

Comparison of an Upflow Anaerobic Sludge Blanket and an Anaerobic Filter for Treating Wheat Straw Wash Water

Authors : Syazwani Idrus, Charles Banks, Sonia Heaven

Abstract : The effect of osmotic stress was carried out to determine the ability for biogas production in two types of digesters; anaerobic sludge blanket and anaerobic filters in treating wheat straw washed water. Two anaerobic filters (AF1 and 2) and two UASB reactors (U1 and 2) with working volumes of 1.5 L were employed at mesophilic temperatures (37°C). Digesters AF1 and two were seeded with an inoculum which had previously been fed on with a synthetic wastewater including Sodium Chloride and Potassium Chloride. Digesters U1 and two were seeded with 1 kg wet weight of granular sludge which had previously been treating paper mill effluent. During the first 48 days, all digesters were successfully acclimated with synthetic wastewater (SW) to organic loading rate (OLR) of 6 g COD l⁻¹ day⁻¹. Specific methane production (SMP) of 0.333 l CH₄ g⁻¹ COD. The feed was then changed to wash water from a washing operation to reduce the salt content of wheat straw (wheat straw wash water, WSW) at the same OLR. SMP fell sharply in all reactors to less than 0.1 l CH₄ g⁻¹ COD, with the AF affected more than the UASB. The OLR was reduced to 2.5 g COD l⁻¹ day⁻¹ to allow adaptation to WSW, and both the UASB and the AF reactors achieved an SMP of 0.21 l CH₄ g⁻¹ COD added at 82% of COD removal. This study also revealed the accumulation of potassium (K) inside the UASB granules to a concentration of 4.5 mg K g⁻¹ wet weight of granular sludge. The phenomenon of lower SMP and accumulation of K indicates the effect of osmotic stress when fed on WSW. This finding is consistent with the theory that methanogenic organisms operate a Potassium pump to maintain ionic equilibrium, and as this is an energy-driven process, it will, therefore, reduce the overall methane yield.

Keywords : wheat straw wash water, upflow anaerobic sludge blanket, anaerobic filter, specific methane production, osmotic stress

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