CI Action : Digestate storage / testing proposal

Subject

Digestate storage / testing proposal

Action Description

Further to the meeting on 04/03/2020, you are required to submit a proposal for approval by the Agency in relation to digestate storage and testing on site in order to comply with Schedule E of the licence

INTRODUCTION

Schedule E of Licence Registration No. P1104-02 prescribes Standards for Digestate Quality. The stability test method outlined is Oxygen Uptake Rate (OUR) with a limit value of ≤ 13mmol O_2/kg organic solids /hour. The oxygen uptake rate is an indicator of the extent to which biodegradable organic matter is being broken down within a specified time period. The material is suspended in water and the respiration rate (i.e. oxygen uptake rate) is estimated by measuring the pressure drop in the headspace (i.e. gas phase in the closed space above the water phase). GGL have experienced difficulties with this method due to the low dry matter content of digestate and note that the test method is more suited to compost than digestate.

As such, GGL propose the use of the stability test in Annex A, Table A.1 of the British Standard PAS 110:2014 Specification for whole digestate, separated liquor and separated fibre derived from the anaerobic digestion of source-segregated biodegradable materials. However, use of the stability test contained within PAS110:2014 presents another issue; turnaround time of results since the test is a 28-day test. GGL therefore submit this proposal for approval by the Agency in relation to stability testing to satisfy storage and testing of material to comply with Schedule E of P-1004-02. It should be noted that GGL has lodged a planning application with the planning authority to provide additional solutions for the management and enhancement of digestate produced at the site.

DIGESTATE STABILITY

At present, there is no EU-wide standard available for determination of stability in compost or digestate, with Member States employing diverse standards and systems. Many stability standards are based on organic acids testing or assessment of remaining biodegradability through an aerobic respirometric test or anaerobic biogas formation potential. Hence, many experts advocated recognising several test methods and limits that are widely in use at present (JRCI 2014, p. 127-128).

Notes for proposal for testing regime under Schedule E: Standards for Digestate Quality

The Residual Biogas Potential (RBP) test is the current accepted method under the BSI PAS 110:2014[1] (with a limit value of 0.45 l biogas/g volatile solids) used to determine digestate stability or degree of digestion. PAS 110 is used in conjunction with the supporting Anaerobic Digestion Quality Protocol (ADQP), to assign end of waste (EoW) status to digestate materials produced from anaerobic digestion.

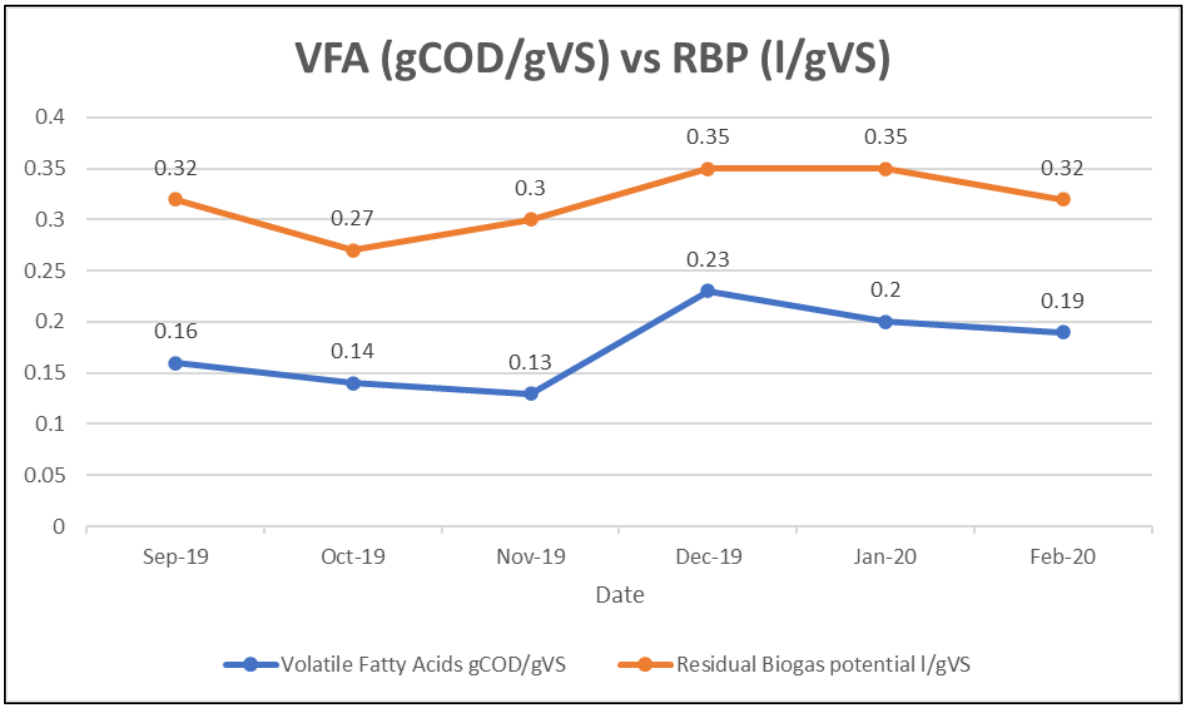
The RBP test is based on digesting samples in small-scale, batch anaerobic digesters over the 28-day period of test. For digestates, the RBP test gives a direct measure of the capacity of the residual carbon in digestates to produce biogas which in turn indicates how well the feedstock has been digested. The drawback associated with the 28-day RBP test relates to the turnaround time and availability of results.

