

## **4C-105 - Assessing Stimulation and Inhibition of Anaerobic Lagoons**

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### **Aims and Objectives**

To promote the widespread use of inhibition testing in assessing anaerobic digestion of pig manure, this project develops and validates a simplified and unified inhibition test protocol. The method development was performed on two very distinct inoculum sources, one being sludge from a covered piggery lagoon, and using two inhibitors, namely ammonia nitrogen and sodium. Attention was given to important details of the test method which were extensively validated with experiments.

### **Key Findings**

Key findings include a clear definition of optimum/preferred test conditions. It is observed that it is necessary to pre-dilute sludge sample to  $10\text{g.L}^{-1}$  volatile solids content upon receipt before carrying out inhibition testing, and then to provide sodium acetate as a carbon source at around  $2\text{gAcetate.L}^{-1}$ .

A simplified version of the test assay is also developed and is shown to perform equally well to the full version. The simplified method is targeted for reduced complexity and cost to promote routine inhibition analysis. In the simplified method, as few as two sampling events over 1.5 days provide a reliable measure of activity in the presence of an inhibitor, and this method is expected to achieve costs as low as the target of \$250/sample.

The inhibition response is observed to differ slightly (as expected) between the two trial inoculums and is found to be largely consistent between the simplified and the full-test method (multiple sampling events).

### **Application to Industry**

This project defined and validated, through extensive experimental work, a simple yet robust inhibition and activity test assay. For producers, this test assay will be able to quickly quantify how much of a particular chemical or agent can be tolerated in their shed flush effluent before significant inhibition of a covered lagoon will occur (a threshold test).

The test assay is of a general nature, being potentially applicable across anaerobic digestion in many industries, including pork production. This is significant, because such a unified assay has not been previously reported, even in the broader anaerobic digestion community, and therefore the test technique developed in this project also has broader general implications for anaerobic digestion studies. Various test assay conditions were assessed through the project to fully define the assay method. To promote widespread adoption, a simplified and unified test assay was targeted with a cost potentially as low as \$250/test without compromising data quality.

The test technique is well-documented in this report and the associated journal paper and can accordingly be promoted for adoption by NATA accredited test facilities across Australia. The inhibition test method will be integral part of the analyses toolbox for Project 4C-111 *Anaerobic treatment for emissions reduction from solid manure residues* and Project 4C-109 *Enhanced methane production from pig manure in covered lagoons and digesters*.