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NOTE

Spectroscopic Studies of Minerals in Some Indian Coals

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Far-infrared spectra of the range, 400-200 cm^{-1} were recorded for eight different high sulphur coal samples from Assam (India) for the first time. The observed unusual spectral bands are accounts for the minerals *viz.*, kaolinite, calcite, magnesite, illite, siderite, pyrite present in the coals.

Key Words: Far-infrared spectra, Coal, Indian coal, Minerals.

Coal contains mineral matters in various quantities, where major portions are usually shale, kaolinite and sulphide[1]. The abundance and composition of minerals in a coal reflect the geochemical listing of the coal forming environment. The availability of analytical methods of characterization of minerals in coal is obviously well developed[2]. FT-IR spectroscopy is considered to be one of the most promising methods for determination of minerals in coal[3]. The prime advantage of FTIR technique is that it can be used directly on coal. The potential of far-infrared spectra in identification of minerals in naturally occurring materials can never be ignored[4-7]. The feasibility of mineral identification in Indian coals from their far-infrared spectral regions has not been in attention in spite of having several studies by usual FTIR spectroscopy[8-10].

The purpose of this short communication is to present the far-infrared spectra of eight high sulphur coal samples from Makum coal field, Margherita, Assam (India) for the first time. The far-infrared spectra (400-200 cm^{-1}) of these industrially important coals were recorded and tried to analyze them. It makes possible the acquisition of far-infrared (FIR) spectra to identify coal minerals which had previously been unexplored.

Eight different coal samples were collected from various collieries of the Makum coalfield, Assam, India (latitudes 27° 13'-27° 23' N and longitudes 95° 35'-96° 00' E). The samples were finely ground before taking spectra. The IR spectrum in the region, 400-200 cm^{-1} was recorded in FT-IR spectrophotometer (Perkin Elmer, Spectrum One) with CsI pellet. The detector used was deuterated triglycine sulfate (DTGS) and total numbers of scans were 50 with the spectral resolution of 4 cm^{-1} during the recording of the spectra.

The far-infrared spectra for the eight coal samples are presented in Fig. 1. The spectra are appeared to be identical with only exception in the intensities of peaks. The spectra show prominent peaks mainly in the region of 300-200 cm^{-1}. There are several advantages of working at long wavelength. The particle size of naturally occurring specimen is such that while they scatter shorter wavelengths they will act as simple absorbers for long wavelengths. These long wavelengths correspond to fundamental lattice frequencies of compounds containing all but the lightest elements. The strong absorption bands observed in the range 250-200 cm^{-1} are particularly for the silica rich clay minerals present in the coals. Assam coals were reported to be rich in quartz[8]. The bands near 210 cm^{-1} in the coal samples are due to the δ-OSiO groups in the clay minerals. Larson *et al.*[11], has also observed strong peaks around 300-200 cm^{-1} for the clay minerals. The weak band near 275 cm^{-1} (sample 10B) is due to the O---O vibrations in the layer structures of the kaolinite in the coal. The bands around 250 and 275 cm^{-1} (3B, 7B, 8B, 10B) are accounts for the illite and kaolinite minerals present in the coal, respectively. The small bands around 230 cm^{-1} (3B, 6B, 10B) are observed for the presence of calcite and magnesite in the coals. The strong peaks around 210 cm^{-1} (3B, 5B, 6B, 7B, 8B, 9B, 10B) are due to the siderite ($FeCO_3$) present in the coals. The small peak at 300 cm^{-1} (7B) is accounts for the pyrites in the coal.

Conclusion

This study provides a technique for preliminary identification of minerals in the coals. It can also serve as a "fingerprint" to give proof of identity without rescue to any other

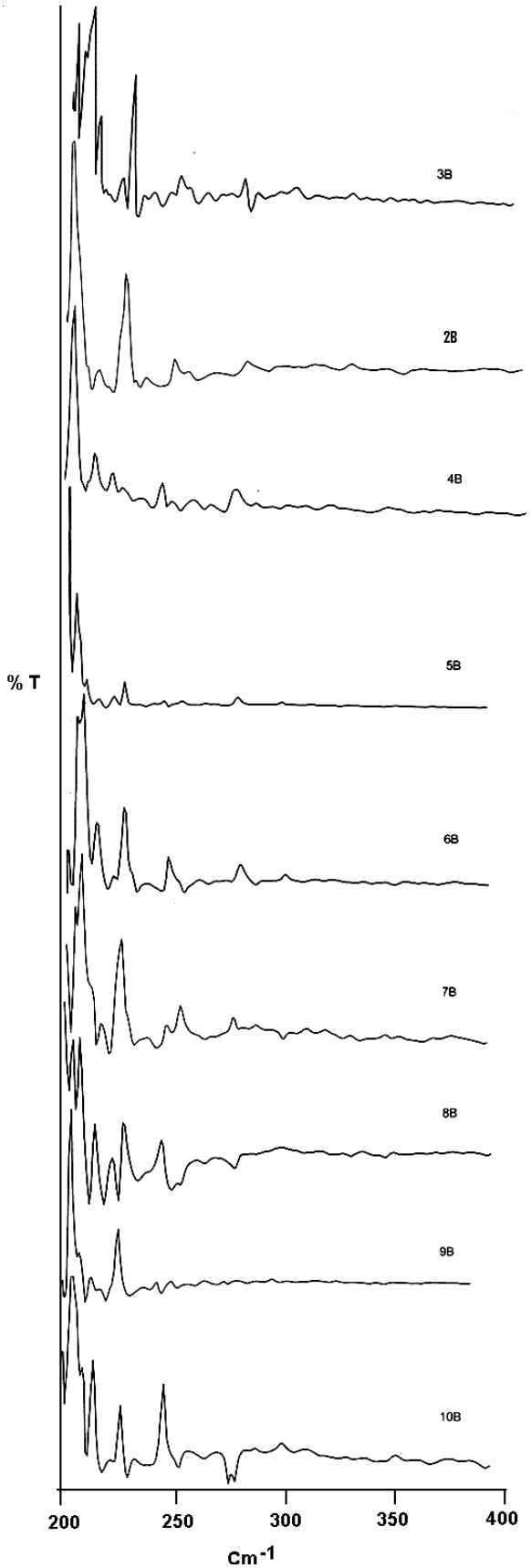

Fig. 1. Far-infrared spectra of Assam coal samples

analytical method. Moreover, these far-infrared spectrums may be extended for quantitative analysis of the minerals in the Indian coals.

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