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Mekonnen, Anduale

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Anaerobic treatment of tannery wastewater using ASBR for methane recovery and greenhouse gas emission mitigation

Anduale Mekonnen, Seyoum Letaa, Karoli Nicholas Njau

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Abstract

The objective of this study was to develop and optimize a pilot scale Anaerobic Sequencing Batch Reactor (ASBR) for the treatment tannery wastewater and reduction of greenhouse gas emission. The performance of the pilot scale ASBR was evaluated at the OLRs of 1.03, 1.23, 1.52 and 2.21 kg m⁻³ d⁻¹ under mesophilic condition (31 °C). The removal efficiencies of COD and methane yield in the pilot scale ASBR were in the range of 69–85% and 0.17 ± 0.2 – 0.30 ± 0.02 m³/kg COD removed, respectively. The optimum COD removal and methane yield were obtained at OLR of 1.03 kg m⁻³ d⁻¹ (HRT of 4 days) in the stepwise feeding mode. The maximum amount of COD ($83.3 \pm 3.6\%$) converted to methane was also obtained in the same loading rate. At this OLR, the volumetric methane production would be 148,190 m³ per year when the digester will be operated at full scale level. The total amount of GHG emission reduction from factory is estimated in the range between 1500 and 3032 tons CO₂-eq per year. Generally, the results of this study showed that ASBR is efficient on generating biogas and reducing greenhouse gas emission while treating high strength wastewater such as tannery. Hence, a full scale ASBR should be developed and used to treat the wastewater generated in the tanning industries.

Keywords

Anaerobic treatment; ASBR; GHG; Methane yield and tannery wastewater