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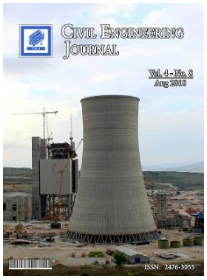

Removal of Aliphatic Hydrocarbons from Gas Oil Contaminated Clay Soil via Soil Vapor Extraction

Hossein Nematollahi [a*], Nasim Moradi [b], Morteza RiyaziNejad [a], Hossein Vahidi [c]

[a] *Faculty of Environment, University of Tehran, Tehran, Iran.*

[b] *Department of Civil Engineering, Sirjan University of Technology, Kerman, Iran.*

[c] *Department of Environment, Institute of Advanced Science and Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran.*

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Abstract

In this research, the performance of soil vapor extraction (SVE) for the removal of aliphatic hydrocarbons from gas oil contaminated soil and the effect of soil type on this method is studied. To explore the effect of soil type in the removal of hydrocarbons, SVE tests were conducted on 3 types of soil: 1) fine sand, 2) fine sand with 20% of kaolinite clay and 3) fine sand with 40% of kaolinite clay. Three extraction periods of 8, 16 and 24 hours were used. The results have shown that the efficiency of this method exceeds 78% in the removal of all hydrocarbons from fine sand, while an increase in clay significantly decreases the efficiency. Accordingly, the efficiency of this method decreases by 53.1% and 54.6% in fine sand with 20% of clay and fine sand with 40% of clay respectively. Furthermore, the results show that the higher concentration of some heavy and medium hydrocarbon leads to the more increase in early hours of SVE process, which indicates the alteration of hydrocarbons into each other.

Keywords: Soil Vapor Extraction; Fine Sand; Clay; Aliphatic Hydrocarbons; Gas Oil.

1. Introduction

In recent years, human activities, especially in developing countries, increase the amount of environmental pollutants. This situation will be crucial as the contaminants penetrate through the soil and give rise to groundwater contamination [1, 2]. Polluting the ecosystem affects the cycle of nature and will have negative feedbacks for humans, animals, plants, and structures [3]. One kind of ecosystem pollution is polluting the soil. Examples of soil pollutants are oil products and their derivatives which can cause pollution during transport or nonstandard storage [4]. Volatile Organic Compounds, petroleum hydrocarbons containing Benzene, Toluene, Ethylbenzene, and Xylene, are among the contaminants which are a threat to the porous media, soil. Considering the type of soil, type of contaminant, location, soil physical and chemical characteristics and operating conditions are necessary for eliminating soil contamination [1].

Vapor extraction from soil is one method of soil remediation and by using it the concentration of the volatile substances in oil products which are absorbed by the non-saturated parts of the sand, can be reduced [5, 6]. Over the past 35 years, one of the conventional technologies used in the United States is Soil Vapor Extraction (SVE) [7]. Statistics show a 26% of the soil remediation, implementing SVE in the US. Soil Vapor Extraction is an efficient way of contaminant extraction from the soil in the vadose zones [8]. Using vacuum blowers, creating airflow, inducing the air flow through the soil matrix and collecting the extracted contaminated soil vapor are the basis of this soil remediation technology [9].

* Corresponding author: hnematollahi@ut.ac.ir

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