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Influence of Hydraulic Retention Time, Food-to-microorganism ratio and influent biodegradability on the performance of an aerobic selector treating petrochemical wastewater

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HIGHLIGHTS

- Selector's F/M ratio and Hydraulic Retention Time determined sludge settling
- Best settling was coincident with maximum COD removal efficiency in the selector
- Increasing the influent's biodegradability to the selector improved sludge settling
- Supplying more particulate matter to the selector worsened sludge settling
- Including a selector in the activated sludge system resulted in an older sludge

ABSTRACT

Selectors have been widely recognized as a solution to control filamentous bulking and consequently enhance sludge settling. However, to guarantee the selector's effectiveness (Sludge Volumetric Index< 100 mL g^{-1}during 90% of the time) in a full-scale installation, it is compulsory to find the proper design and operational parameters, according to the quality of the wastewater treated. In order to identify the key parameters to optimize the selector's performance, petrochemical wastewater was tested in a pilot-scale activated sludge system including an aerobic selector. The optimum conditions in the selector were an hydraulic retention time (HRT) of 30 minutes and a food-to-microorganism ratio (F/M) from 30 to 35 g COD g^{-1} VSS day^{-1}. They corresponded to the selector's maximum COD (37.4%) and BOD_5 (95.1%) removal efficiency and the dominance of the storage mechanism in front of replicative growth (ratio Nitrogen assimilation-to-Volatile Suspended Solid production of 0.07 g NH_4^+-N assimilated g^{-1} VSS produced). Feeding a more biodegradable influent to the selector (up to 45 g BOD g^{-1} VSS day^{-1}) enhanced its effectiveness, whereas increasing the supply of particulate matter (up to 139.6 g COD g^{-1} VSS day^{-1}) showed a negative effect on sludge settling. The inclusion of the aerobic selector in the activated sludge system, operated at the optimum parameters, resulted in an older aged sludge. Increasing the selector's F/M