

Role of calcium oxide in sludge granulation and methanogenesis for the treatment of palm oil mill effluent using UASB reactor

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ABSTRACT

The granulation process in palm oil mill effluent using calcium oxide-cement kiln dust (CaO-CKD) provides an attractive and cost effective treatment option. In this study the efficiency of CaO-CKD at doses of 1.5–20 g/l was tested in batch experiments and found that 10 g of CaO/l caused the greatest degradation of VFA, butyrate and acetate. An upflow anaerobic sludge blanket (UASB) reactor was operated continuously at 35 °C for 150 days to investigate the effect of CaO-CKD on sludge granulation and methanogenesis during start-up. The treatment of POME emphasized the influence of varying organic loading rates (OLR). Up to 94.9% of COD was removed when the reactor was fed with the 15.5–65.5 g-COD g/l at an OLR of 4.5–12.5 kg-COD/m³ d, suggesting the feasibility of using CaO in an UASB process to treat POME. The ratio of volatile solids/total solids (VS/TS) and volatile fatty acids in the anaerobic sludge in the UASB reactor decreased significantly after long-term operation due to the precipitation of calcium carbonate in the granules. Granulation and methanogenesis decreased with an increase in the influent CaO-CKD concentration.

KEYWORDS

CaO-CKD; Chemical and biological treatment; Granulation; Methanogenesis; UASB reactor