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# Use of Methylene Blue and Crystal Violet for Determination of Exchangeable Cations in Montmorillonite

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**Abstract:** A procedure for the determination of cation exchange capacity (CEC) and the amounts of exchangeable cations adsorbed to montmorillonite is proposed. The method consists of a single incubation of the clay in a suspension containing a low concentration of an organic dye of large binding affinity, followed by analysis of the displaced inorganic cations by inductively-coupled plasma emission spectrometry (ICPES). The CEC is obtained by taking the largest sum of displaced exchangeable cations. Montmorillonite suspensions were incubated with methylene blue (MB) or crystal violet (CV) at dye concentrations below 4 mM, for one, three or fourteen days. For total dye concentrations up to the CEC, all the dye was adsorbed and equivalent amounts of exchangeable cations were released. Both dyes could adsorb to the clay in excess of the CEC.

After one day of incubation in the presence of dye concentrations of about 50% in excess of the CEC, the total amounts of cations released were reduced to below the CEC. This reduction was interpreted as due to massive aggregation of the clay particles induced by the dye. With CV the total amounts of cations released after three or fourteen days of incubation increased and became equal to the CEC.

The same CEC was found for Na-, Ca- and SWy1 crude-montmorillonite, by employing either of the dyes.

**Key Words:** Cation exchange capacity • Crystal violet • Exchangeable cations • ICP • Methylene blue • Montmorillonite • Organic cations

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