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Editorial

Xerophytic Phytoplankton as an Anaerobic Fermentation Substrate

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Abstract

(Baumann K et al ., 2020) From leftover microalgae biomass obtained from either a lipid-based biofuel process or wastewater treatment, anaerobic digestion can be used to make methane biogas. Due of their potential for robustness in large-scale open pond production, halophytic microalgae are being considered for use in the production of biofuel. Halophytic microalgae biomass would be difficult to digest anaerobically due to high salinities that are uncommon in anaerobic digestion settings. (Austin RS et al ., 2011) As a viable substrate feedstock for anaerobic digestion, halophytic microalgae biomass would have salinities greater than 3.5%, which are frequently observed in marine environments. The first step of the study described here examines changes made in the bacterial population as a result of the anaerobic digestion of piggery effluent, which is a problem with the anaerobic digestion of halophytic microalgae. with the goal of developing a saline-tolerant anaerobic digestion inoculum capable of breaking down feedstocks under extreme salinity conditions. Positive outcomes from this inoculum development study enabled the study of halophytic microalgae's anaerobic digestion (Färe R et al., 2007). According to the results, a saline-tolerant inoculum was kept up. Following halophytic bacterial community fingerprinting using denaturing gradient gel electrophoresis (DGGE), numerous halophytic methanogens were discovered. It was the inoculum that broke down the halophytic microalgae. The obtained gas data demonstrated that at 7% salinity, biogas generation of 358 53 mL/g of volatile solids (VS) with a methane concentration of 54 4.3% was accomplished. Wet weight microalgae biomass produced 122 26 and 175 25 mL/g of biogas, respectively. of halophytic microalgae biomass (74 2.8 wt.% moisture content), respectively. At salinities of 3.4% and 7%, respectively, the conversion of carbon in the feedstock to methane was successful with efficiencies of 26.4% and 46.6%. In order to close the loop on nutrient recycling needed for the generation of halophytic microalgae based biofuels and maybe, hypersaline wastewater treatment applications, a halo-tolerant anaerobic digestion microbial community could be further developed (Dagum C et al., 1997).

Keywords: Pyrolysis Combustion, Oil, Microalgae, LCA, TGA

INTRODUCTION

(Cole S A et al ., 2017) The production of methane biogas from waste microalgae biomass derived from a lipid-based biofuel process or saline wastewater treatment is made possible by the anaerobic digestion of halophytic microalgae biomass. The resulting methane biogas can be used to power a co-generation facility that generates renewable thermal and electric energy. Electricity generated from biomass extraction may allow for a significant reduction in the amount of grid-supplied electricity needed. In addition to lowering the greenhouse gas emissions connected with the facility, the potential reduction in electricity requirements would significantly increase the commercial viability of the microalgae biofuel production operation(Mason N M et al., 2017).

(Luo Y et al., 2017) The additional benefit of recovering vital nutrients from the leftover 60–70% extracted microalgae biomass by anaerobic digestion will allow the nutrient

loop associated with microalgae extraction to be closed. its manufacturing. This leftover microalgal biomass contains nutrients that are biologically locked up, but anaerobic digestion has the power to release those nutrients, making them bio-available and ideal for regrowing microalgal biomass. It is crucial for boosting the viability of the microalgae biofuel businesses to use anaerobic digestion in salty circumstances for the generation of microalgae biofuels and/or the treatment of saline effluent. Before the commercialization of this technology can be advantageous for the microalgae business, there are a number of issues that need to be resolved with regard to the anaerobic digestion of halophytic microalgae biomass. When anaerobically digesting saline microalgae biomass, there are two main obstacles to overcome: the first is the high salinity that results from halophytic microalgae culture conditions, and the second is the physical properties of microalgae biomass as a substrate feedstock for anaerobic digestion. According to existing research, methane production declines noticeably as salt levels rise. (Bosker M et al., 2009) The effects of salt on anaerobic digestion are well known, and it has been hypothesised that sodium concentrations of 5745 mg L1 can considerably limit anaerobic digestion. However, McCarty later revised this inhibitory dosage and increased it to 8000 mg L1. The anaerobic digestion of biomass obtained from seawater is hampered by this concentration since surface sea water typically contains 10,000–11,000 mg L1 of sodium. Using 16S rDNA techniques, Lefebvre et al. identified numerous methanogen species that are identifiable at greater salinities; nevertheless, as the salinity concentration increased, the specific methanogenic activity and methane generation declined. (Dagum C et al.,1997) The authors also mentioned that the substrate of the feedstock had an impact.

