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Enhanced biogas production of red microalgae via enzymatic pretreatment and preliminary economic assessment

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Microalgal biomass is a promising candidate for biogas production, however; cell characteristics may prevent accessibility of anaerobic microorganisms to organic matter and limits methane production from microalgae. Pretreatments provide enhancement in methane yields via cell wall disruption and cell membrane solubilization. In this study, improvement of methane production from Porphyridium cruentum by enzymatic pretreatment was investigated. Enzymatic pretreatment at 55 °C showed the highest solubilization efficiencies. Protease, viscozyme, and enzyme mix pretreatment showed highest solubilization increases as 32.3%, 30.4%, and 30.5%, respectively. Highest methane improvements from P. cruentum were achieved after protease pretreatment with the highest dose (0.5 mL/g dry biomass) at both mesophilic (77% improvement) and thermophilic conditions (100% improvement). Modified Gompertz model results showed that lag phase was reduced and methane production rates were improved after enzymatic pretreatment. Preliminary economic assessment results showed that the cost of enzymes makes enzymatic pretreatment is not economically feasible due to critical cost of enzyme yet. However, production of low cost enzymes could facilitate the use of enzymes in pretreatment of microalgae and biogas production.