

Co-Digestion of Hog Manure with Glycerol to Boost Biogas Production

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Anaerobic digestion (AD) of animal wastes can generate a valuable end product referred to as biogas which is primarily composed of methane and carbon dioxide. When this process is contained in a reactor vessel, the biogas can be collected and used as a fuel source for heating or electricity generation, making this a source of renewable energy, while at the same time reducing the emission of greenhouse gases released in open manure storages or lagoons. In an effort to boost methane yields, many different amendments have been used, such as adding fats, oils and grease (FOG), municipal solid waste, and different mixtures of hog, poultry and cattle manure. Glycerol is a readily biodegradable sugar alcohol, which is a by-product of biodiesel production, and is of particular interest in the province of Manitoba, due to the anticipated increase in the biodiesel industry and the associated waste products. The purpose of this study was to co-digest hog manure with glycerol in an attempt to boost biogas and methane yields. Four continuous feed, lab-scale anaerobic digesters were run under mesophilic, fully mixed conditions, while being fed a mixture of dilute hog manure and varying concentrations of glycerol. The control reactor was fed manure alone, while the other three were fed manure with 1%, 2%, and 4% glycerol by weight, which was equivalent to 1.7, 2.4, and 3.8 times the COD loading of the control reactor. All three reactors with glycerol showed a rapid utilization of the additional COD and more than a doubling of biogas production within 3 days, however the 4% reactor experienced a sharp decline in biogas production after 5 days, resulting from a rapid build-up of VFA's and a corresponding drop in pH and alkalinity to toxic levels after 12 days. The 2% reactor experienced a similar drop in biogas production after 25 days, also corresponding to an increase in VFA's and a drop in pH and alkalinity. The 1% reactor continued to produce approximately 1.8 times the CH₄ after 30 days without any excess build-up of VFA's. The reactors are being continually run in an attempt to produce a bacterial culture that can withstand higher loadings of glycerol and can be used in a full-scale application.