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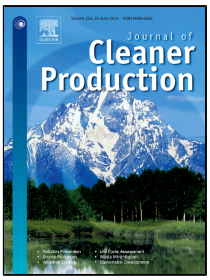

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PII:	S0959-6526(19)31414-3
DOI:	10.1016/j.jclepro.2019.04.317
Reference:	JCLP 16673
To appear in:	*Journal of Cleaner Production*
Received Date:	07 November 2018
Accepted Date:	23 April 2019

Please cite this article as: Puranjan Mishra, Fuad Ameen, Rubaiyi M. Zaid, Lakhveer Singh, Zularisam Ab Wahid, M.Amirul Islam, Arun Gupta, Saleh Al Nadhari, Relative effectiveness of substrate-inoculum ratio and initial pH on hydrogen production from palm oil mill effluent: Kinetics and statistical optimization, *Journal of Cleaner Production* (2019), doi: 10.1016/j.jclepro.2019.04.317

Relative effectiveness of substrate-inoculum ratio and initial pH on hydrogen production from palm oil mill effluent: Kinetics and statistical optimization

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Abstract

The present study has enabled to establish an appropriate kinetic and operational condition for hydrogen production using ultrasonicated palm oil mill effluent (POME). The kinetic analysis was performed corresponds to cumulative hydrogen (H_2) production by varying substrate-inoculum ratio (COD/VS) from 0.2 to 0.6. The maximum H_2 production potential (P) of 448 mL H_2 with lag-time (ρ) of 8.2 h and H_2 production rate (R_m) of 14.62 ml H_2 h^{-1} was achieved using the substrate-inoculum ratio of 0.6. However, the R_m of 17.979 ml H_2 h^{-1} with the ρ of 16.84 h, which is almost double than the substrate-inoculum ratio of 0.6 was observed at a substrate-inoculum ratio of 0.4. Furthermore, response surface methodology (RSM), including experimental design, regression analysis, was successfully applied to achieved optimum substrate-inoculum ratio and initial pH for biological H_2 production from ultrasonicated POME. The maximum yield of 0.416 L H_2/ g-$COD_{removal}$ was observed at the optimum conditions of substrate-inoculum ratio of 0.5 and an initial pH of 5.0. The linear, quadratic and interactive effect of substrate-inoculum ratio and initial pH on H_2 yield were significant.