Biorenewables Development Centre

Plants • Processes • Products

Report developed for:

Espazyme UK Ltd

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Effect of a microbial additive on biogas yield in anaerobic digestion

Contact details

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Contents

1. Experimental aims

This short piece of work on behalf of Espazyme UK (Espazyme) has been designed to test the effect of a microbial additive on biogas production in an AD system, fed with a pig slurry and ensiled grass feedstock.

The aim is to test whether use of this additive improves biogas production and to see if any other effects on the process are observed.

2. Our methodology

2.1. Feedstock analysis

The feedstock used for this experiment was pig slurry and ensiled grass sourced from a local farm which also runs an anaerobic digester with these inputs.

2. 1. 1. **Total solids content**

The total solids content of the feedstock was measured by taking a known quantity of material and drying in a furnace at 105 °C until a constant weight was achieved.

2. 1. 2. **Volatile solids content**

Volatile solids were measured by taking a known amount of material and heating in a furnace at 550 °C until a constant weight was achieved. The solids lost on ignition equate to the volatile solids content.

2.2. Experimental set up

The analysis was carried out in two 30 L digesters with programmable feed pumps and passive digestate collection. The evolved gas was passed through a flow meter (measuring standard cubic centimetres per minute; SCCM) via a moisture trap. The gas volume was logged using Windmill data logging software, collecting one data point per second. The pH and temperature were monitored via a Hach pH/temperature probe.

The digesters were filled with 50:50 ratio of digestate (obtained from the same source as the feedstock) and water. The feed pump was programmed to deliver 100 ml of pig slurry every 2 hours.

A microbial supplement (supplied by Espazyme) was added to one of the digesters as per manufacturer's instructions - see Table 1. The supplement was added to a requisite amount of process water them made up to 100 ml with slurry. The mix was added to the digester with the rest of the feed. The supplement was added daily for the first 25 days and then weekly after that.

Table 1. Timetable for the addition of the microbial supplement, giving daily dosage and quantity of process water required.

Stage of analysis (days from start)	Daily dose of microbial supplement (g)	Volume of process water required (ml)
1	20	50
2	20	50
3	10	25
4	10	25
5	10	25
6	8	20
7	8	20
8	8	20
9	8	20
10	8	20
11	7	20
12	7	20
13	7	20
14	7	20
15	7	20
16	6	15 or 20
17	6	15 or 20
18	6	15 or 20
19	6	15 or 20
20	6	15 or 20
21	5	15 or 20
22	5	15 or 20
23	5	15 or 20
24	5	15 or 20
25	5	15 or 20
Weekly maintenance	5	15

3. Key findings

3.1. Total and volatile solids of the feedstock

The total and volatile solids contents were determined as shown in Table 2 below. The pig slurry has low organic matter content but this is improved with the addition of ensiled grass.

Table 2. Total and volatile solids of the digester feedstocks.

Sample	Total solids (%)	Volatile solids (% of dry solids)
Pig slurry	2.8	72
Ensiled Grass	24.34	92.4

3.2. Gas production

Gas production was measured over a 90 day period. Figure 1 shows the rate of gas flow as an hourly rate. This shows that there is a lot of fluctuation in the rate of gas flow. Despite the fluctuations it can be seen that the digester with the microbial additive consistently exhibits a higher rate of biogas production.

