

DRS-UV, FT-IR AND XRD STUDIES OF COASTAL SOIL SAMPLES OF WEST COAST OF KANYAKUMARI DISTRICT

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Abstract:

The mineralogical characterization was carried out to determine the major and minor constituents minerals present in the coastal soil samples of kanyakumari district, Tamilnadu, India by FT-IR spectroscopy. The identified minerals are quartz, orthoclase, microcline, albite, kaolinite, montmorillonite, illite, calcite, aragonite and organic carbon. Mineralogical investigations were generally performed by using X-ray diffraction (XRD). XRD technique to yield more information about the minerals. FT-IR and XRD methods were non destructive and can be used in the identification of mineralogical composition. DRS-UV spectroscopy can be used to determine the absorbance of important minerals at wavelengths in the range of 200-400 nm. The UV results showed the peak absorption at 302 to 306 nm range. The UV result indicates the presence of zinc and iron minerals enriched the coastal soil samples of Kanyakumari district.

Key words: Diffractive Reflectance Spectroscopy (DRS)- UV, FT-IR, XRD

I. Introduction:

Coastal soil is one of the most important resources of the nature. Soil formation is a constructive as well as destructive process (Pujar et al.,2012).Soil is a complex of living, changing and dynamic component of earth crust. A thorough understanding of the mineralogy of soil is very important because of their low cost, abundance in most continents of the world, high sorption properties and potential for ion exchange. Soil materials are strong candidates as adsorbents (Preeti and Singh, 2007). Clay is a general name for an important mineral group which is used for the production of great number products, encompasses every part of daily life, such as from soil to ceramics and from fine arts to advanced technological industry (Adams, 1987). The mineral analysis gives prompt area of research and gives an important tool in economic scale also. There are number of methods are used to identify the minerals by the conventional techniques such thin section analysis, XRD and FT-IR Spectroscopy for the mineral identification (Ravisankar R,2009, Frammer V.C 1974, Clarecekarr.J, 1974, Pichard et al., 1986, Herbert et al., 1992, Benedetto et al., 2002, Ravisankar et al., 2010). The FTIR spectrum was used to determine the nature of functional groups which could possibly influence the adsorption of soil (Sarala thambavani, 2014). UV spectroscopy can be used to determine the absorption of electromagnetic radiation at wave length in the region of 200-400nm. Powder X-ray diffraction pattern gives more information about minerals present in soil or sedimentary samples (Ramasamy et al.,2006, Nayak et al., 2007).

II. Materials and Methods

Study Area

The study area chosen for the present work is west coast of Kanyakumari District which is covering a distance of 75km from Vattakottai to Vallavilai of Kanyakumari coast. The sample sites are Vattakottai S1, Chotthavilai S2, Rajakkamangalam S3, Muttam S4, Manavalakurichi S5, Kottilpaadu S6, Kurumpanai S7, Pattanam S8, Thoothoor S9, VallavilaiS10.

Soil Samples Collection and Preparation:

Coastal soil samples were collected using Peterson grab at all the designated locations during low tide. The samples collected from ten different sites. The distance between each site falls around 5kms.The collected soil samples were initially sundried for seven days followed by drying in hot air oven at 383 +- 1K for two days. The dried soil was crushed, sieved and stored in sterile closed glass bottles till further investigation.

FTIR, DRS-UV and XRD analysis of coastal soil samples of Kanyakumari District:

The infrared spectra were recorded in the mid IR region 400-4000 cm⁻¹ using Nicolet iS5 Fourier Transform Infrared Spectrometer (IR-Affinity-1). To identify the mineral phases in the samples, X-ray diffractograms for the shreds in the powdered form recorded using Shimadzu XRD 6000 25°C of $\gamma = 1.5405 \text{ \AA}$ The DRS- UV /Vis spectroscopy is routinely used in a quantitative way to determine the concentration of an absorbing species in solution. The UV was analyzed using JASCO UV-model name V-650, serial no-B138461150.

III. Results and Discussion:

Characterization of Soil Particle:

For understanding the nature of coastal soil samples formation, minerals and stability of minerals, FT-IR, XRD and DRS-UV were performed in the following sections.

FT-IR Characterization:

The FT-IR spectrum was used to determine the nature of functional groups which could possibly influence the adsorption of the soil Coates,(1977). The FT-IR spectrum of the soil is shown in Fig.1 By comparing the observed frequencies with available literature (Crowley and Vergo 1983, Clark et al., 1990, Summer 1995, Gustafsson et al., 1999, Sun et al., 2001, Shoval 2004 and Ravisankar et al., 2010) the minerals such as quartz, microcline, orthoclase, albite, kaolinite, montmorillonite, illite, calcite and aragonite have been identified.

