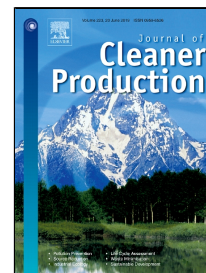


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Relative effectiveness of substrate-inoculum ratio and initial pH on hydrogen production from palm oil mill effluent: Kinetics and statistical optimization

Puranjan Mishra, Fuad Ameen, Rubaiyi M. Zaid, Lakhveer Singh, Zularisam Ab Wahid, M.Amirul Islam, Arun Gupta, Saleh Al Nadhari



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

3 Puranjan Mishra*¹, Fuad Ameen², Rubaiyi M. Zaid¹, Lakhveer Singh*¹, Zularisam Ab
4 Wahid¹, M Amirul Islam³, Arun Gupta⁴, Saleh Al Nadhari⁵
5

6 ¹Faculty of Engineering Technology, Universiti Malaysia Pahang, Gambang campus,
7 Kuantan 26300, Malaysia.

8 ²Department of Botany and Microbiology, college of Science, King Saud University, Riyadh
9 11451, Saudi Arabia.

10 ³Laboratory for Quantum Semiconductors and Photon-based BioNanotechnology,
11 Department of Electrical and Computer Engineering, Faculty of Engineering, Université de
12 Sherbrooke, Sherbrooke, Québec J1K 2R1, Canada.

13 ⁴Faculty of chemical and natural resource engineering, Universiti Malaysia Pahang, Gambang
14 campus, Kuantan, 26300, Malaysia.

15 ⁵Department of plant protection, college of agriculture, King Saud University, Riyadh, Saudi
16 Arabia.

17
18 *Corresponding Author: Email: puranjanmishra@gmail.com, lucki.chem09@gmail.com
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20 **Abstract**

21 The present study has enabled to establish an appropriate kinetic and operational
22 condition for hydrogen production using ultrasonicated palm oil mill effluent (POME). The
23 kinetic analysis was performed corresponds to cumulative hydrogen (H₂) production by
24 varying substrate-inoculum ratio (COD/VS) from 0.2 to 0.6. The maximum H₂ production
25 potential (P) of 448 mL H₂ with lag-time (ρ) of 8.2 h and H₂ production rate (R_m) of 14.62 ml
26 H₂ h⁻¹ was achieved using the substrate-inoculum ratio of 0.6. However, the R_m of 17.979
27 ml H₂ h⁻¹ with the ρ of 16.84 h, which is almost double than the substrate-inoculum ratio of
28 0.6 was observed at a substrate-inoculum ratio of 0.4. Furthermore, response surface
29 methodology (RSM), including experimental design, regression analysis, was successfully
30 applied to achieved optimum substrate-inoculum ratio and initial pH for biological H₂
31 production from ultrasonicated POME. The maximum yield of 0.416 L H₂/ g-COD_{removal} was
32 observed at the optimum conditions of substrate-inoculum ratio of 0.5 and an initial pH of
33 5.0. The linear, quadratic and interactive effect of substrate-inoculum ratio and initial pH on
34 H₂ yield were significant.