

Advice Sheet 35: Residual Biogas Potential (RBP) of Anaerobic Digestate

Introduction

Anaerobic Digestion (AD) is the process of producing bioenergy from organic waste by the action of microorganisms in the feedstock under anaerobic conditions. Once the digestion process is completed the waste slurry from the digester may be applied to land as a source of nutrients for the soil. The residual biogas potential (RBP) test is designed to measure the stability of the waste from the digester. The test ensures that the digestion process has approached completion and that the waste will not continue to produce appreciable amounts of biogas.

Test Method

Samples are homogenised and the dry matter and volatile solids (at 550°C) are analysed in triplicate to determine the sample quantity to take for RBP analysis. Prior to starting the RBP test it is necessary to confirm suitability of the sample by undertaking a screen for volatile fatty acids (VFAs). The amount present must fall below 0.774 g COD / g VS to be suitable. (Note this is not carried out on separated fibre).

A representative portion of sample along with an excess of nutrients and inoculum of sewage sludge to provide microorganisms, is added to a small digestion vessel. This is incubated at 35°C and the volume of biogas produced is measured over a 28-day period. The inoculum is also measured as a separate sample allowing the volume of biogas produced by the digestate sample to be calculated. The biogas production of the control substance of cellulose is similarly measured for quality control purposes.

NRM Laboratories have been appointed by REAL (Renewable Energy Assurance Ltd) to conduct testing of digestate under the Biofertiliser Certification Scheme to PAS110 (see Advice Sheet AS27). Validation data was scrutinised by these organisations and approval granted for our RBP test based on the WRAP reference method [OFW004-005].

Subcontracting

NRM have a dedicated testing facility for RBP with equipment to run up to 48 samples. However, at times of high demand it is sometimes necessary to send samples to another laboratory to ensure the test is started in the necessary timeframe. The laboratory used is approved by REAL and is subject to regular audit to make sure the reference method is followed. A comparison exercise is routinely carried out by NRM where both labs test the same samples to ensure similar results are produced. If a sample has been subcontracted, it will be indicated on the final and interim report.

Reporting Results

All analysis is carried out in triplicate and the RBP reported as litres of biogas per gram of volatile solids (l/gVS). The result for each replicate along with the average value is reported for the digestate sample, QC sample and inoculum.

There are two instances where one of the replicates may be excluded. On occasion the equipment fails (e.g., gas leak, mechanical fault) meaning the gas measurement has not been properly recorded so it is not possible to provide all 3 results. As this is a biological test sometimes the triplicate results show an obvious outlier (e.g., 0.25, 0.28, 0.55). In this case the anomalous result is excluded to avoid skewing the average. The reason for excluding a result will be indicated on the report and the average calculated from the remaining two results.

The threshold as dictated in PAS110 is 0.45 l/g VS. The plot of the average biogas produced over the 28-day time period for the sample, inoculum and cellulose will be sent as a pdf file.

Quality Control

There are a number of conditions to be met for the test results to be valid. These are checked during the test and after the 28-day run is complete.

The inoculum control must produce a measurable volume of biogas. If this is not the case, it is not suitable, and the analysis will be re-run with a different batch of inoculum.

The plots of gas produced over time for the inoculum, QC sample and digestate sample should all be smooth with no obvious spikes.

The 28-day RBP of the QC sample must exceed 0.5 l/g volatile solids. This is checked in the early stages of the test. If it does not look on track to be at this level by day 28 the analysis will be re-run.

The digestate sample RBP is not allowed to be negative past the first 5 days of the test (the volume of gas produced is less than the inoculum control). In this situation the result will be reported as '*invalid result as inoculum inhibited*'.

In the case of an invalid result due to inoculum inhibition we will continue to run the test to 28 days and will provide the RBP plot to show when / if the sample gas production becomes positive. We advise this is sent to the Certification Body as supporting information. Some samples appear to be susceptible to inhibition issues and if more than one invalid result is reported please contact REAL (Thomas Aspray - thomas@realschemes.org.uk). They will discuss possible causes of the inhibition and may suggest modifications to the method to help achieve a valid result.

How to submit a sample for analysis

Samples are required to be sent using a courier service expected to arrive at the laboratory within 24 hours of the sample being taken and the test started within 7 days. Please plan to sample at the beginning of the working week to help achieve this. If it is not possible to start the test within one week (due to equipment breakdown or issues with inoculum) we will check if you still want to go ahead with the test. The result may be considered invalid if started outside of the 7 days.

In order to proceed with the RBP test we need to receive 2L of liquid in a suitable bottle or 1kg of solid in a large grip seal bag. This is in addition to sample quantity requirements for other analysis. Suitable sample containers can be provided on request. Samples need to be labelled and kept under cool conditions during transit. Please provide the current BCS analysis request form (available from BCS website) with the samples.

To arrange delivery of sample containers / cool boxes and courier bookings and all other queries please contact Customer Services:

E-mail: enquiries@nrm.uk.com

Tel: 01344 886338

Method Reference

'Residual Biogas Potential Test for Digestates'

WRAP, Final Report – 7th January 2010, Project Code: OFW004-005, ISBN: 1-84405-421-7