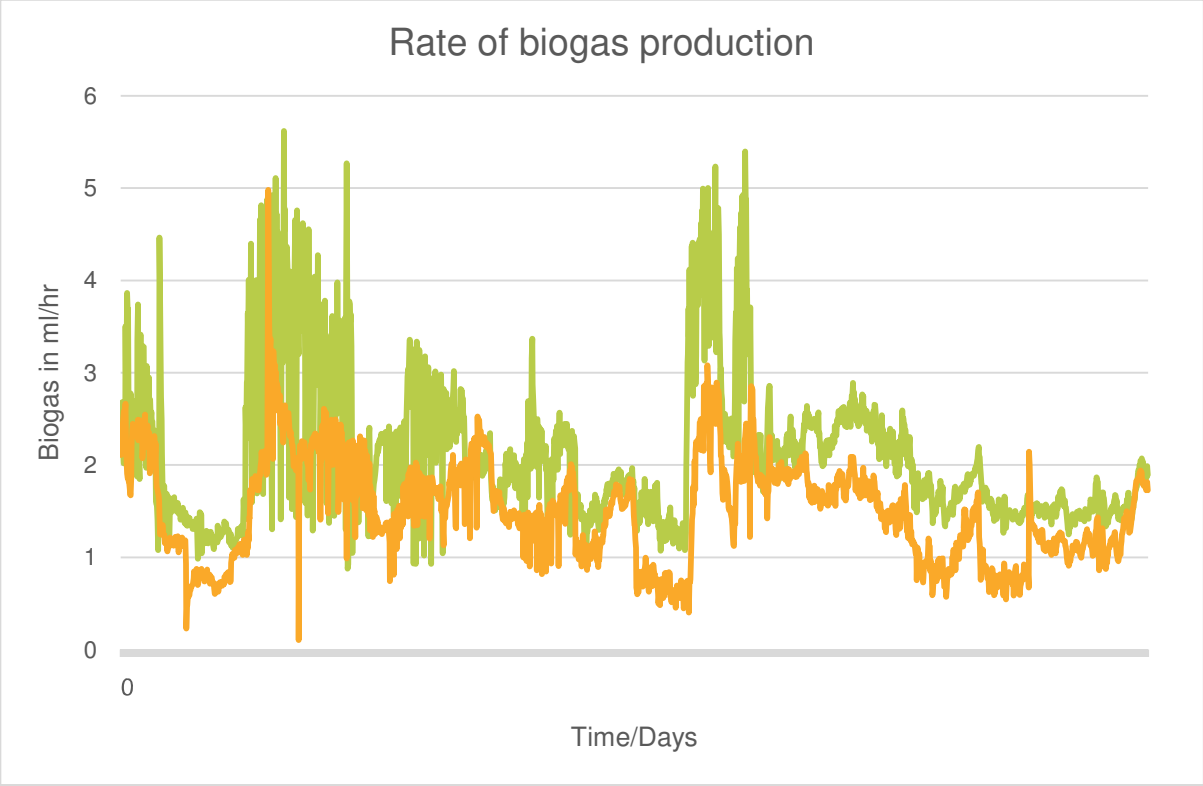

Figure 1. Rate of biogas production in ml/hr over the period of the experiment, comparing the treated and untreated digesters.

3.3. Total and volatile solids of digestate

The digestate was analysed for total and volatile solids content to ascertain if the microbial supplement led to a significant reduction in solid material in the digestate at the end of the experiment. Figure 3 shows the result of this analysis and indicates a reduction in the solid material in the digestate of the treated sample of 23 % compared to the untreated under the conditions tested.

