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BIOLOGICAL SULPHATE REDUCTION IN ANAEROBIC TREATMENT OF AMMONIA-RICH SKIM LATEX WASTEWATER

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Abstract

Skim Latex Wastewater (SLW) contains elevated sulphate concentrations. The low COD/SO_4^{-2} ratio and high concentrations of ammonia and protein present in the SLW make it more challenging to treat anaerobically due to inhibition. This research aimed at improving the biological sulfidogenesis of SLW, altering pH and adding electron donors using semi-batch fed completely mixed Anaerobic Digesters (ADs) operated at mesophilic temperature. Experiments were conducted under four phases by varying influent COD/SO_4^{-2} and pH. Input COD/SO_4^{-2} and COD/TKN ratio of original SLW was 2.7 and 9.7, respectively. During phase I, the ADs' pH was not controlled, whereas it was maintained at 7.5-8.0 from phases II to IV. During phases I and II, input COD/SO_4^{-2} was 2.7, but in phases III and IV, it was increased to 5.0 and 10.0 using an acetic acid solution which automatically increased the COD/TKN ratio to 18.0 and 36.0, respectively. The sulphate reduction was negatively affected due to a significant Free Ammonia (FAN) generation of 175.4± 44.5 mg/L, with the hydrolysis of protein inside AD causing digester pH to increase above 8.0. However, when the digester pH was 7.5-8.0, the inhibitory FAN concentration dropped by 83%, while the cumulative percentage and the rate of sulphidogenesis increased by 10% and 16%, respectively. Nevertheless, sulphate reduction increased from 77.7% to 100% when the input COD/SO_4^{-2} ratio was elevated from 2.7 to 5 and 10. However, when the input COD/SO_4^{-2} ratio was increased from 5 to 10, the sulphidogenesis rate decreased, dominating methanogenic bacteria over sulphate-reducing bacteria.

Key words: ammonia inhibition, anaerobic digestion, influent COD/SO_4^{-2}, methanogenic bacteria sulphate reduction

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