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Predicament in Identifying Clay Palygorskite in Vertisols of Chhattisgarh Basin, India

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Abstract: *Earlier research on non-saline and non-sodic shrink-swell soils (Typic Haplusterts) of semi-arid climates (SAT) of western Maharashtra exhibited poor hydraulic properties due to the presence of clay palygorskite, which causes a remarkable reduction in crop yield. Similar impairment of hydraulic properties is recently observed also in non-saline and non-sodic deep shrink-swell soils (Typic Haplusterts) of sub-humid dry (SHD) climate of Chhattisgarh Basin of central India. In contrast to poor crop productivity of SAT Typic Haplusterts, SHD Typic Haplusterts are cultivated to rice as a prosperous agricultural land use plan.To confirm the possible presence of palygorskite as the causative factor in impairing the hydraulic properties of Typic Haplusterts of Chhattisgarh Basin, X-ray diffraction (XRD) technique was used to identify palygorskite in their clay fractions (< 2µm). Identification of clay palygorskite in Indian shrink-swell soils (Vertisols and their intergrades) by XRD method has not always been straight forward or might have been overlooked because of its low content, and also due to lack of sharp characteristic peak at 1.05 nm. It is also apprehended that its presence could be destroyed due to the chemical pre-treatments that are routinely applied to separate soil clay fractions.Often the identification of palygorskite in the pre-treated clay fractions is fraught with difficulty as no distinct peak at 1.05 nm is observed at a scanning speed of $2^0 2\theta\ min^{-1}$. To circumvent this predicament, water-dispersible clays (WDC) of SHD Typic Haplusterts were used for XRD analysis. Presence of a broad peak around 1.05 nm was observed, which was further resolved by slow-scanning at a speed of $1^0 2\theta\ min^{-1}$ and $0.5^0 2\theta\ min^{-1}$. In the scanning speed of $0.5^0 2\theta\ min^{-1}$, palygorskite peak at 1.05 nm was relatively well resolved than by scanning speed of $1^0 2\theta\ min^{-1}$. By the use of deconvolution method, the identification problem of the peak at 1.05 nm for palygorskite was much better resolved. Palygorskite mineral creates some unique physical and chemical properties of soils, such as a decrease in sHC (< 10 mm hr^{-1}) and exchangeable Ca/Mg ratio with pedon depth, and an increase in soil base saturation (> 100). The results of the present study suggest that these unique soil properties would be enough to ensure the presence of palygorskite in Vertisols even when XRD facilities are not available. Its presence poses a challenge to pedologists/ soil mappers, which demands a new initiative to classify palygorskite containing Vertisols at a higher categorical level for the benefit of various stakeholders, farmers' communities of rain-fed regions in particular.*

Keywords*: Palygorskite mineral; Vertisols; Identification of palygorskite*

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