Effect of Current on the Removal of Chromium Hexavalent from Soil by Electro-Kinetics Remediation Test

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Abstract— Electrokinetic experiments were conducted on soil contaminated from the chromium which is carcinogenic and very hazardous to public health and environment. This paper mainly tells about the removal of the chromium from chromium contaminated soil by changing the current in the electrokinetics test for the removal of Chromium hexavalent from contaminated soil. The advantage of removal of chromium by the electrokinetics remediation is mainly it is in-situ and cost effective process. In this we take the current as variable in the electrokinetic testing and check what is the effect of current on the removal of chromium hexa-valent.

Key words: Chromium Hexavalent, Electro-Kinetics Remediation Test

I. INTRODUCTION

The chromium is listed 129 priority pollutants, according to the environment protection agency. In the present time the major soil contaminant is chromium, the chromium occurs mainly in two stable oxidation states, chromium tri-valent and chromium hexavalent, the chromium trivalent is not harmful to the point of view of the human health and the environment.

The chromium hexavalent is mainly carcinogenic, causing lung cancer, skin cancer etc. The main source of the chromium in the soil is the leather tanning, metallergy, electroplating, power generation industries and other industries. To removeing the chromium from contaminated site is the very important task from the point of the view of human health and environment.

II. ELECTROKINETICS REMEDIATION

The electro kinetics remediation mainly when the direct current is applied through electrode into the soil containing from the toxic metal, the metal get and ionized metal moves towards the opposite electrode depending upon the charge they hold, that means –ve ions moves towards the anode and +ve ion moves towards the cathode.

III. ELECTRO KINETICS TESTING

A. Electro Kinetics Test Apparatus

The rectangular test cell, which accommodates the soil sample, the dimensions of the rectangular test cell ($3.5cm \times 10cm \times 10cm$).

This cell is connected to the anode at one end and cathode at one end, this electrodes are mainly made of steel, circular plate, diameter 3.5cm.

B. Sample Preparation

1.6 gram $k_2Cr_2O_7$ (potassium dichromate) is dissolved in the deionized water. By dissolving 1.6 gram $k_2Cr_2O_7$ in the 660 m.l. deionized water and mix with 1100 gram of soil (silt), to maintain the initial moisture content 60% and maintain the Cr_6 concentration 500 mg kg^{-1}, contaminated soil mixed homogeneously and equilibrated and spread in the layer form I n electro kinetics cell.

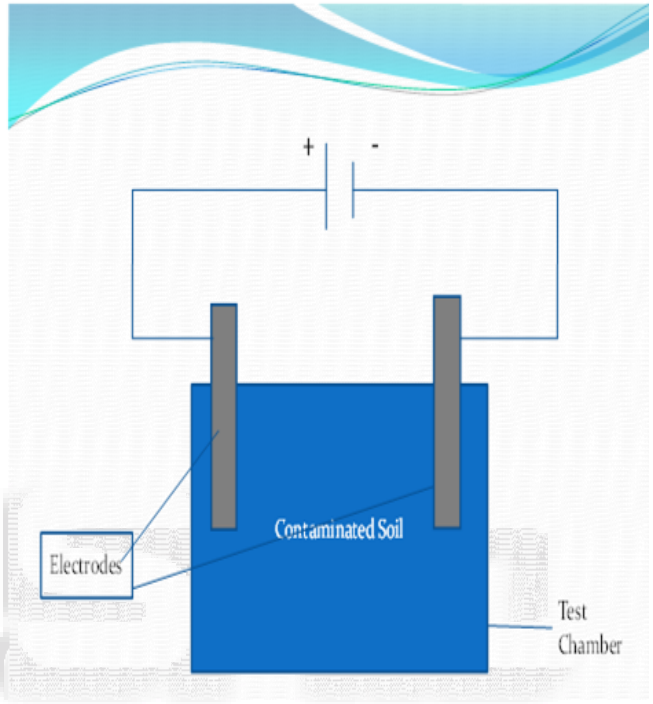

Fig. 1: Electro Kinetics Remediation

C. Methodology

1) Case1

When the constant DC current of 25V is applied for four days to the soil, through the electrodes, there is the separation of ions di-chromate ion moves towards the anode and potassium ion moves towards the cathode. The movement of ions depending upon the charge they hold, that means positively charged ion moves towards the cathode and negatively charged ion moves toward the anode. In this experiment the distance between the electrode is 16.0 cm.

2) Case2

When the constant DC current of 30V is applied for four days to the soil, through the electrodes, there is the separation of ions di-chromate ion moves towards the anode and potassium ion moves towards the cathode. The movement of ions depending upon the charge they hold, that means positively charged ion moves towards the cathode and negatively charged ion moves toward the anode. In this experiment the distance between the electrode is 16.0 cm.

Fig. 2: Setup of electrokinetics test

D. Testing Procedure

At the end of the test the soil around the circular steel electrode in the 5 cm. range is carefully taken by the stainless steel spatula. The 40 gram soil taken from the anode and 40 gram soil taken from the cathode. The 40 gram of soil extruded from the middle from the both electrode anode and cathode. By using UV spectrophotometer examine the amount of chromium at each electrode and middle portion.

IV. Result and Discussion

For case 1 when 25 volt current is applied: Concentration of chromium hexavalent in soil sample at both electrode and middle of the electrodes is shown in the following table.

Sr No.	Electrode	Set1 (mg/10gm)	Set2 (mg/10gm)	Set3 (mg/10gm)
1	Cathode	4.0	4.2	4.2
2	Anode	5.3	5.0	5.7
3	Middle	4.1	4.0	4.1

Table 1: Results

In the sample set 1 the chromium hexavalent concentration is found to be 4.0, 5.3, 4.1 mg/10 gm of soil sample at cathode anode and middle of the electrodes respectively.

In the sample set 2 the chromium hexavalent concentration is found to be 4.2, 5.0, 4.0 mg/10 gm of soil sample at cathode anode and middle of the electrodes respectively.

In the sample set 3 the chromium hexavalent concentration is found to be 4.2, 5.7, 4.1 mg/10 gm of soil sample at cathode anode and middle of the electrodes respectively.

From the above table it reveals that the maximum chromium concentration found at the sample taken from anode.

For case 1 when 30 volt current is applied: Concentration of chromium hexavalent in soil sample at both electrode and middle of the electrodes is shown in the following table.

Sr No.	Electrode	Set1 (mg/10gm)	Set2 (mg/10gm)	Set3 (mg/10gm)
1	Cathode	3.9	4.1	4.1
2	Anode	5.8	5.8	5.9
3	Middle	4.3	4.2	4.2

Table 2: Results

In the sample set 1 the chromium hexavalent concentration is found to be 3.9, 5.8., 4.3 mg/10 gm of soil sample at cathode anode and middle of the electrodes respectively.

In the sample set 2 the chromium hexavalent concentration is found to be 4.1, 5.8, 4.2 mg/10 gm of soil sample at cathode anode and middle of the electrodes respectively.

In the sample set 3 the chromium hexavalent concentration is found to be 4.1, 5.9, 4.2 mg/10 gm of soil sample at cathode anode and middle of the electrodes respectively. From the above table it reveals that the maximum chromium concentration found at the sample taken from anode.

V. Conclusion

When current using as a variable in the electrokinetics test for the removal of chromium hexavalent from the soil sample, the current plays an important role. In case 1 average chromium concentration found at anode is 5.33 mg. For case 2 average chromium concentration found at anode is 5.83 mg. So we can conclude that as current increases in case 2 we found more concentration of chromium at anode.

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