Solid-liquid separation of solid waste

Tommy Ohlsson and Anders Lagerkvist, Division of Waste Science and Technology, Luleå University of Technology, Luleå, Sweden, e-mail: tommy.ohlsson@nsr.se

Background

Anaerobic digestion of organic material with gas utilisation has been a growing market for several years. In many countries digestion plants has been build for homogenous organic wastes like wastewater treatment sludge, farm crops, manure etc. There are also several facilities for different types of organic solid waste, mainly for source separated organic solid waste. While the plants for homogenous waste often use a fairly simple digestion process, in many cases a wet, one-step, totally mixed process, the process for facilities for solid waste is in many cases much more complicated or have a complicated pre-treatment process.

Separation of liquid and solid material is a common industrial process with several applications in many different areas like food processing, paper industry, wastewater treatment etc. The purpose of the separation is that one or both of the fractions could have increased values or result in decreased costs by separating the two phases from each other. There are several different methods to perform a solid-liquid separation (SLS). Some examples of methods is evaporation, sedimentation, centrifugation, flotation, filtration etc. In many cases SLS is used to process different kind of waste products to increase the possibility for treatment and/or reduce the costs for dispose of it. Some examples are dewatering of sludges in wastewater treatment plants and fibersludge in papermills, separation of packages from its content, production of RDF for incineration etc. In this case the solid-liquid separation is used as a pre-treatment method for organic solid waste. With this pre-treatment the liquid phase after separation could be treated in a simple digester where the biogas could be used for heat, electricity and fuel for vehicles.

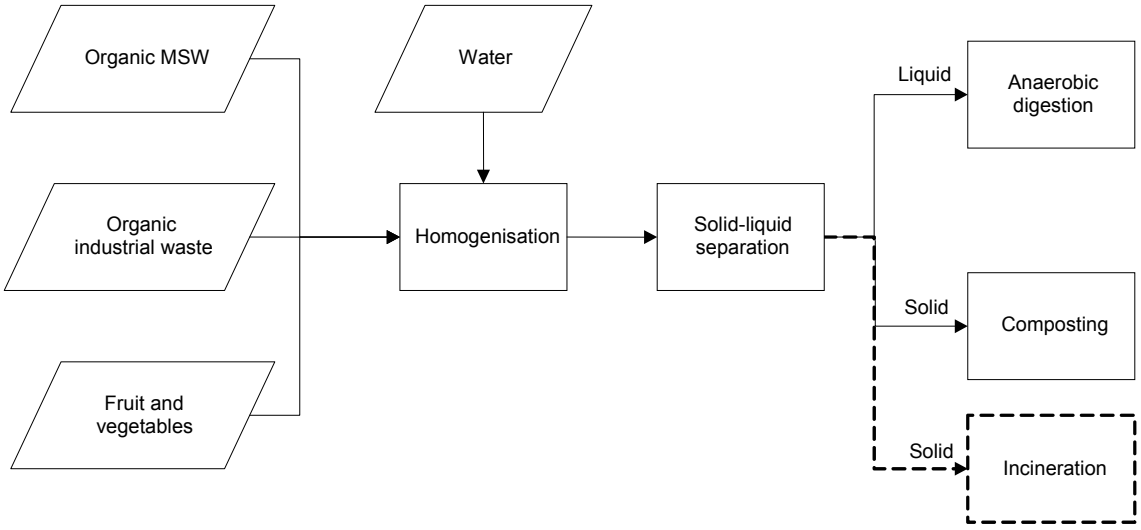

Figure 1 A flow chart for a system with solid-liquid separation followed by biological treatment (thermal treatment as alternative to composting)

Research questions

- How much liquid material could be separated from the organic solid waste?
- Which factors affect the gas potential of the liquid phase?

- Do the quality of the liquid phase fulfil Swedish certification standards for digestate?

Material and methods

Organic waste with three different origins was used for the test:

- Source separated organic material from households.
- Source separated organic material from restaurants, stores and other commercial activities.
- Residual organics from importers of fruit and vegetables.

The organic waste was homogenised in a mixer. If the material is dry, additional water could be added to get a slurry in the mixer. In this case organics with high water content, e.g. fruit and vegetables, were used to increase the water content of the mixture. The material was added batch wise, each batch consisted of 4-5 ton of waste. After the homogenisation the material was pressed in the screw press. The liquid phase was collected in a mobile tank and the solid phase was stored on an asphalt surface.

Preliminary results

The initial tests showed that about 40-60 % of the weight could be separated into the liquid phase. Some hard and/or elastic organic material was not affected by the pressing, e.g. potatoes, carrots. To be able to press that type of organics a more intensive homogenisation must be made, for example with a hammer mill. The amount of total solids in the liquid phase varied between 10-20 %. The heavy metal content in the liquid phase is shown in Table 1. The results showed that all heavy metals were far below the demands of the Swedish certification system for digestate. The average amount of total nitrogen and total phosphor was 24,7 g/kg TS and 4,2 g/kg TS.

Table 1 Heavy metal content of the liquid phase compared to the demands in the Swedish certification system for digestate.

	Concentration mg/kg TS	Certification demands mg/kg TS
Pb	6,7	100
Cd	0,46	1
Cu	26	100
Cr	11,3	100
Hg	0,04	1
Ni	6,0	50
Zn	81	300
Contaminants >2 mm	0,039[1)]	0,5

1)% of TS

References

SP Swedish national testing and research institute (2001) Certification rules for compost and digestate (in Swedish) 46p