the methane decrease caused by sodium inhibition. According to Lefebvre et al., the reaction appeared to be hindered when a reactor was operating with distillery vinasse feedstock at a lower salt concentration of 10 g L-1 as opposed to a second reactor that was working with ethanol feedstock, where inhibition wasn't noticed until 60 g L-1. This finding illustrates how the substrate used for digestion might affect how the methanogenic bacteria are inhibited. It is obvious that each substrate should be subjected to independent investigation in order to determine how it affects the response of the bacterial community. An initial assessment of a functional piggery effluent anaerobic digestion community was carried out using polymerase chain reaction denaturing gradient gel electrophoresis because salinity inhibits anaerobic digestion (PCR DGGE) analysis. To examine the reaction and adaptation of the microbial community to increasingly saline circumstances, this DGGE study used microbial community samples from an operating piggery effluent anaerobic digester that had been treated to increased salt. In the second stage of the investigation, Tetraselmis sp., a halophytic alga, was used as a feedstock for the synthesis of bio-methane via anaerobic digestion in saline conditions. Using PCR DGGE to profile the response and adaptation of the bacterial community, it was determined how the microbial community changed during anaerobic digestion. Comparing the acidogenesis and hydrolysis stages of anaerobic digestion to the methanogen stage, it has been found that methanogen bacteria are significantly more affected by environmental factors. Therefore, Archaea-specific primers were also used to particularly study the activity of methanogen bacteria responsible for methane synthesis (Dubey A et al., 2009).

In the second stage of the investigation, Tetraselmis sp., a halophytic alga, was used as a feedstock for the synthesis of bio-methane via anaerobic digestion in saline conditions. Using PCR DGGE to profile the response and adaptation of the bacterial community, it was determined how the microbial community changed during anaerobic digestion. When compared to the acidogenesis and hydrolysis stages of anaerobic digestion, methanogen bacteria have been demonstrated to be substantially affected by environmental variables. Therefore, in addition to using general bacterial primers, Archaea-specific primers were also used to specifically study the activity of methanogen bacteria that produce methane. The Archaea-specific primers focus on methanogen bacteria and offer a more thorough understanding of how salinity affects the population of microbes that produce methane.generation of methane fragments of sections

source of piggish wastewater as a feedstock

At the University of Adelaide Roseworthy Campus piggery research site, pig wastewater was drawn from the main pig sump and transferred in 20 L containers. To prevent pre-digestion during storage, the collected piggery effluent was kept chilled at 4 °C. The effluent was employed to create a dependable anaerobic digestion community for the reported study's inoculum development part.

Development of the vaccine

Over the course of the ten-week trial, gas was created, but the volume was substantially smaller in weeks 6, 7, and 8 even though it did grow in the final two. The precise quantification of gas was ideal because this was the first inoculum formation investigation, but it was not necessary because the main goal of the study was to use PCR DGGE to profile the microbial community. Table 1 displays the average weekly salinity (%) and pH (%) values.

DISCUSSION

To make sure a healthy bacterial community existed, the experimental anaerobic digester was initially infected and ran at steady-state for four weeks. The MWA data confirmed that the digester was stable for the first four weeks and that the salinity correction process had started. The bacterial and archaeal communities were constant, according to MWA analysis of the DGGE data, which showed a score of zero for both populations.

CONCLUSION

During this study, a molecular analysis of the impact of salinity on a functioning piggery effluent digester was conducted. Results showed a change in the methanogen community and biogas production at 7% salinity. The halophytic microalgae anaerobic digestion research digesters with this methanogen community afterward. The halophytic microalgae anaerobic digestion investigation provided more evidence that the community had evolved into one that was halo-tolerant favourable gas

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CONFLICT OF INTEREST

The author has no known conflicts of interested associated with this paper.

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