Photohydrogen production from dark-fermented palm oil mill effluent (DPOME) and statistical optimization: Renewable substrate for hydrogen

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ABSTRACT

Biological hydrogen production through photo-fermentative process using dark fermented palm oil effluent (DPOME) is a cost effective and environmentally benign process. In this study, effect of various factors like light intensity, agitation rate and dilution of DPOME on the hydrogen productivity of *Rhodopseudomanas palustris* were investigated using batch system. Investigation methods like response surface methodology (RSM) and Box-Behnken design were employed to investigate the optimum conditions for enhanced photo-fermentative hydrogen production. The regression analysis suggested that hydrogen yield was well fitted by a quadratic polynomial equation ($R^2 = 0.92$). The hydrogen production was investigated by varying the intensity levels of these three independent variables, in which all have significant influences on hydrogen yield. The set of 19 experimental runs were conducted to optimize these variables. The highest hydrogen yield of 3.07 ± 0.66 H_2 yield mol-H_2/mol-acetate was obtained under the optimum condition of light intensity 250 W/m^2, agitation rate 200 rpm, and 30% dilution of DPOME. The experimentally obtained hydrogen yield found out to be in a good agreement with predicted yield which was about 2.80 mol-H_2/mol-acetate. In short, results suggest that experimental strategy using RSM approach along with Box-Behnken design can be a promising approach to achieve enhanced biological hydrogen production.

KEYWORDS:

Hydrogen production; Photo-fermentation; Process optimization; Response surface methodology