Measurement of montmorillonite content of bentonite by methylene blue adsorbed

YASUTAKA WATANABE[1]* AND SHINGO YOKOYAMA[1]

[1]Central Research Institute of Electric Power Industry, 1646 Abiko, Abiko-shi, Chiba-ken 270-1194 Japan
(*correspondence: yasutaka@criepi.denken.or.jp)

Quality control of bentonite is important to construct the engineered barrier with required physicochemical properties in radioactive waste disposal. Since montmorillonite content of the bentonite is strongly related to its properties, highly accurate quantitative analysis of montmorillonite content is needed to evaluate the quality of the bentonite. In this study, measurement of the montmorillonite content of the bentonite was investigated based on methylene blue adsorption tests.

Two kinds of bentonite contained accessory minerals were used. The exchangeable cation of these bentonites was Ca ion ranged from 66.0 % to 76.5 %. To collect the pure montmorillonite, particle fractions of the bentonites dispered in deionized water were separated by sedimentation. Dried superfine particles of less than 0.2 μm in the Stokes' diameter was collected by drying suspension at 60 degrees C. No accessory minerals were detected in the fraction of less than 0.2 μm by XRD.

The amount of methylene blue (MB) adsorbed on the pure montmorillonite and the bentonite was measured by the spot method and the spectrometry method. The spot method complies with the concept of ASTM standard [1]. The relation between the amount of MB added and the amount of MB adsorbed was investigated and a basal spacing of the montmorillonite after adsorbing MB was measured by XRD.

The basal spacing of the montmorillonite increased by addition of MB, then the converged basal spacing indicated the saturated adosorption amount of MB (SAA_{MB}). The SAA_{MB} obtained by the spectrometry method was compatible with that obtained by the spot method. The SAA_{MB} of the pure montmorillonite was determined as 151 mmol/100g. As a result, the montmorillonite content of the bentonites was 76-77 %. So far, a representative SAA_{MB} of pure montmorillonite, 140 mmol/100g, has been used without depending on a kind of the bentonite [2]. It is suggested that the montmorillonite content will be overestimated, if the fixed SAA_{MB} is applied to the bentonite used in this study. It is necessary to use the SAA_{MB} of the extracted pure montmorillonite for reliable montmorillonite content.

[1] ASTM (1984) ASTM Standards, sect. 15, vol. 15.02.
[2] H. Komine and N. Ogata (2004) J. Geotechnical and Geoenvironmental Engineering, ASCE, 818-829.