



## Crude Oil Pollution in Soils: Causes, Impacts and Sustainable Remediation

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### Introduction

Crude oil is one of naturally available resource, extracted from earth and refined to other products. It is made up of complex mixture of hydrocarbons of varying molecular weight and structure made up of 17000 hydrocarbons. It is non-polar and hydrophobic in nature. Crude oil is called as 'black gold' and 'economic blood' because of its colour and high value. Crude oil released into the Soil environment through Transportation accidents, Tanker operations (washings), Pipeline spill, Atmospheric/fuel combustion, Municipal, industrial and surface run-off

### Crude oil pollution:

Contamination of soil ecosystem by oil or other petroleum products is termed as oil pollution in soil. An oil spill is a release of a liquid petroleum hydrocarbon into the environment due to human activity, and is a form of pollution. Oil spills include releases of crude oil from tankers, off shore platforms, drilling rigs and wells, as well as spills of refined petroleum products (such as gasoline, diesel) and their by-products, and heavier fuels used by large ships such as bunker fuel, or the spill of any oily substance refuse or waste oil. Spills may take months or even years to clean up.

### EFFECT OF OIL POLLUTION ON SOIL PROPERTIES

**Compaction-** As crude oil pollutants adsorbed on soil particles, it increases the sticky nature of the soil particle and they slip on each other. It increases the closeness between the particle and soil becomes compacted.

**Porosity-** When oil pollutants concentration increases in soil, micropores and macropores present in soil are filled by the oil pollutants. It reduces the pore percentage in soil.

**Bulk density-** With increase in compactness of the soil particles it also increases the bulk density of the soil.



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**Permeability** - Due to high compactness between the particles and decreased in pore percentage reduce the permeability of the soil.

**pH** - As increase in crude oil content it increases in hydrocarbon content in soil; it adds high amount of hydrogen to soil. As increase in hydrogen concentration, decrease the soil pH.

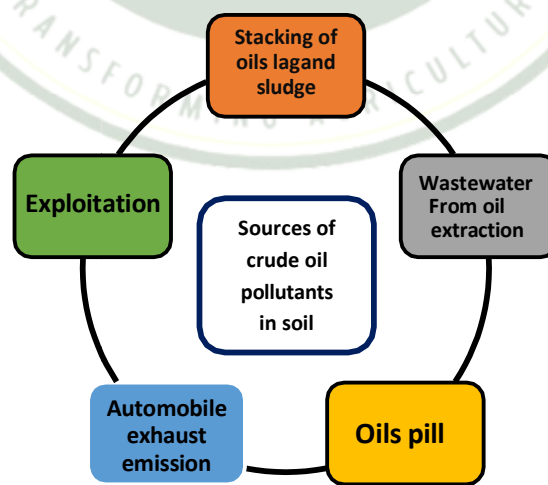
**Total organic carbon-** As pollutants concentration increase in soil it adds high amount of carbon content to soil, the agronomical practices increase the organic carbon content in the soil.

**Enzymatic activity-** Crude oil pollutants increase in soil it increases hydrocarbon concentration. This high concentration of hydrocarbons leads to toxic effect on microorganism which are involved in enzymatic activity. It leads to decrease in enzymatic activity.

**Microorganism population-** Crude oil pollutants increase in soil it increases hydrocarbon concentration. This high concentration of hydrocarbons lead to toxic effect on microorganism causes death of organisms, reduce the population of the microorganisms.

**Earthworm population-** Crude oil pollutants increase in soil it increases hydrocarbon concentration. This high concentration of hydro carbons leads to toxic effect on earth worm causes death of earth worm, reduce the population of the earthworm

### Sources crude oil pollutants in soil





## REMEDICATION OF OIL POLLUTED SOILS

Remediation is a process of removal pollutants which are present in soil by different methods.

<b>Physical remediation</b>	<b>Chemical remediation</b>	<b>Thermal remediation</b>	<b>Biological remediation</b>
<ul style="list-style-type: none"><li>• Excavation</li><li>• Washing of soil</li></ul>	<ul style="list-style-type: none"><li>• Chemical oxidation</li><li>• Ozonation</li></ul>	<ul style="list-style-type: none"><li>• Pyrolysis</li><li>• Inceneration</li></ul>	<ul style="list-style-type: none"><li>• Microbial remediation</li><li>• Phyto-remediation</li></ul>

## **CONCLUSION:**

Oil contamination causes serious environmental concern and adversely affects the soil environment due to the release of toxic by-products. Soil compatibility and hydrophobicity can be increased with increasing the percentages of oil. Diesel has adverse impacts on the cohesion and swelling of the illite. Soil properties like pH, EC, moisture content, available phosphorus and TO Care found to be significantly affected due to oil contamination. *Ex situ* solvent extraction can technically be a feasible option for the remediation of semi-volatile aromatic, poly aromatic and linear hydrocarbons. Bio remediation is a cost effective and eco-friendly technology for the efficient remediation of oil polluted soils compared to other physical and chemical methods.