Towards digestible plastics: The impact of plastic bin liners on anaerobic digestion performance

UK AD & Biogas Research & Innovation Hub, NEC Birmingham, July 6-7 2016

Towards digestible plastics: The impact of plastic bin liners on Anaerobic Digestion performance

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Plastic materials are ideal for the hygienic individual household collection of wet wastes. However, their poor biodegradability at ambient temperatures and light requires separation of bags from the food waste prior to digestion, causing loss of organic material and increases the cost of digestion. Accumulations of fugitive plastic residues in the environment are also an urgent and serious concern.

Our industrial partners (Biffa and Aquapack) are interested in benchmarking digestibility of biodegradable liners and industrial synthetis polymers against existing biodegradability claims, mechanisms involved and rates of breakdown to bring about further developments in formulation to increase digestion.

In this work, we are assessing toxicity, biodegradability and biogas production of the industrial polymer (to be used for bin liners production) by comparison with other feedstocks as controls. 10 litre digesters were used with and without pretreatment of the plastic. Digestion of the synthetic polymer was compared to natural polymers from maize and rice. Two controls were also used: cellulose (known for its high biodegradability) and sewage sludge (the most commonly used AD substrate). Parameters checked daily, included gas production and composition, CST and total and volatile solids of the digestate. Stability was assessed by Ripley's ratio, VFA, ammonia and pH. Digester loading was 1.36 g VS/l/day at 60 day HRT. The experiment was in two halves with sewage sludge feed in the middle, as an internal control to check activity. In a second experiment the material was pre-treated according to the Animal By-product Regulations heating to 70^{o}C for 1hr. The results show the material was not toxic and completely inert.

Since anaerobic digestion is the most sustainable process for the biological conversion of food waste to energy, the availability of biodegradable plastic will support an increase in household participation and amounts of household food waste collected. Safer and sustainable plastics from biomass precursors are a major potential contribution to biotechnology.