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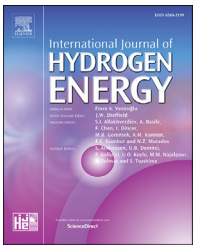

Impacts of nano-metal oxides on hydrogen production in anaerobic digestion of palm oil mill effluent – A novel approach

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ABSTRACT

In the present study, hydrogen production from palm oil mill effluent (POME) was investigated with the incorporation of nanoparticles (NPs) comprising of nickel (NiO) and cobalt oxides (CoO). The NPs of NiO and CoO were prepared using hydrothermal method and were further applied to analyse, their effect on hydrogen production. The results demonstrated that, a maxima volumetric hydrogen production rate of 21 ml H_2/L-POME/h with the hydrogen yield of 0.563 L H_2/g-$COD_{removed}$ was obtained with 1.5 mg/L concentration of NiO NPs. On the other hand, the addition of CoO NPs produced maximum volumetric hydrogen production rate of 18 ml H_2/L-POME/h with a hydrogen yield of 0.487 L H_2/g-$COD_{removed}$ with 1.0 mg/L of CoO NPs. Results showed that addition of optimal concentration of NiO and CoO NPs to the POME enhances the hydrogen yield by 1.51 and 1.67 fold respectively. Besides, this addition of NiO and CoO enhanced the COD removal efficiency by 15 and 10% respectively as compared to an un-additive NPs POME. The toxicity of NPs was also tested using bacterial viability test, which revealed that application of 3.0 mg/L of NiO and CoO NPs to modified Luria-Bertani (LB) medium had 63% and 83% reduction in bacterial cell growth. The results concluded that supplementation of NiO and CoO NPs under an optimal range to the wastewater can improve the hydrogen productivity.