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The Optimization of Immobilization Conditions for Biohydrogen Production from Palm Industry Wastewater

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Abstract : Clostridium sp. LS2 was immobilised by entrapment in polyethylene glycol (PEG) gel beads to improve the biohydrogen production rate from palm oil mill effluent (POME). We sought to explore and optimise the hydrogen production capability of the immobilised cells by studying the conditions for cell immobilisation, including PEG concentration, cell loading and curing times, as well as the effects of temperature and K2HPO4 (500–2000 mg/L), NiCl2 (0.1–5.0 mg/L), FeCl2 (100–400 mg/L) MgSO4 (50–200 mg/L) concentrations on hydrogen production rate. The results showed that by optimising the PEG concentration (10% w/v), initial biomass (2.2 g dry weight), curing time (80 min) and temperature (37 °C), as well as the concentrations of K2HPO4 (2000 mg/L), NiCl2 (1 mg/L), FeCl2 (300 mg/L) and MgSO4 (100 mg/L), a maximum hydrogen production rate of 7.3 L/L-POME/day and a yield of 0.31 L H2/g chemical oxygen demand were obtained during continuous operation. We believe that this process may be potentially expanded for sustained and large-scale hydrogen production.

Keywords : hydrogen, polyethylene glycol, immobilised cell, fermentation, palm oil mill effluent
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