Treatment of distillery wastewater in an upflow anaerobic sludge blanket (UASB) reactor

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ABSTRACT

The treatment of high-strength wastewater from distillery was studied in a bench-scale upflow anaerobic sludge blanket (UASB) reactor. Reactor was operated at different organic loading rates (OLRs) and constant hydraulic retention time for 2 d at mesophilic temperature of 37°C for a period of about two years (635 d). The maximum COD and BOD removals achieved were 68.35 and 89.11%, respectively, at optimum OLR of 15.34 kg COD/m³ d. UASB reactor performance was also evaluated in terms of hydrolysis, acidification, and methanogenesis, and the performance values were found to be 33.88, 52.16, and 48.07%, respectively. Total and soluble biodegradability of the high-strength wastewater were 48.09 and 78.06%, respectively, that represents good conversion of soluble substrate to biogas. The average biogas produced was 0.38 m³/kg COD removed. The COD mass balance of the reactor showed that 51.32, 0.24, 9.46, 1.75, and 37.22% COD was converted into methane (gaseous phase), methane (aqueous phase), sludge, sulfate reduction, and effluent, respectively. The characteristics of the port sludge elaborate the sludge profile in the reactor. FEG-SEM shows the morphology of the sludge granules, showing various colonies of cocci and rods grown on granules surface. ICP-AES indicates that Ca was utilized for the formation of granules and FTIR shows IR spectrum of an alcohol.

Keywords: Bench-scale reactor; Distillery wastewater; UASB reactor; COD mass balance; Reactor processes; ICP-AES; FEG-SEM; FTIR

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