

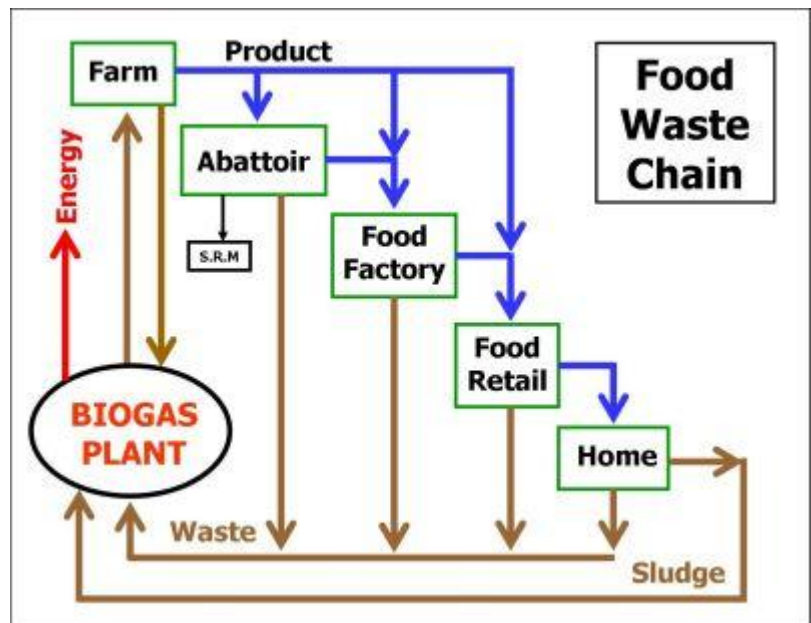


Comparative evaluation of mesophilic and thermophilic digestion of source segregated domestic food waste

Project Staff	Principal investigator: Prof. CJ Banks
Start year	2001
Finish year	2002
Funding body	Biffaward Landfill Tax Credit Scheme
Related website	

Introduction

The research looked at the suitability of using anaerobic digestion as a method of processing domestic kitchen waste and was carried out in conjunction with Greenfinch Ltd, specialists in Biogas Technology R & D. The work compared the process efficiency and stability of mesophilic and thermophilic operation, and at the same time considered the microbiological quality of the digestate to protect agriculture and ensure that human, animal and plant health are not detrimentally affected by the agricultural use of the treated biowaste.



- Food waste chain

Digesters

The two digesters used in the project were based at Greenfinch's site, at Burford House in South Shropshire. The design of digesters is to the same pattern as those used in full-scale operations in terms of mixing, heating, temperature control and particle size reduction. The continuously-mixed digesters are 1500 litres in size: one running at 35oC, the other at 55oC. Pathogen reduction was achieved by maintaining time/temperature regimes (as described by Bendixen, 1999). Daily measurements of biogas, pH and volatile fatty acids were made and temperature measurements were monitored at several positions within the digesters.



- Greenfinch research digester

Food collection

Kitchen waste was collected weekly in plastic waste disposal bags from 150 householders in Burford Village. The bags of food waste were weighed and any contaminants removed before the food was macerated for use in the digesters.

An average of 2.9 kg of kitchen waste was collected from each household every week. Particle size analysis of the shredded kitchen waste, mixed-feed and digestate showed that most particles were less than 2mm thick, and none were greater than 12mm thick, thus achieving the size reduction required by the EU Regulations.

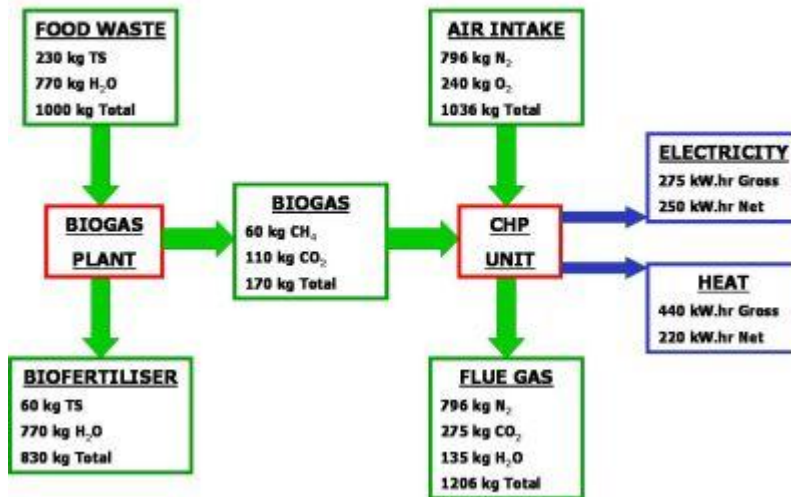


- Digestion of food waste collected from households

Digester performance

Data from the thermocouples showed that the temperatures in the digesters varied by less than 0.5°C from the set temperature. The average TS%, VS% and pH of the mixed feed and digestate showed that the solids were reduced through the process from around 12% TS to 5.5% TS in both the mesophilic and the thermophilic digesters. There was an overall reduction in the proportion of volatile solids between the feedstock and the final digestate. In both processes there was a tendency for high concentrations of VFAs to accumulate. In the mesophilic digester VFA concentrations rose to a maximum of 27,400 mg/l, but the digester appeared to be well buffered and pH levels were not greatly affected, ranging between 7.3 and 7.7 during the study period. In the thermophilic digester, a hydraulic retention time of approximately 27 days over 20 weeks prior to the start of the microbial analysis led to high concentrations of VFAs. The pH varied between 7.3 and 7.6, although it did drop to 6.8 when the VFA concentration reached 44,625 mg/l. A materials mass balance around the digester is given in the diagram.

BIOGAS PLANT - MASS & ENERGY BALANCE



Partners

Greenfinch Ltd

Publications

Banks C.J., Chesshire, M. and Stringfellow A., 2008. A pilot-scale comparison of mesophilic and thermophilic digestion of source segregated domestic food waste. *Wat. Sci. Technol.* 58(7), 1475-1480.

Banks, C.J. and Stringfellow, A. (2003) Survival of salmonella in the anaerobic digestion of kitchen waste. In, *Proceedings of the ninth international waste management and landfill symposium, Sardinia, Italy, 06 - 10 Oct 2003.*

Banks, C.J. and Stringfellow, A. (2002) Biodigestion of kitchen wastes. In, *Proceedings of the Chartered Institute of Waste Management 2002 Conference, Torbay, UK, 18 - 21 Jun 2002.*