Fed-batch anaerobic degradation of long chain fatty acids

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Efficient mineralization of effluents with high lipid content is possible in anaerobic digesters when a sequential operation mode is applied, favoring the adsorption of LCFA onto the sludge and then allowing the adsorbed substrate to be biodegraded[1-3]. The study of adsorption along time can help to optimize the process. Five batch assays were conducted in 160 mL vials inoculated with flocculent biomass and fed with sodium oleate (1 g CQO/gVSS). Feeding was applied during 10 min (0.8 ml/min), after which (t=0) a vial was immediately sacrificed and analyzed for soluble COD, VSS and biomass-associated LCFA. After 0.5, 1, 24 and 1000 hours of incubation at 37±1°C, 150 rpm, one vial was sacrificed and analyzed for the parameters stated before. Two additional vials prepared and fed in a similar way and two blank controls (without substrate) were incubated in the same conditions to follow cumulative methane production. At the end of the feeding period, soluble COD removal efficiency was 73%, corresponding exclusively to LCFA accumulation onto the sludge. During the first 24 hours, methane or VFA production were negligible probably due to residual substrate degradation. Palmitic acid accounted for 46 to 54% of the biomass-associated LCFA and oleic acid for 31 to 40%. After 1000 hours of incubation soluble COD removal was 86% and palmitic acid accounted for 100% of the biomass-associated LCFA (45 mg COD-LCFA/g VSS).

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