Project Number & Title
4C-115 Bioenergy Support Program – Transition (Research)

Project Leader
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Project Participants
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Aims and Objectives

Biogas is increasingly used at Australian piggeries to produce heat and generate electricity, with current uptake of biogas by about 13.5% of total Australian pork production. The present project facilitated further uptake of biogas, by conducting targeted biogas-related research.

Solids separation can be used to reduce volatile solids (VS) loading on a covered anaerobic pond (CAP), thereby decreasing the propensity for scum/sludge formation and reducing the pond size required. However, separation of manure solids also removes organic matter and with it methane potential. Australian piggeries installing biogas systems were interested to understand the impact of solids separation. Manure samples were collected from these piggeries before and after solids separation to quantify methane potential losses.

High concentrations of hydrogen sulphide (H_2S) in piggery biogas (500-3000ppm) currently discourages biogas use in Australia. H_2S at these concentrations is extremely hazardous and highly corrosive. There is a lack of practical and cost-effective H_2S removal options, because the many commercially available H_2S removal methods have limited applicability because of high cost, complexity and potential safety issues. To develop practical and cost-effective options, the present study carried out piggery field trials of a simple biological oxidation concept and separately chemisorption using an iron-rich red soil.

Key Findings

Results of the solids separation study confirmed that VS removal by solids separation also reduced methane potential (an unwanted effect), specifically by 17-31% for a screw press and by 22% for a static run-down screen. Methane yield loss was approximately proportional to the extent of VS removed by the solids separation.

H_2S removal by biological oxidation in an simple external vessel was very effective, removing over 90% of the H_2S and reducing H_2S concentrations from a high 4,000 ppm to <400 ppm. Chemisorption using red soil also removed H_2S, but substantially less than a commercial iron-oxide pellet media. Therefore, red soil would only be feasible for final polishing of biogas after an initial biological oxidation step had removed most of the H_2S.

Application to Industry

For covered ponds, it is recommended that a static screen or a similar, mild method of solids separation, be considered to reduce the potential for float layers/crust under the pond cover. This solids separation would reduce methane potential near equivalent to the extent of VS removed.

It is recommended that H_2S be removed from piggery biogas using biological oxidation in an external treatment vessel and using covered pond effluent as nutrient source, because it is simple, cost effective, and performs very well. However, the safety aspects of mixing small amounts of air with biogas (for the biological oxidation) should made clear and widely advertised, to prevent hazardous scenarios with explosive gas mixtures in the Australian pork sector. Chemisorption with iron-oxide media can be used to remove any H_2S that remains after the initial biological oxidation step. This would ensure that biogas is treated to a consistent high quality for on-farm use.

In the future, food by-products unsuitable as a pig feed will likely be increasingly co-digested with pig manure to boost methane production. However, it is recommended that food by-products instead be used as a pig feed wherever nutritionally, legislatively and economically appropriate. This is so that energy production does not compete with food production, and because the value of pig feed far exceeds the value of biogas methane that can be produced organic matter in the feed.