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Electrical conductivity of Riverbed Soil of Tamirabarani at Tirunelveli, TN

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Abstract

Electrical conductivity (EC) study of different types of soil is an interesting factor. The available compounds dissolved in water breakdown into ions. In this riverbed soil EC variation study constitutes, Humus content, Base saturation, cat ion exchange and mineral composition. The spectral assignment of (FTIR) peaks revealed the presence of O-H bond, C-O bond, methyl group, chlorine etc. The analytical study of elements like Carbon, Silicon, and Oxygen present in the riverbed soil sample carried out by SEM-EDAX-SAIF, IIT Chennai. The presence of functional groups and mineral elements in the riverbed soil played a vital role for EC variation. The characteristics study of EC of soil cell will create a new source of energy which is Eco friendly and pollution free.

Key words: Electrical Conductivity, Cation Exchange, pH, FTIR, EDAX.

Introduction

Soils are formed from rock masses, loose unconsolidated transported materials and organic residues (decomposing plants & animals). Originally, even the loose mineral materials were formed by weathering of rock masses to stones, gravels, sand, silts, clays and soluble ions. The physical properties of soil include texture, structure, density, porosity, temperature, color and water content. The present paper deals with the electrical conductivity study of soil[1-3].

Experiment

The experimental setup is similar to Electrochemical cell. Electrodes- Carbon rods and zinc rods. The riverbed soil sample measured

250g and diluted with 500 ml of deionized water. The output voltage measured to be 1.39 to 1.52 V. The constancy of the voltage has been maintained for 45 days. Electrochemical reaction is taking place in the setup as per Arrhenius theory- Neutral molecules dissociates into ions. During electrolytic dissociation moving of ions towards oppositely charged electrodes constitutes electro-motive force. If dilution increases conduction also increases-Oswald dilution law[4-6].

Observation

The FTIR spectra for riverbed soil sample showed the presence of functional group. (Admittance verses wave number (cm^{-1})). Methyl group, C-O bond chlorine etc. were identified. For example, the wave number 3445 indicates O-H stretching. 2924, 2852- methyl asymmetric and symmetric stretching. 1053 denotes C-O bond, 777- chlorine etc.

Table 1 shows the spectral assignments of riverbed soil samples using FTIR

S.No.	Wave number	Assignment
1	3445	O-H stretching
2	2924	Methyl asymmetric
3	2852	Methyl symmetric
4	1053	C-O bond
5	777	Chlorine

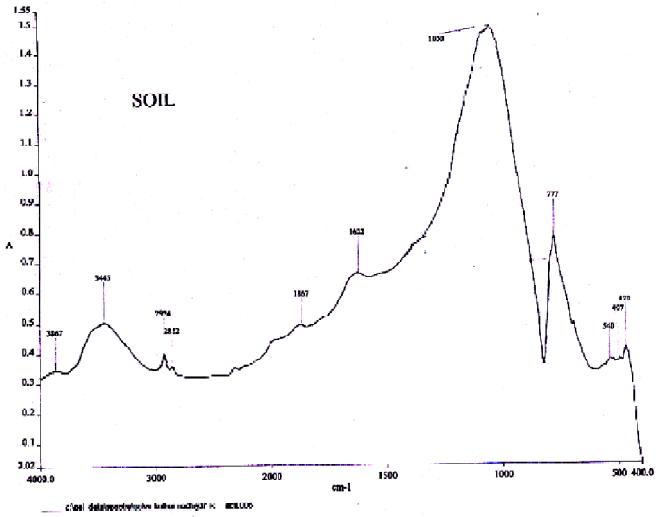

Table1. Spectral assignments of riverbed soil sample using FTIR

Discussion

The fine soil (say 0.1mg) was given for elemental analysis study (SEM-EDAX) to IIT, Chennai. Each fine piece of soil showing different magnification photographed (Refer Figure A & Figure C). The peaks in the map energy (kev) versus electrons in k shell clearly refers the weight% and the atomic percentage of different elements like carbon, Nitrogen, Sodium, Aluminium, Silicon, Chlorine, Calcium etc. were observed (Refer Figure B & Figure D).

In table 3, the weight percentage and atomic percentage of carbon is maximum of 47.40% and 59.74 % respectively, Oxygen is 27.77% and 26.28 %, Silicon is 9.45% and 5.09 %, Aluminium is 5.35 and 3%, Nitrogen is 2.62% and 2.84%, Calcium is 1.43% and 0.54%, Zinc is 1.07% and 0..25%, Potassium is 0.61% and 0.24%, and Manganese 0.21% and 0.06% etc. The existence of the above said elements naturally in soil as ionic forms of carbon- HCO_3^-, Nitrogen as NO_3^-, NH_4^+, sodium as Na^{+-} soluble salt. Silicon Si-Si^{++++-} common in mineral holding oxygen together as SiO_2. Chlorine Cl^- as soluble salts. Calcium Ca-Ca^{+++-} the cation most prevalent in non acidic soils. The least wt% identified in the River bed soil was Sulphur as 0.12% and 0.06% The presence of copper, potassium, and manganese were identified minimum in this soil sample. Among all the elements the weight % of carbon is maximum in the riverbed soil[1-6].

