Biodegradation of Hydrocarbon Slurries Retained in Oil Separators of Vehicle Washing Facilities

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Wastewater discharges from vehicle washing facilities represent a major source of hydrocarbon (HC) contamination of water, soils and municipal wastewater treatment plants. For that reason, oil separators are mandatory at such facilities. Periodically, separators are cleaned and contaminated HC sludges are disposed off. The final disposal is somehow problematic because oily sludges are classified as hazardous wastes. An approach to solve this problem could be the use of bioaugmentation techniques and Sequencing Batch Reactors (SBR). Thus, the present study concerns a basic characterisation of HC contaminated sludges and a preliminary assessment of their biodegradation potential using batch processes. The assessment was performed using a non-adapted biomass inoculum and an enriched one, registered under the reference Bioactiv HGS.
Grab samples of HC slurries were collected in oil separators operating at two vehicle washing facilities located at the city of Braga. COD, BOD, solids and pH were analysed according to Standard Methods. Total hydrocarbons were analysed by infrared spectrophotometer according to ASTM, D3921-80. The samples had a pH of 5.5 (sample A) and 10.7 (sample B). COD values were very high, 29371 ±1929 mg/L and 66376 ± 838 mg/L. Average total solids were 406.6 g/L and 311.0 g/L, respectively. BOD_5 determination, using non-acclimatised biomass, reached values 35% and 9% lower than COD, indicating the recalcitrant nature of oily sludges. The respirometric assays reinforced such results: oxygen consumption of undiluted samples was very low, but respiration rate increased with dilution. Furthermore, an acclimatisation potential was observed, the second feeding provided a higher degradation rate when compared with the first one. Experiments performed without any nutrient (N,P) supplementation displayed very low respiration rates. Following the indications provided by respirometric tests, batch treatability experiments were performed with a sample dilution of 1:10, being air and nutrients added. The values of COD and solids decreased along experimental time. After 90 days of operation, total and volatile solids reached values 50% lower than initial ones, approximately 15 g/l and 2 g/l. Regarding HC determination, it should be mentioned that the method was rather difficult to perform. Indeed, the paper filtration step during extraction procedure was affected by the high solids content, meaning all HC measurements could be underestimated. Nevertheless, the assays performed with enriched biomass were the first ones where no HC was detected. Reactors inoculated with unacclimatized microbial populations also remove HC compounds but at longer retention times. In the blank assay (reactor not inoculated, only aerated) a significant decrease in HC content was also observed. Such result indicated that overall hydrocarbon reduction was also due to a volatilisation phenomenon enhanced by air stripping. Therefore, despite some indications on the profitability of enriched biomass to remove HC, the results can not be considered sufficient to state a clear advantage of such procedure. The present study indicates that a further optimisation of process parameters should be performed before the set-up of a full scale SBR for HC degradation.