

# Influence of physico-chemical characteristics on dissolved organic carbon retention in soil clay minerals

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Adsorption on clay minerals is important for organic carbon (OC) association in soils. However, functional relationships of the influence of physico-chemical properties of soil clay fractions (SCF) and on the retention of dissolved organic carbon (DOC) are still uncertain. To clarify the influence of these properties, batch DOC adsorption-desorption experiments were conducted using sequentially treated SCFs dominated by kaolinite and illite ("kaolinite-illite"), smectite and allophane. A fluorescence spectroscopic characterisation of the wheat-straw extracted DOC sample suggested was composed of dominant like humic and fulvic acid like compounds. The sequential treatment of clays included removal of native C and sesquioxides using sodium hypochlorite (NaOCl) and citrate-dithionate-bicarbonate (CDB), respectively. All the clay samples were investigated for their physico-chemical properties by XRD, FTIR, specific surface area (SSA), cation exchange capacity (CEC) and surface charge measurements. Results indicated that removal of native C increased the SSA, while removal of sesquioxides decreased it in all samples. The sequential treatment reflected a small change in the CEC values of kaolinite-illite, but significant changes in those of smectite and allophane. The negative surface charge increased in all samples with an increase in pH indicating their variable charge characteristics. Kaolinite-illite and smectite showed a negative charge over the 2 – 12 range, whereas allophane showed a slight positive charge at low pH. The removal of native C resulted in a slight increase in the positive charges on clay surfaces, while sesquioxide removal increased the negative charges. These variations in physico-chemical properties significantly influenced the Langmuir maximum DOC adsorption capacity ( $Q_{max}$ ) and binding strength parameters of DOC adsorption on the clay surfaces. A pronounced relationship between SSA vs  $Q_{max}$  ( $R^2 = 0.93$ ) and OC content vs  $Q_{max}$  ( $R^2 = 0.19$ ) was recorded.