

Investigation of Options to Remove the Fat Based Deposits in the Anaerobic Digestion Facility

Prepared For

United Utilities Industrial

By

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1.0 Introduction

The effluent from Greencore is treated by a hybrid AD facility which incorporates UASB granular sludge bed and fixed film media technology. The plant is not designed to treat fats, oils and greases and the presence of fats, oils and grease (FOG) has two detrimental effects on plant performance, namely;

1. FOG's coat the UASB sludge granules causing them to float and be lost from the system. It is therefore impossible to sustain a sufficient sludge bed to treat the design load
2. FOG's form hard stabilised material (up to 50mm in diameter) which has blocked the media in the uppermost part of the digester. This further reduces the treatment capacity but also increases the velocity through remaining pathways in the media, thus increasing the granular sludge loss

The plant can now no longer treat the maximum design load, which not only risks prosecution from breaching the discharge consent but also massively increases operating costs due to the reduced biogas yields that the plant can generate. An assessment of the digester has concluded that the degree of fouling with hardened fat material is such that this will never degrade under normal operating conditions and action must be taken to remove it. Additionally, a strategy to cope with future discharges of FOG's is required.

The cost of opening the digester and physically removing and replacing the media has been estimated to be in the region of £120k. Aqua Enviro have previously been involved in the site and identified the causes of the operating problems. In order to help identify a solution Aqua Enviro have provided an initial trial of a couple of products which can solubilise FOG's and thus render them treatable. This has been carried out at no cost to assess whether this is a potential solution. The laboratory trials have indicated this to be a viable option to provide the following benefits:

1. The chemical has been shown to solubilise the hardened material blocking the filter media. Dosing may be able to clear the filter media thus removing the need to spend £120k refurbishing the digester

2. An ongoing dosing regime at times of FOG discharge could protect the digester from granule loss and media blockage as well as providing significantly enhanced biogas yields for use in the CHP plant.

2.0 Laboratory Assessment

The two products investigated are produced by Bio-Organic Catalyst (BOC) and supplied in the UK by H₂O Water Services. These bio-organic catalysts are designed to breakdown and solubilise FOG's into a form which the bacteria in the AD plant can metabolise. The two compounds investigated were Ecosystem Plus and EcoCatalyst Green.

Three vessels were filled with 500ml of distilled water and equal quantities of the hardened Fat material from the digester. These were dosed as follows:

- Control – no chemical added
- Test 1 – 10ml Ecosystem Plus
- Test 2 – 10ml EcoCatalyst Green
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The vessels were incubated at 35°C for 48 hours after which time the following observations were made.

- Control – no degradation, fat material still present, liquor clear
- Test 1 – Around 70% of fat material appeared degraded. High level of colouration in liquor from solubilised organic material
- Test 2 – Around 50% degradation of fat material degraded, Colouration of liquor from solubilised organic material.

This is shown in the photos below



Photo 1: Control (left), EcoSystem Plus (centre) and EcoCatalyst Green (right).



Photos 2: Control (left), EcoSystem Plus (centre) and EcoCatalyst Green (right).

The COD of the liquor was tested and the control EcoSystem Plus and EcoCatalyst Green were 1,200 mg/l, 16,070 mg/l and 14,310 mg/l respectively. The COD in the control appeared to be from small particles of organic material that was present in the fat sample. This clearly shows that in test 1 14,870 mg/l of COD was solubilised and in test 2 - 13,310 mg/l of COD was solubilised. Once the organics are solubilised the digester should rapidly strip this out as methane. Therefore not only should this clean out the digester, it will also enhance biogas yields and so reduce operating costs.

3.0 Conclusions

These initial trials indicate that Ecosystem plus is the most suitable compound for the degradation of the hardened fat material. It appears that a sustained dosing regime over a period of weeks/months will have a significant benefit on digester performance with the opportunity to clear the media from blockages and enhance COD destruction/biogas yields.

In order to implement this strategy effectively and to provide a more detailed assessment Aqua Enviro can provide a pilot scale UASB reactor to test the effect of the compounds prior to dosing. Aqua Enviro can also provide process support to monitor and optimise the process during the course of dosing and provide an assessment of the effectiveness of dosing.