Novel insights into scalability of biosurfactant combined microwave disintegration of sludge at alkali pH for achieving profitable bioenergy recovery and net profit

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Abstract

In the present study, a novel alkali rhamnolipid combined microwave disintegration (ARMD) was employed to achieve net energy production, increased liquefaction and to increase the amenability of sludge towards biomethanation. Additionaly, biosurfactant rhamnolipid under alkali conditions enhances the liquefaction at alkali pH of 10 with a maximal liquefaction of 55 % with reduced energy consumption (1620 kJ/kg TS) than RMD (45.7 % and 3240 kJ/kg TS specific energy) and MD (33.7 % and 6480 kJ/kg TS specific energy). A higher biomethane production of 379 mL/g COD was achieved for ARMD when compared to RMD (329 mL/g COD) and MD (239 mL/g COD). The scalable studies imply that the ARMD demands input energy of -282.27 kWh. A net yield of (0.39 USD/ton) was probably achieved via novel ARMD technique indicating its suitability at large scale execution when compared to RMD (net cost -31.34 USD/ton) and MD (-84.23 net cost USD/ton), respectively.

Keywords: dairy waste activated sludge; microwave disintegration; biosurfactant; specific energy; biomethane; energy analysis