



Investigation of petroleum-contaminated groundwater remediation using multi-stage pilot system: physical and biological approach

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ABSTRACT

In this paper, a pilot-scale system including various process steps was investigated in order to treat contaminated groundwater supplies which have been exposed to oil pollutants for a long time as they are located near the Tehran oil refinery company (TORC). For achieving this goal, a combination of dissolved air flotation unit that is followed by activated sludge bioreactors (ASBRs) and an activated carbon filter was chosen. The crude oil combined with tap water was applied to synthesize contaminated groundwater. Activated sludge taken from wastewater treatment plant at TORC was used to supply oil-degrading bacteria. Besides, the solution of mineral salts was added to the bioreactor as nutrients amendment. The optimum design parameters such as hydraulic retention time, return activated sludge rate of the ASBRs, and total residence time for all steps were 14 h, 100%, and 21 h, respectively. The operation of the pilot system which was implemented in different initial crude oil concentrations ($206 \pm 1,412 \pm 3,1590 \pm 10 \text{ mg l}^{-1}$) finally led to total petroleum hydrocarbons removal of 97, 97.25, and 98.57%, respectively. The reduction efficiency of chemical oxygen demand during the experiment was more than 97%. Furthermore, the quality of the treated groundwater was clearly improved, as the turbidity reduction through the experiment exceeded 90%. According to the results of the study, this treatment system can be considered as a reliable and efficient approach that is recommended to be used in case of extremely contaminated groundwater.

Keywords: Bioremediation; Activated sludge; Crude oil; Groundwater; TPH

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