

**OPTIMIZATION OF THE ADDITION OF NANOCATALYSTS IN
BIOHYDROGEN PRODUCTION USING A CONTINUOUS SYSTEM
MADE FROM BANANA PEEL AND VINASSE WASTE**

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ABSTRACT

Biohydrogen production through dark fermentation is one of the renewable energy alternatives that utilizes organic waste as a substrate. This study aims to determine the optimal conditions for the addition of nanocatalysts in biohydrogen production using a continuous system made from banana peel and vinasse waste and to determine the effect of adding nanocatalysts on biohydrogen production. The study used a quantitative experimental method with variations in the concentration of nanocatalysts of 5 mg, 10 mg, and 15 mg. The fermentation process is carried out using a continuous reactor under mesophilic conditions with test parameters including biohydrogen volume and volatile solid (VS). Data analysis was carried out using Response Surface Methodology (RSM) and ANOVA test through Minitab 22 software. The results showed that the optimal condition for biohydrogen production was obtained by adding a 5 mg nanocatalyst with a substrate variation of 70:30, namely 9 ml H₂/L, with a solid volatile value of 90.67212%. This suggests that an increase in volatile solids that decompose correlates with an increase in gases. The result of the gas volume obtained by the addition of nanocatalysts was 9 ml H₂/L, while the control treatment without the addition of nanocatalysts produced 6 ml H₂/L. Based on the results of the study, the addition of nanocatalysts had an effect on increasing biohydrogen production, but the increase in the volume of biohydrogen produced in each treatment was still relatively low. Continuous fermentation systems are able to maintain the stability of the anaerobic fermentation process during biohydrogen production.

Keywords: Biohydrogen, Dark Fermentation, Banana Peel, Nanocatalyst, Semi-Continuous, Vinasse.