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ABSTRACT

The present study deals with the removal of zinc (Zn), cadmium (Cd), lead (Pb) and copper (Cu) from contaminated soil sample collected from Hattar Industrial Estate, Haripur, by using the electrokinetic (EK) technique in laboratory conditions. The technique involves two different electrolytes, acetic acid (CH_3COOH) and hydrochloric acid (HCl) keeping the voltage 20 V and 10 V respectively. The experiments were performed for 106 and 92 hours operation under 4.25 V/cm^2 and 2.0V/cm^2 potential gradient using the same type of soil sample. The EK apparatus was specially consisted of three compartments: cathode reservoir (5cm in length), anode reservoir (5cm in length) and contaminated soil chamber (10 x10x10 cm^3). Two titanium electrodes were installed in the cathode and anode reservoir, respectively and five tungsten electrode wires of 2mm in contaminated soil sample with increment of ~2 cm. In the first experiment the (3M) CH_3COOH was used as electrolyte. Current density from cathode to anode increases with passage of time, however, small increase in current was observed after 30 hours till the termination of experiment which may be due to the loss of ionic strength in the pore fluid and movements of ionic species in EK cell. The pH of electrolyte became more acidic with the passage of time. The percentage removal of Zn, Cd, Pb and Cu was 97.2%, 97.9%, 98.9% and 97.3% respectively. In the second electrokinetic experiment, after four hours from the start of experiment, the current density slightly decreases from 5.8 mA/cm^2 to 4.6 mA/cm^2. The addition of fresh 10 ml electrolyte (HCl) increased the current which may be due to high acidic conditions. Same behaviour was also observed up to 92 hours. The percentage removal of Zn, Cd, Pb and Cu were 36.13%, 63.37%, 88.65% and 72.14% respectively. The Zn concentration in residual soil was highest at a

distance of 4.5cm away from anode and lowest at the start of anode. The concentration of Cd was significantly low in all segments of soil. Similarly, the concentration of Pb in soil segments at 4.5 cm away from anode was highest and lowest near anode. The concentration of Cu was almost uniform in the each segments of soil.

The study concludes that acetic acid is more efficient electrolyte in electrokinetic remediation as compared to hydrochloric acid. Further, acetic acid is an environmentally safe organic acid, biodegradable and does not create a health hazard when it is used in conditioning the pore fluid in electrokinetic remediation of sites, however detailed studies should be conducted to know the effectiveness of electrokinetic remediation process by using different electrolytes for the removal of heavy metals from polluted soils.

ABBREVIATIONS

Abbreviation	
EK	Electrokinetic
DC	Direct Current
EKR	Electrokinetic Remediation
EKRT	Electrokinetics Remediation Technology
pH	Power of Hydrogen ions
M	Molarity
TAC	Towards Anode Concentration
TCC	Towards Cathode Concentration
MC	Middle Concentration
Zn	Zinc
Cd	Cadmium
Pb	Lead
Cu	Copper
CH_3COOH	CH_3COOH
HCl	Hydrochloric Acid
V	Voltage
DC	Direct Current
pH	Power of Hydrogen Ions
BOD	Biological Oxygen Demand
KPK	Khyber Pakhtunkhwa
ppm	parts per million
IAD	Isotope Application Division
PINSTECH	Pakistan Institute of Nuclear Science and Technology

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