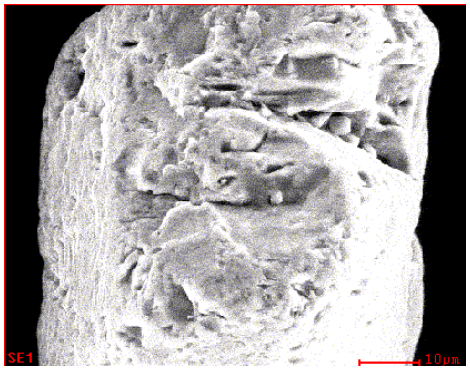

Figure -A

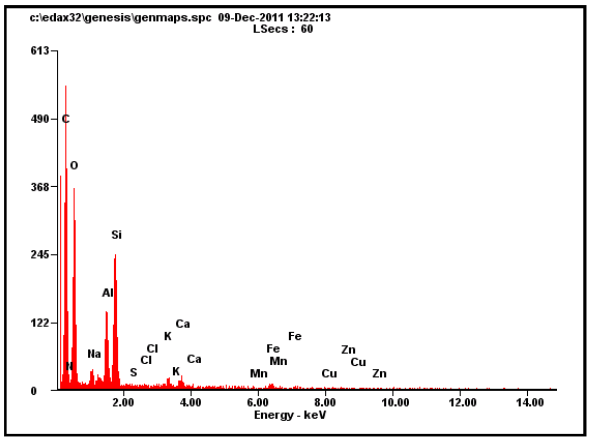

Figure -B

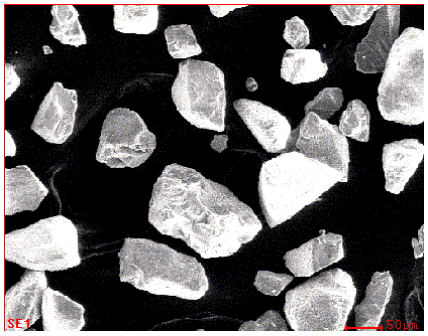

Figure -C

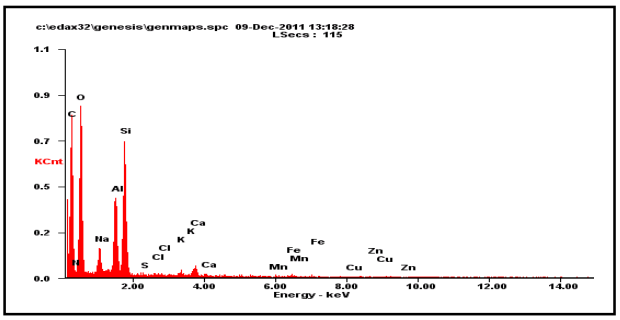

Figure -D

this result confirmed the presence of micro nutrients and minerals present in the Riverbed soil. For different magnification of the soil sample -Photograph SEM shows the variation (Refer Fig. A & C). The below table 3 indicates the element and its weight percentage.

Table 3

Element	Wt%	At%
CK	47.40	59.74
NK	02.62	02.84
OK	27.77	26.28
NaK	02.11	01.39
AlK	05.35	03.00
SiK	09.45	05.09
SK	00.12	00.06
ClK	00.17	00.07
KK	00.61	00.24
CaK	01.43	00.54
MnK	00.21	00.06
FeK	01.29	00.35
CuK	00.40	00.10
ZnK	01.07	00.25

Conclusion

1. Minerals, micronutrients, soluble salts and organic matters present in the River bed soil were the factors contributing electrical conductivity.
2. Using FTIR (Fourier Transform Infrared) Spectral assignment study, the functional groups like O-H stretching, methyl asymmetric, methyl symmetric, C-O and chlorine were identified.
3. The presence of element in weight percentage and the atomic percentage were referred by scanning electron microscope-EDAX-SAIF, IITChennai. The peaks in the map energy (kev) versus K electron shell confirmed the weight percentage of carbon as 47.40%. Oxygen 27.77%, silicon 9.45%, Aluminium 5.35%, Iron 1.29% calcium 1.43% nitrogen 2.62% Sodium 2.11% and minimum percentage of chlorine and sulphur are .017% and .012%.
4. For different magnification like 10µm, 50µm (for 0.1mg river bed soil photographs were taken) though the magnification varies the weight percentage of carbon is maximum in river bed soil that may enhance the soil electrical conductivity.
5. The output voltage measured from riverbed soil varies from 1.39 to 1.52 V (open circuit voltage).

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