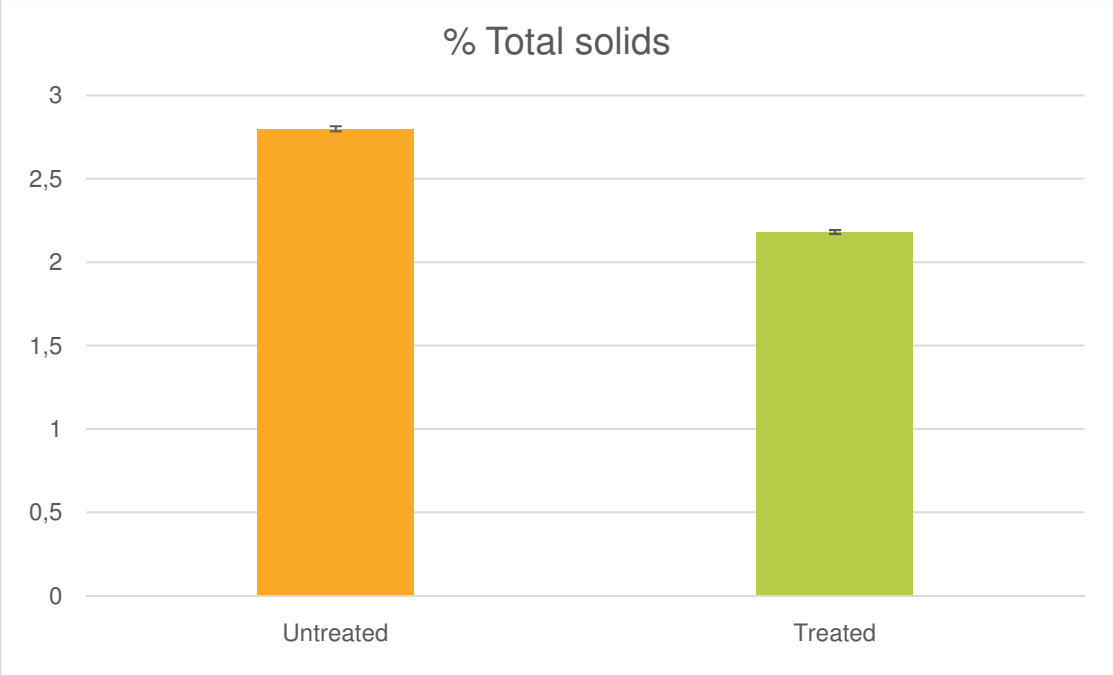

Figure 3. Total solids contents of the digestates remaining at the end of the experiment

4. Conclusions

The results of this study show that the addition of the microbial additive supplied by Espazyme UK has a positive effect on the biogas yield from pig slurry and grass silage. The results show a consistently higher rate of biogas production from the treated material.

The total solids content analysis of the digestate indicates a reduction in dry solids of the treated vessel of 23 % compared to the untreated, with a reduction of 17 % in the volatile solids percentage.

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This document has been prepared as a result of a short study and should be considered as an early stage piece of work on the topic.

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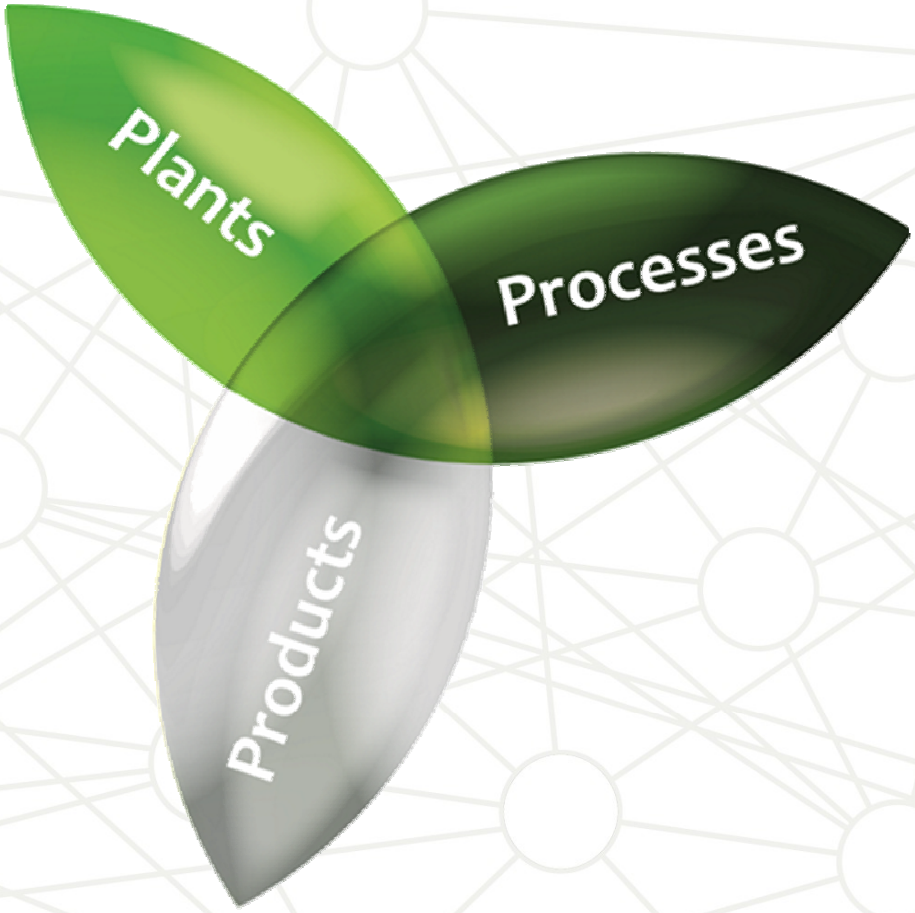

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