Spectroscopic studies of silicate minerals from North-Eastern India

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The samples we reported here are collected from North-Eastern region of India in their almost pure form of quartz crystal and silicates. Here an overview of the basic morphological, physico-chemical and crystallographic characteristics of the silicates is given. Particular emphasis is given to make a catalogue of silicates on the basis of structural classifications. The colour of the quartz crystal of these locations indicates the inclusion of the trace elements present in the host rocks. The compositional and structural studies were carried out at room temperature by using X-ray fluorescence (XRF), electron microprobe (EPMA) analyses and Fourier transform infrared (FTIR) spectroscopic techniques. Differential thermal analysis (DTA) and thermo gravimetric studies were also performed. The results of the compositional analysis of the samples are comparable to the standard literature. The compositional analysis of the samples exhibits that the major trace elements are Fe, Al, Ca and Mg. The optical properties are compared with the standard literature and the results are found to be satisfactory. An attempt to identify the minerals using the FTIR spectroscopy and to classify them according to their structural characteristics is performed. The crystallinity investigation throws light on the dependency on temperature and pressure during formation. The purity and distributions of the samples can also helps on the economic and industrial values of the silicates of the study region.

A rough idea about the silicate minerals of the study area can be lead from this investigation. Since silicates are known as rock forming mineral, one can have a fairly good idea about the rocks found in these areas.

Complexation of Eu^{3+} with humic substances studied by time-resolved laser fluorescence spectroscopy and parallel factor analysis

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Humic substances (HS) are heterogeneous and ill-defined organic nanoparticles widely found in soil and aqueous environments. HS are known as effective complexants for inorganic and organic contaminants, mediating their migration through geosphere. Although many researches have been devoted to study binding of metal ions to HS mostly in terms of macroscopic binding amounts, detailed information on the binding processes are still limited, because of the heterogeneity and variety of HS from different origins. In this research, we investigated the binding of Eu^{3+} to various HS by time-resolved laser fluorescence spectroscopy (TRLFS) hyphnated with parallel factor analysis (PARAFAC). TRLFS is an analytical technique sensitive to physico-chemical forms of a target fluorescent metal ion, which can be further reinforced by combining with a powerful multivariate data analysis, PARARAC [1].

Binding of Eu^{3+} to HS purchased from the International and Japanese Humic Substances Societies was examined by TRLFS as a function of pH. A series of TRLFS data obtained for a certain HS were processed by PARAFAC to determine the number, spectra, decays and relative concentrations of factors. Except for one HS, three factors were necessary and enough to describe the variations in the data sets. These factors were distinctive with each other and could correspond to different Eu^{3+} species bound to HS. Each of the factors has some similarity among different HS, suggesting the presence of similar binding environments in different HS. It was further revealed that there were systematic trends between the spectra, decays and concentrations of the factors and the physical and chemical properties of HS. The observed trends will be used to deduce the characteristics of the different binding environments for Eu^{3+} in HS.

[1] Saito *et al*. (2010) *Environ. Sci. Technol*. **44**, 5055-5060.