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STUDY OF AN OILY WATER TREATMENT PROCESS IN A PILOT HYBRID SYSTEM COMBINING AIR FLOTATION AND A CONSTRUCTED WETLAND: DATA ANALYSIS, EFFICIENCY OPTIMIZATION AND SCALE-UP

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Abstract

In this study, we developed a hybrid system for the treatment of oily water composed of two pilot-scale prototypes combining physicochemical and biological separation methods. Oily water flowed through a dissolved air flotation (DAF) prototype in the first step. At the exit of this prototype, part of the water was saturated with atmospheric air and sent back into the DAF chamber with the aid of a centrifuge pump and the injection of microbubbles. The other part of the treated water fed a constructed wetland prototype involving floating macrophytes of the species *Eichhornia crassipes*. With the aid of a central composite rotatable design (CCRD, with two operating parameters) and the response surface methodology (RSM), a predictive statistical model was created for the operating conditions associated with an optimal oil-water separation efficiency of around 97% of the initial concentration of 120 ppm of oil, which is much higher than the concentration permitted by environmental legislation in Brazil (20 ppm). The efficiency results are discussed and interpreted based on the phenomena of physical and mechanical liquid particles. The combination of DAF and constructed wetland methods for oily water treatment without the addition of a coagulant/flocculant agent achieved quite satisfactory results and proved to be an eco-friendly technology. Hydraulic similarity laws were used to obtain scale-up correlations for designing the size of pilot plant equipment for the treatment of oily water with the proposed hybrid process.

Keywords: central composite rotatable design, dissolved air flotation, *Eichhornia crassipes*, liquid-liquid separation, oily water, wetlands

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