# ELECTROKINETIC REMEDIATION OF OIL CONTAMINATED SOIL

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***Abstract:*** *Due to rapid industrialization and urbanization, soils are increasingly getting polluted. Most of the industries are creating wastes which contain heavy metals. These days, industries are practicing open dumping, since it is an cost effective means of waste disposal. By-product which contains heavy metal, either in liquid or solid form, will contaminate soil and ground water, when it gets disposed off to the soil. A number of method are available for removal of soil contamination. Electrokinetic remediation method removes heavy metals effectively because an external energy is applied in the form of current. This method does not cause any secondary pollution.*

**Keywords :- Electrokinetic , current , heavy metal**

## I. INTRODUCTION

Due to rapid industrialization and urbanization, soils are increasingly getting polluted. Heavy metal contamination of soil is a ordinary phenomenon in industrial areas and in areas with high traffic volume. Heavy metal contamination of soil takes place usually during mining, manufacturing and the use of synthetic products such as pesticides, paints, batteries, industrial waste, and land application of industrial or domestic slush. A number of method are available for removal of soil contamination , but 100 % removal is not possible. Electrokinetic remediation method removes heavy metals effectively because an external energy is applied in the form of current. This method does not cause any secondary pollution.

## II. REMEDIATION TECHNIQUES

A number of techniques have been developed in response to inscribe increasing environmental problems. A particular contaminated site demand a coalition of various technologies. Soil remediation techniques can broadly be classified into physical, chemical and biological remediation. It can also be divided into in-situ and ex-situ techniques .

### 2.1 Solidification/Stabilization

Solidification or stabilization technique is used to rectify soil as well as slime. It can also be used to nurse harmful residues of any industrial activity. By this method the metal mobility is reduced by physically limiting the contact between the contaminant and the ground water or the chemical properties of the contaminants are altered to restrict the contact.

### 2.2 Soil Washing

Soil washing is relatively a easy method which is acquired to decontaminate soil. Washing water is mixed to remove the pollutant from the soil . Mostly used wiping agents are surfactant, chelating agents, acids, etc. But more often it is combined with other technologies as a pre treatment or post treatment technique.

### 2.3 Flotation

It is one of the segregation method for hetero phase system. Gas bubbles are spread to disseminate phase to form aggregates. Then these aggregates are floated, and thus segregated from the disseminating medium. This method is mainly used in mining industry to segregate exorbitant metals .

### 2.4 Electrokinetic Remediation

This is one of the most reassuring technologies to detach the heavy metals from the contaminated soils. Remediation is manageable by the application of low voltage electric field over the soil. An acid front is developed in the positively charged anode electrode and a base front is developed in the negatively charged cathode electrode. The acid and base fronts are initiated due to the electrolysis reaction and are explained by given equations .

$2H_2O - 4e^- \rightarrow O_2 + 2OH^-$

$2H_2O + 2e^- \rightarrow O_2 + 2OH^-$

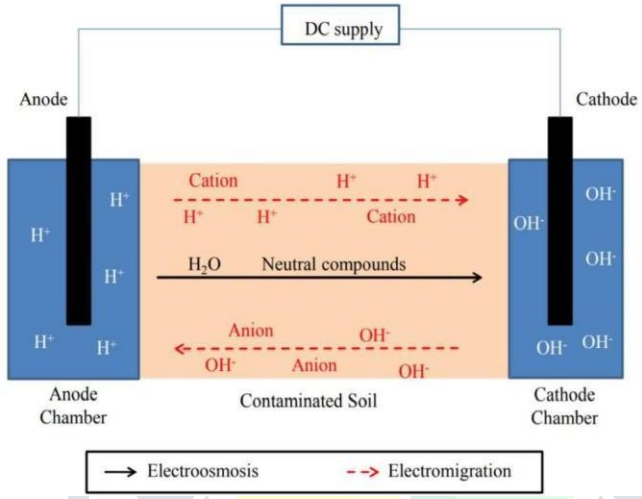


Fig 1.1 Electrokinetic process in soil treatment

### 2.5 Capping

The surface water infiltration into contaminant is constricted to stop further release of contaminant into ground water. This barrier also controls gas and odour emission, improves aesthetics and provides a stable structure. Dermal contact of contaminant is also eliminated by this method .

## III. ELECTROKINETIC REMEDIATION

Electrokinetic Remediation (EKR) is a green remediation technology( pollution free) which has the following advantages: decreases on spot pollution , reduces the remediation time, lowers the cost and capable of treating low permeability soil. So this method is now gaining importance. A large number of studies have been conducted on electrokinetic remediation EKR involves the application of a low voltage DC across the soil by means of positive and negative electrodes. Under the applied electric field processes that take place are as follow ; electroosmosis, electromigration, electrophoresis.

There are three mechanisms by which ions flow towards cathode or anode:-

i. Electroosmosis:- In electroosmosis transportation of ions towords cathode done only by flow of pure water .

ii. Electromigration:-It is the movement of ions due to an applied electric field.

iii. Electrophoresis:- It is the colloidal movement of ions towards the anode .

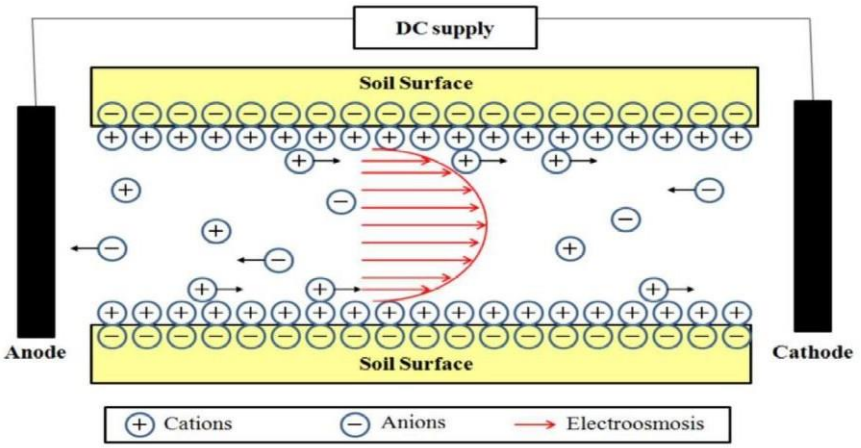


Fig.1.2 transfer mechanism of ions

These mechanism generates movements of ions towards one or other electrode. The direction and velocity of the movement depends on the charge of ions and velocity movement of flow generates by electroosmosis.

## IV. CONCLUSION

Electrokinetic remediation is an operative method for the restoration of heavy metal contaminated soil. This method is based on the soil type, soil pH, applied current, presence of carbonates, buffering capacity of soil. Making of acid front in the cathode compartment retards the removal efficiency. This situation can be reduce by certain improvement technique. With the support of enhancement technique it is feasible to fulfil approximately high removal efficiency. A brief explanation of a few enhancement techniques is stated in this paper and other available remediation techniques are also explained.

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