Biorefinery of cattle slurry

Koos Verloop, Gerjan Hilhorst, Leon Sebek, Zwier van der Vegte

Summary

- Manure is valuable raw material. But processing it is necessary for an utmost utilisation of the components.
- We put a new Biorefinery installation into operation to investigate its practicability
- In this contribution we explain how the system works and what contribution we expect.
- Results will be reported later.

Background

Dairy farmers commonly use artificial fertilizers in addition to farm slurry to meet crop nitrogen (N) and phosphorus (P) requirements. The better N and P in manure can be utilized by crops, the lower the need for additional N and P. Particularly for N, utilization by crops is enhanced by an increase of the amount of mineral N in the slurry and a decrease of the organically bound N. Therefore we are interested in processes like biorefinery, that transfer organically bound N into mineral N. Biorefinery is such a process. The question is to what extend the use of mineral fertilizers can be reduced by biorefinery. Our objective is to match N needs of crops completely with products of biorefinery.

Expected contribution to the farm

We expect biorefinery to contribute to:

1. Further closing the mineral cycle on De Marke (figure 1);
2. Limiting methane and nitrous oxide emissions and
3. A more efficient production of bioenergy.

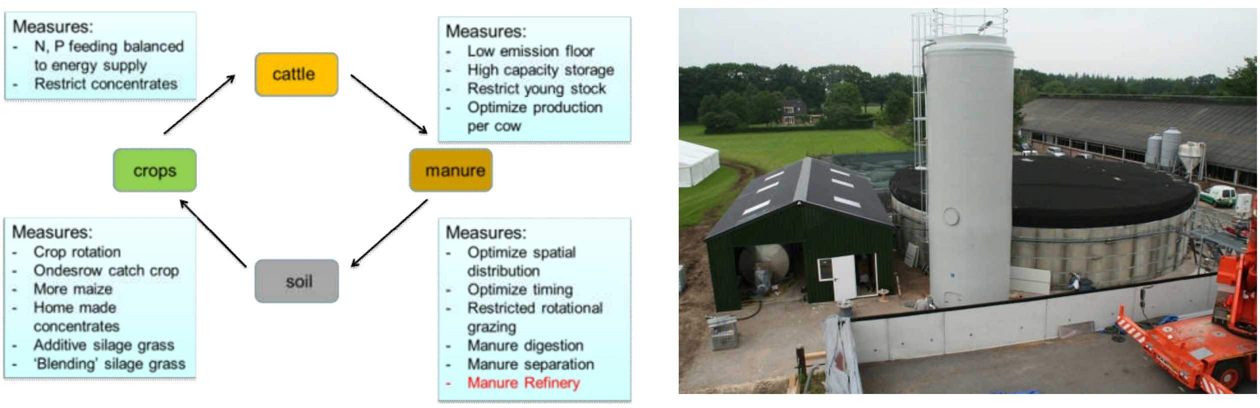

Figure 1: Biorefinary as component of mineral management on the farm.

A birds'-eye-view of the process

Biorefinery is the cleavage of manure into useful components. The system that is being developed on De Marke consists of different parts (see also figure 2):

1. Hydrolysis
   decomposition of large organic compounds by bacterial enzymes in a lightly acid environment. Hydrolyses paves the path for the next step (methane forming). Fatty acids are formed.
2. Methane forming
   converting the fatty acids into methane. This occurs by other bacteria than those that are involved in hydrolysis. During the methane forming biogas and digestate arise. The biogas contains mostly methane, but also other gases such as CO_2. The higher the methane content, the higher the energy output. In the digestate, the amount of ammoniacal nitrogen in relation to organic-bound nitrogen is higher than in the starting material: the unprocessed liquid fraction.
3. Separation
   the digestate is separated with the SMICON screw press. Separating the digestate results in a solid and a liquid fraction.
4. Extracting struvite
   From the liquid fraction, struvite is extracted. Struvite is a precipitate. This is a deposition of phosphate, ammonia and magnesium in the shape of a dry particle. Precipitation emerges after adding magnesium to the liquid fraction of the digestate (in crystalliser) the struvite deposits. Struvite is, however, a slow release fertiliser. That is why we do not improve all manure to struvite, but we are also going to use the intermediate product, the digestate, for fertilising.

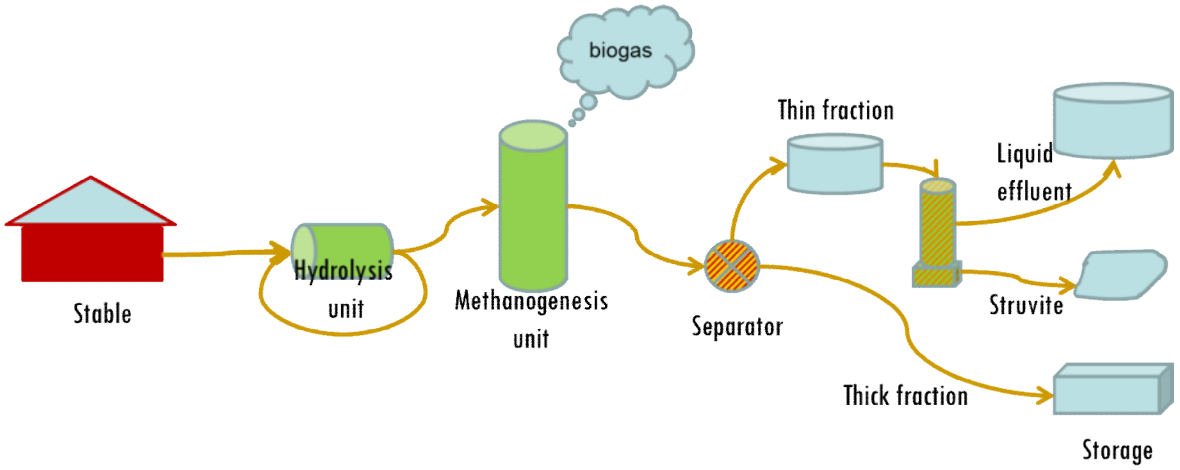

Figure 2: Overview of the manure flow at biorefinery on De Marke.

Implications and recommendations

This innovation may be interesting for enterprises in the future, but implementation at this moment seems premature and therefore risky. It is advisable to first await evaluation of the running tests. This should clarify questions, like:

- How sensitive is the process?
- What technical skills are required to manage the process
- When and on what kind of farms is biorefinery cost-effective?
- What is the fertilising value of the products?