

Removal of Diesel by Soil Washing Technologies Using a Non-Ionic Surfactant

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Abstract : A large number of soils highly polluted with recalcitrant hydrocarbons and the limitation of the current bioremediation methods continue being the drawback for an efficient recuperation of these under safe conditions. In this regard, soil washing by degradable surfactants is an alternative option knowing the capacity of surfactants to desorb oily organic compounds. The aim of this study was the establishment of the washing conditions of a soil polluted with diesel, using a nonionic surfactant. A soil polluted with diesel was used. This was collected near to a polluted railway station zone. The soil was dried at room temperature and sieved to a mesh size 10 for its physicochemical and biological characterization. Washing of the polluted soil was performed with surfactant solutions in a 1:5 ratio (5g of soil per 25 mL of the surfactant solution). This was carried out at 28 ± 1 °C and 150 rpm for 72 hours. The factors tested were the Tween 80 surfactant concentration (1, 2, 5 and 10%) and the treatment time. Residual diesel concentration was determined every 24 h. The soil was of a sandy loam texture with a low concentration of organic matter (3.68%) and conductivity (0.016 dS.m^{-1}). The soil had a pH of 7.63 which was slightly alkaline and a Total Petroleum Hydrocarbon content (TPH) of $11,600 \pm 1058.38 \text{ mg/kg}$. The high TPH content could explain the low microbial count of 1.1×10^5 determined as UFC per gram of dried soil. Within the range of the surfactant concentration tested for washing the polluted soil under study, TPH removal increased proportionally with the surfactant concentration. $5080.8 \pm 422.2 \text{ ppm}$ ($43.8 \pm 3.64 \%$) was the maximal concentration of TPH removed after 72 h of contact with surfactant pollution at 10%. Despite the high percentage of hydrocarbons removed, it is assumed that a higher concentration of these could be removed if the washing process is extended or is carried out by stages. Soil washing through the use of surfactants as a desorbing agent was found to be a viable and effective technology for the rapid recovery of soils highly polluted with recalcitrant hydrocarbons.

Keywords : diesel, hydrocarbons, soil washing, tween 80

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