ABSTRACT

The current study was concerned with the enhanced co-production of biohydrogen and biomethane by two stage process (i.e. dark fermentation and anaerobic digestion) from *Atriplex crassifolia*. The halophyte *Atriplex crassifolia* was subjected to alkali pretreatment and further biomass compositional analysis. Maximum delignification i.e. 64% and maximum available cellulosic content i.e. 62.1% was observed by the substrate pretreated with 3% sodium hydroxide (NaOH) solution. The pretreated substrate was subjected to dark fermentation and anaerobic digestion for biohydrogen and biomethane production respectively. One variable at a time experimental design was opted for the optimization of biohydrogen and biomethane parameters. Parameters analyzed for optimization of dark fermentation for biohydrogen production included retention time (1-7 days), fermentation media (A-E), inoculum samples (sludge, waste water, river soil, cow dung and garbage compost), inoculum pretreatment methods (heat shock, acid, alkali, aeration and UV radiations), incubation temperature (25$_o$C- 40$_o$C), pH (4.5-7), substrate concentration (3g-7g) and inoculum concentration (5ml-25ml). The findings of this experiment showed 23% increase in biohydrogen production utilizing 5g pretreated substrate and 10ml heat shock pretreated sewage sludge after 48hours of incubation at 37$_o$C and pH of 5.5. The hydrogenic slurry obtained after optimization of biohydrogen was then used in place of *Atriplex crassifolia* in anaerobic digestion for biomethane production. Different parameters optimized for biomethane production included retention time (4-20days), incubation temperature (35- 55 $_o$C), pH (7-9.5), slurry concentration (10-50ml) and inoculum concentration (20-100ml). Hydrogenic slurry concentration of 40ml was inoculated with 80ml sewage sludge to obtain maximum percentage of biomethane production i.e. 52% after18days of incubation at 45$_o$C and pH of 8.