In digestate, the RBP test will respond principally to the volatile fatty acids (VFAs) in solution, with low concentrations giving a low RBP result and high concentrations giving a high RBP result, up to a limiting concentration which is known to cause test inhibition. For this reason, the PAS 110:2014 RBP test is currently preceded by a VFA screen, which aims to screen out samples with high VFA concentrations in solution lest they deliver subsequent false negatives in the RBP test. (WRAP 2011, p. 21). A sample with a VFA concentration with a stoichiometric equivalent biogas value greater than the RBP limit, will fail the RBP test since these VFAs are the precursors to biogas production in the digestion process (WRAP 2010 p. 28). The RBP value reflects the total VFA level in the digestate as well as reflecting other forms of carbon, such as partially decomposed waste in solid particulate form. It should be noted VFA concentrations for slurry and liquid digestate samples are determined using the filtered eluates from samples, rather than using the unfiltered liquids – which would also contain carbon in solid form.

The results of digestate stability testing over a 6-month period (September 2019 to February 2020) produced by Glenmore Generation Ltd. (GGL) is presented in Figure 1. The graph profiles VFA and RBP concentrations.

[1] PAS 110:2014 Specification for whole digestate, separated liquor and separated fibre derived from the anaerobic digestion of source segregated biodegradable materials.

Figure 1. Profile of VFA and RBP in digestate produced at GGL



As can be seen and as expected, the total VFA concentration positively correlates to the RBP value (Figure 1). Therefore, forward knowledge of RBP compliance can be achieved using VFA analysis as the turnaround test for VFA analysis is 5 working days (as opposed to 28 days for RBP).

However, it is accepted that total VFA concentration should not be used in isolation as a product stability criterion; rather it is a good indicator of the expected RBP concentration. This is due to the fact that carbon in solid particulate form in the digestate *'as received'* may also make a significant contribution to RBP value (and is currently discarded prior to VFA testing).

Therefore, GGL propose to continue with 28-day RBP analysis as the accepted measure of stability for digestate from the anaerobic digestion process (post pasteurisation). GGL also propose to introduce additional mid-month sampling (every 14-15 days) and analysis of RBP to limit the period of time between stability results and to provide additional confidence that digestates produced meets the quality parameters agreed with the EPA and set out under schedule E of the licence. Mid-month samples will be collected from digester vessel D4 (secondary digester) which is upstream of the back-end pasteurisation process. It is calculated that the hydraulic retention time (HRT) in D4 is approximately 17 days; overall AD HRT being 60-70 days (D1-D4). Sampling of D4 and analysis for RBP will represent stability conditions for the batch (i.e. the contents of digester D4). GGL propose that a 14-day mid-month RBP test is introduced to the testing regime for a period

of 6 months. It is proposed that the results of this validation programme along with the routine 28-day RBP test and VFA test will be presented to the EPA in a technical report to demonstrate that the technical requirements for stability are being met on an ongoing basis.

GGL propose to continue with the existing test regime as specified under Schedule E of P1004-02 for other quality criteria parameters; i.e.

- GGL propose to continue to assess metal content on a monthly basis under PAS110 certified parameters, conducted by NRM.
- As the installation is regulated by the Department of Agriculture, Food and the Marine under the Animal By-products Regulations, analysis for pathogens will continue as per DAFM requirements.
- GGL propose to continue to assess impurities on a monthly basis under PAS110 certified parameters, conducted by NRM.
- GGL propose to continue to assess organic matter on a monthly basis under PAS110 certified parameters, conducted by NRM.
- GGL propose to continue to conduct maturity testing on a monthly basis, by IAS Labs.

Notes for proposal for testing regime under Schedule E: Standards for Digestate Quality

Table 1. Summary of Test Regime Proposals (April 2020)

Parameter	**Frequency as per 8.9 of licence/Proposal**	**Internal/External Lab**	**Turnaround Time**
Stability			
Liquid & Fibre Digestate – 28-Day Residual Biogas Potential (PAS 110:2014 Certification)	Monthly	NRM Lab (UK)	28 days
Liquid and Fibre Digestate - 14 Day Residual Biogas Potential	Monthly (mid-month)	Celegnis (Ireland)	14 days
Metals Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Zinc (PAS110 Certification)	Monthly	NRM (UK)	5 days
Pathogens	Under DAFM ABP Regulation:		
Salmonella	Salmonella 1 x 5 batch sample per export tank per month	Aqualab (Ireland)	2 days
E.Coli	E.Coli 3 x 5 batch samples per pasteurisation tank per week		24 hours
Impurities (PAS110 Certification)	Monthly	NRM Labs (UK)	5 days
Organic Matter (PAS110 Certification)	Monthly	NRM Labs (UK)	5 days