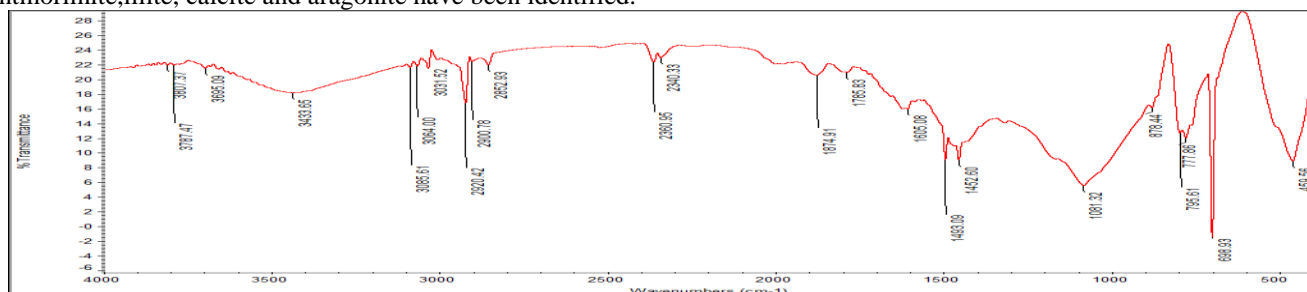


Fig 1. A representative FT-IR spectrum of coastal sediment samples from Kanyakumari District.

UV Characterization:

UV spectroscopy is routinely used in analytical chemistry for the quantitative determination of different metal ions present in the coastal soil samples. The UV studies of the coastal soil samples spectrum is shown in Fig .2. The absorbance values ranges from 1.25485 to 1.29966 and the wavelength varies only from 302 to 306 nm. It confirmed the coastal soil samples of west coast of kanyakumari enriched Zinc and iron.

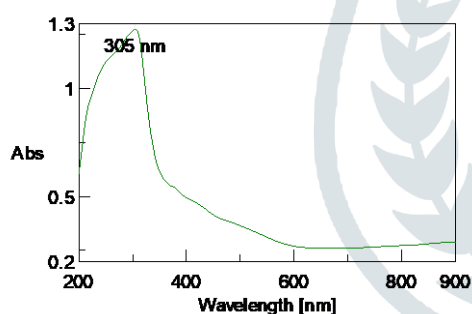


Fig 2. UV studies of coastal soil samples

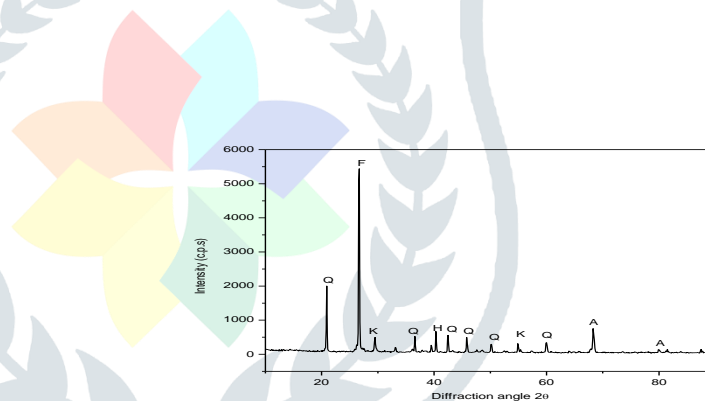


Fig 3. XRD spectrum of samples

XRD Characterization:

X-ray powder diffraction (XRD) method was used to confirm the presence of coastal soil minerals such as Quartz, Feldspar, Kaolinite, Hematite and Aragonite. The d-values of XRD pattern of soil samples were estimated, compared with standard values and their structural analogues. Comparing the d-values, it can be concluded that the soil is mainly Quartz (SiO_2), Feldspar (WZ_4O_8 , W= Na, K, Ca or Al), Kaolinite type of mineral (Aluminum silicate hydroxide, $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$) and small amount of calcium carbonate mineral like Aragonite and Hematite. The XRD spectrum is shown in Fig 3.

Conclusion:

The coastal soil samples are most economically important accumulation of minerals. Every person uses products made from minerals every day. The salt that we add our food is the mineral halite. Antacid tablets are made from the mineral calcite. Most of the things that we use in our daily life are either made from minerals or produced using mineral products. Kaolinite is the basic raw material for ceramics and large quantities are used in the manufacture of coated paper. Accumulations of non-biodegradable wastes are affecting the coastal soil minerals. It is an important problem faced by the developed as well as developing countries. The qualitative identification of minerals in coastal soil samples of west coast of Kanyakumari district was carried out by FT-IR, XRD and DRS-UV techniques. The IR analyses indicate the presence of quartz, microcline, orthoclase, albite, kaolinite, montmorillonite, illite and calcite. XRD concluded the samples contain minerals are Quartz, Feldspar, Kaolinite, Hematite and Aragonite. DRS-UV studies confirmed the coastal soil samples enriched Zinc and iron. Reduce the non-biodegradable wastes will prevent the nature of coastal minerals of west coast of Kanyakumari district.

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