Optimization of biohydrogen production by Clostridium butyricum EB6 from palm oil mill effluent using response surface methodology

ABSTRACT

Clostridium butyricum EB6 successfully produced hydrogen gas from palm oil mill effluent (POME). In this study, central composite design and response surface methodology were applied to determine the optimum conditions for hydrogen production (Pc) and maximum hydrogen production rate (Rmax) from POME. Experimental results showed that the pH, temperature and chemical oxygen demand (COD) of POME affected both the hydrogen production and production rate, both individually and interactively. The optimum conditions for hydrogen production (Pc) were pH 5.69, 36degreeC, and 92g COD/l; with an estimated Pc value of 306ml H2/g carbohydrate. The optimum conditions for maximum hydrogen production rate (Rmax) were pH 6.52, 41degreeC and 60g COD/l; with an estimated Rmax value of 914ml H2/h. An overlay study was performed to obtain an overall model optimization. The optimized conditions for the overall model were pH 6.05, 36degreeC and 94g COD/l. The hydrogen content in the biogas produced ranged from 60% to 75%.

Keyword: Biohydrogen; Clostridium butyricum EB6; Response surface methodology; POME