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Cation Exchange Capacity Measurement for Bentonite by Spectrophotometry

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The cation exchange capacity (CEC) of bentonite is commonly measured by the method JBAS-106-77, provided by Japan Bentonite Manufacturers Association. JBAS-106-77 instructs the use of ammonium acetate for cation exchange, and recommends the Kjeldahl method for the quantification of ammonium ions. Though this procedure is a general method for the CEC measurement, it is often time-consuming and laborious. There are several other methods for the quantification of ammonia nitrogen, such as spectrophotometry, ionic electrode method, and ion chromatography. Of these methods, the spectrophotometry seems to be most favorable for the CEC measurement, in the point of accuracy, simplicity and quickness. In this study, we have tried to experiment spectrophotometry by using indophenol color development for attempting of convenient CEC measurement. Indophenol represents blue color, which is generated by the reaction of ammonium ions with phenol and hypochlorite.

As a result of the experiment, color development of samples started immediately after the mixture of reagent. The absorbance had stabilized after 4-5 hours, without regard to the concentration of ammonia nitrogen. The CEC value of standard bentonite, measured by the absorbance after 5 hours, represented lower values than expected value of this sample by the Kjeldahl method. This inconsistency is probably resulted from inappropriate conditions of color development, such as pH. In the future, it is necessary to improve the accuracy and reproducibility of this CEC measurement.