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Mineralogical study along the northern coast of Chennai

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Fourier Transform Infra-Red spectroscopy is used for identifying the minerals present in the samples collected from the northern coast of Chennai. Minerals such as Quartz, Feldspar and Hematite were predominantly observed in the IR spectra.

Keywords: Mineralogy, FTIR study, crystallinity index, clay minerology.

Introduction

Most of the geological materials (Soil and Rock) are multi-mineral in nature because of which ascertain the mineralogical nature of a geological material is an interesting challenge to the researchers. Fourier Transform Infra-Red spectroscopy (FTIR) is a promising technique for identifying minerals qualitatively based on the vibration spectra of the functional group of a molecule present in a mineral.

Study area:

The present study area is the northern coast of Chennai, this coastline is highly industrialized, with several industries, coal fueled thermal power plants and busy shipping ports. This region is considered to be highly polluted and many reports are available denoting the pollution load in this region.

Experimental

Three samples were collected from the study area one at the onshore along the coastal stretch (C01) and two at the hinterland (H02 and H03) near the vicinity of coal fired thermal power plant as mentioned and presented in Table 1 and Fig. 1.

The KBr pelleting technique is employed for the sample preparation for FTIR analysis. Bruker-Tensor 27 FTIR spectrophotometer was used for analyzing the samples. The FTIR was recorded at the range from 4000 cm^{-1} to 400 cm^{-1}. The instrument had a resolution of ±4 cm^{-1}.

Table 1. Geographical location details of the sampling sites collected along the northern coast of Chennai

Sampling site	Latitude	Longitude	Topographical region
C01	13°13'51"N	80°19'52"E	Beach
H02	13°14'39"N	80°18'41"E	Hinterland
H03	13°13'04"N	80°16'39"E	Hinterland

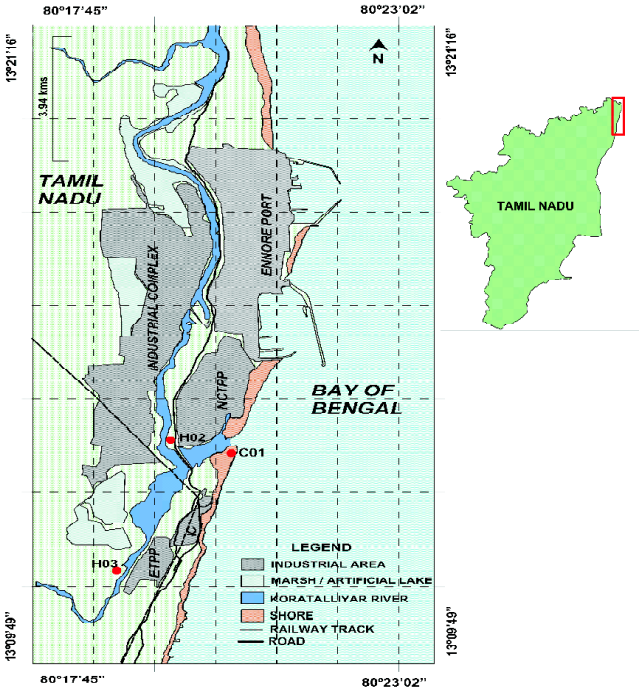

Fig. 1. Geographical location of the study area with the sampling sites collected along the northern coast of Chennai.

Results and discussion

The FTIR spectra obtained for the selected samples from various sampling sites (C01, H02 and H03) are given as Fig. 2 (a, b and c). The FTIR studies confirm the noticeable presence of iron oxide minerals such as Goethite through its peak observed at 495 cm^{-1} by Fe^{III}-O-Si bending mode vibrations[1], Hematite by Fe-O symmetrical bending at 532–540 cm^{-1} and the 906 cm^{-1} peak corresponding to -OH bending bands of FeOH[1–4] and Magnetite is confirmed through the peak at 572 cm^{-1} occurring due to Fe-O bending vibration[1] of C01 (Fig. 2(a)). Hematite peak at 540 cm^{-1} is also noticed in the samples of sites H02 (Fig. 2(b)) and H03 (Fig. 2(c)).

The organic carbon peak due to C-H stretching mode[1] is observed between 2852–2854 cm^{-1} and 2923–2927 cm^{-1} in all the three samples. The presence of carbon peak is considered due to the anthropogenic activities and organic debris present in the study area.

The presence of the crustal silicate minerals such as Quartz are confirmed through the Si-O asymmetrical bending vibration peak between 465–468 cm^{-1}, Si-O symmetrical bending at 693 cm^{-1} and also due to the peak observed at 1080–1084 cm^{-1} caused due to Si-O asymmetrical stretching vibration peak[1,3–5]. The presence of Feldspar is confirmed through the O-Si(Al)-O bending vibration peak between 583–587 cm^{-1} and through 1768–1775 cm^{-1} peak noticed because of Al-O coordination vibration[4,6]. Other minerals such as Sepiolite (OH stretching peak at 1657 cm^{-1})[7] and Montmorillonite (OH deformation band of Al-Fe^{3+} OH grouping at 879 cm^{-1})[4] are also present in the sediment samples of the three sampling site. The clay minerals such as Kaolinite, Gibbsite (O-Al-OH vibration mode between 666–670 cm^{-1} and 1030–1037 cm^{-1} and OH stretching bands at 3380 cm^{-1} and 3692–3696 cm^{-1})[2,4], Illite (OH bending vibration mode at 1630–1635 cm^{-1})[5], Palygorskite (Si-O stretching mode vibration at 567 cm^{-1})[7] and at 915 cm^{-1} due to OH bending band of Nacrite[7] are mostly noticed significantly at the sampling sites of the hinterland region (H02 and H03). These minerals might have been derived due to the process of pedogenesis from the crustal silicate minerals such as Quartz and Feldspar present in the hinterland region.

