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Characterisation of synthesised trimetallic nanoparticles and its influence on anaerobic digestion of palm oil mill effluent

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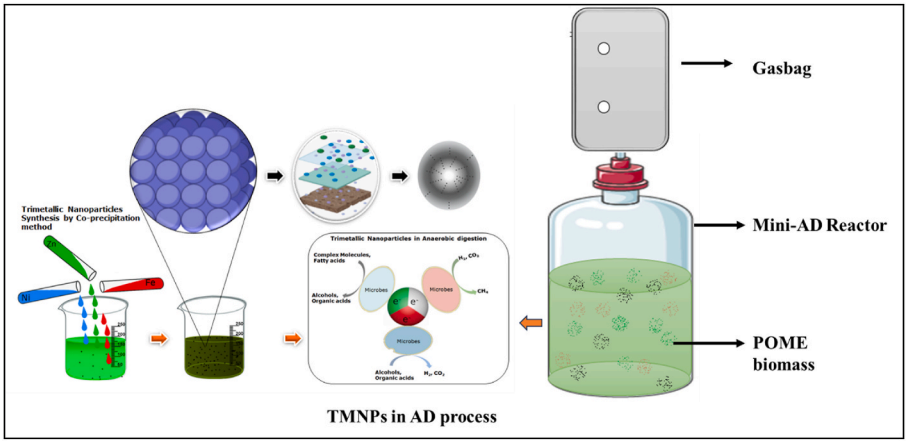
HIGHLIGHTS

- Fe–Ni–Zn and Fe–Co–Zn TMNPs were synthesised by coprecipitation method.
- Fe–Ni–Zn and Fe–Co–Zn influenced biogas production rate.
- Low concentration of trimetallic nanoparticles produced significant amount of biogas.
- 40 mgL^{-1} (Fe–Ni–Zn) and 20 mgL^{-1}(Fe–Co–Zn) increased biogas production by 55.55% and 60.11%.

GRAPHICAL ABSTRACT



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ABSTRACT

The augmentation of biogas production can be achieved by incorporating metallic nanoparticles as additives within anaerobic digestion. The objective of this current study is to examine the synthesis of Fe–Ni–Zn and Fe–Co–Zn trimetallic nanoparticles using the co-precipitation technique and assess its impact on anaerobic digestion using palm oil mill effluent (POME) as carbon source. The structural morphology and size of the synthesised trimetallic nanoparticles were analysed using a range of characterization techniques, such as X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), Scanning electron microscopy (SEM), and Energy-dispersive X-ray spectroscopy (EDX) . The average size of Fe–Ni–Zn and Fe–Co–Zn were 19–25.5 nm and 19.1–30.5 nm respectively. Further, investigation focused on examining the diverse concentrations of trimetallic

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