

An Approach to Quantitative Interpretation of XRD Patterns of Clay Mixtures Using Clay Mineral Society Clays and Their FWHM in the Glycolated Diffractograms

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In this experimental study composite shale mixture composed of montmorillonite (SAz-1), chlorite (Cca-2), illite (IMt-1), and Kaolinite (Kga-2b) mineral standards of the Clay Mineral Society was analysed. Each of 40 samples prepared as consist of 25 % (by weight) montmorillonite, chlorite, illite and kaolinite was analysed.

For XRD clay fraction analysis, oriented samples were prepared via the “home method” Conditions for XRD were the following; generator: Rigaku D/Max-2200 Ultima+/PC, tube: Cu K α =1.54059 Å, filter: Ni, accelerating voltage: 40kV, current: 20mA, goniometer speed: 1°/min, and range: 2-40° 2 theta. The XRD instrument were calibrated using silicon paste before its use, and minerals identified using International Center for Diffraction Data-Inorganic Crystal Structure Database (PDF-2).

FWHM values of 001 reflections of montmorillonite, chlorite, illite and kaolinite minerals in ethylene glycolated diffractograms obtained from 40 separate clay analysis have been measured. Relative response ratios of the other clay components with respect to chlorite have been calculated by using the average FWHM referans value by the use of averages of FWHM and relative response ratios values have been calculated as 1, 1/2,96, 1/2,60, and 1/1, 49 for chlorite, montmorillonite, illite, and kaolinite, respectively. Relative response ratios values were used in the $W_i = (K_i \cdot \text{FWHM}_i / \sum K_i \cdot \text{FWHM}_i) \times 100$ formula to obtain the relative abundances by weight and then the averages of these calculated relative abundance values were obtained. Standart deviation numbers of the calculated relative abundance values are less than % 3 and 2,25, 2,71, 1,91, 1,82 were obtained for montmorillonite, chlorite, illite, and kaolinite, respectively. When the known and found relative abundance values are compared and it is concluded that this analytic approach compares favorably with the other quantitative analysis techniques.

The laboratories at the Turkish Petroleum Corporation (TPAO) now have adequate equipment and trained personnel that can handle the semi-quantitative analyses of minerals and act as a referee laboratory in Turkey.