

Impact of Soil Moisture and Temperature on the Biodegradation of Toluene in Partially Saturated and Saturated Zones

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Contamination of groundwater by organic contaminants like fuel hydrocarbons is a serious threat and requires immediate attention. The biodegradation in the saturated and unsaturated zone is a complex phenomenon and will be governed by both aerobic and anaerobic microbes. In this study a characteristic site was used to study the impact of soil moisture and temperature on the biodegradation of Toluene. The moisture content in the vadose zone were varied from 80% to 20 % for the two temperature combination of 10 and 30°C. A numerical based simulator, HYDRUS 2D was used to simulate the site condition and results suggest that the high moisture content with high temperature helps in faster degradation of Toluene. In case of 80% and 60% moisture content, the toluene concentration was within in the safe limit (5 ppm) after 1 year of remediation period. However, for the lower moisture content the safe limit could not be achieved. Biodegradation rates were found high at 30 °C for batches having 80-60% soil moisture condition as compared to 10°C batches of similar moisture contents. The degradation rates were reduced more significantly at 10°C batches having low soil moisture content of 40-20%. In general, the analysis of the biodegradation rates indicates that the high moisture-high temperature combination provides the favorable conditions for the microbes to degrade the NAPAL concentration at much faster rate. Thus, the in-situ bioremediation method for LNAPL contaminated sites will be relatively more successful and cost effective in high temperature-high moisture content regions.

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