is to focus on requirements placed in connection with process technology as well as on specified conditions for residue recycling and will, sooner or later, affect the interests of waste disposal facilities. If the operators were informed on the qualification of possible co-substrates in an organised way - e. g. within representations of interests or associations -, this might help to make the operators independent from interests other than their own.

Right now the operational concepts mainly focus on selling electric energy, which also leads to the development of direct economic dependence on a long-term basis. As for the thermal use of biogas production by a farm, too little experience has been gained yet. The required machinery would have to be adapted correspondingly. Partly this equipment still is not available at all. The required technical and commercial developments should be tackled together - no matter how. In view of the farmers' pioneer spirit, such developments will remain exceptions. The majority of the required development work will be hardly feasible for the individual farmer for economic reasons.