Harnessing renewable hydrogen-rich syngas from valorization of palm oil mill effluent (POME) using steam reforming technique

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ABSTRACT
Valorization of palm oil mill effluent (POME) over a sol-gel synthesized lanthanum nickel trioxide (LaNiO3) catalyst via steam reforming pathway was investigated from 573 to 1173 K. The blank run (steam reforming) at 873–1173 K neutralized the acidic POME with complete total suspended solids (TSS) removal, which accomplished >88% chemical oxygen demand (COD) removal, >97% 5-days biochemical oxygen demand (BOD5) removal, and >95% decolourization. From 773 K onwards, LaNiO3 greatly enhanced syngas production from POME steam reforming. The principal role of LaNiO3 was to enhance the syngas production. The XRD, FESEM-EDX, and TPO results of spent LaNiO3 were also correlated with gaseous product profiles to scrutinize its catalytic effects. At an optimum temperature of 873 K, catalytic POME steam reforming over LaNiO3 generated 73.91 μmol/min of H2-rich syngas (H2:CO ratio of 107.88). Withal, the aforesaid system was able to neutralize the acidic POME feedstock and eliminate its TSS content while reduced 98.38% COD, 99.10% BOD5, and 99.52% colour intensity.

KEYWORDS:
Lanthanum nickel trioxide; Palm oil mill effluent; Steam reforming; Syngas; Valorization