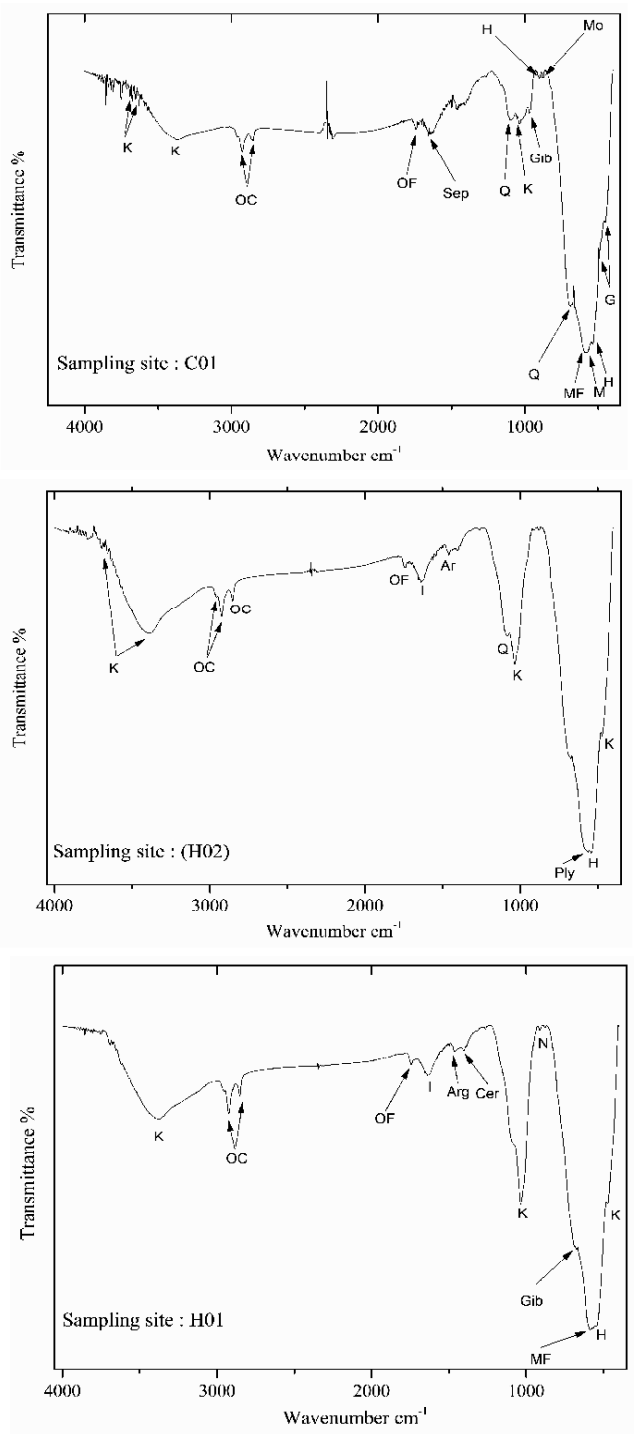

Fig. 2. FTIR spectrum for various sampling sites collected along the northern coast of Chennai.

Conclusions

The presence of crustal minerals such as Quartz and Feldspar are identified in most of the sampling sites and their presence is noted predominantly. The minerals such as Hematite, Magnetite and Goethite were also observed to be present in the study area. Clay minerals are noticed in the hinterland samples.

Acknowledgements

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References

1. S. Gnanasaravanan and P. Rajkumar, *Infrared Physics & Technology,* 2013, **58**, 21.
2. P. Rajesh, S. Joseph Vedhagiri and V. Ramasamy, *Archives of Physics Research*, 2013, **4(4)**, 5.
3. V. Ramasamy and V. Ponnusamy, *Indian Journal of Physics,* 2009, **83(3)**, 301.
4. V. Ramasamy, G. Suresh, V. Meenakshisundaram and V. Ponnusamy, *Applied Radiation and Isotopes*, 2011, **69(1)**, 184.
5. A. Chandrasekaran, R. Ravisankar, A. Rajalakshmi, P. Eswaran, P. Vijayagopal and B. Venkatraman, *Spectrochimica Acta, Part A: Molecular and Biomolecular Spectroscopy, Part C*, 2015, **136**, 1734.
6. V. Ramasamy, P. Rajkumar and V. Ponnusamy, *Indian Journal of Physics*, 2009, **83(9)**, 1295.
7. R. Senthil Kumar and P. Rajkumar, *Infrared Physics & Technology,* 2014, **67**, 30.