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# Analyses of Clay Mineralogy of some Southeastern Nigeria Soils using X-Ray Diffraction and Fluorescence Techniques

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ABSTRACT

Detailed knowledge of soil mineralogy helps in understanding the soil forming processes, the chemical constituent and the general characteristics of the soil. We used x-ray diffraction (XRD) and fluorescence techniques (XRF) to analyse the clay mineralogy and soil chemical properties of varieties of soils within south-eastern Nigeria. The XRD involved both powder and oriented clay analyses. The aim was to determine the clay minerals in both whole sample (fine-earth fraction) and the oriented clays. Soils analysed were from floodplain of alluvial deposits to upland soils derived from shale and sandstone geological formation. The XRD patterns of the clay fraction from selected soils indicate that they are well-defined diffractions at 0.72 nm indicating kaolinite as the dominant clay mineral. Kaolinites are mainly the alumina-silicate clays with 1:1 octahedral and tetrahedral relationship. The 2:1 clay minerals present were illite at 1.0 nm for soils formed on the shale formations, interlayer vermiculite (IV) occurred at 1.4 nm again for soils on shales while smectite was observed especially in floodplain soils at 1.8 nm in those soils. The presence of smectite where it occurred, showed that diffraction peaks found between 1.0 and 1.4 nm in Mg-saturated samples shifted to 1.8 nm after the samples were solvated with glycerol, indicating the presence of smectite in various quantities in the soils. The presence of the 1:1 and 2:1 minerals can be used as a basis for grouping of the soils into expanding and non expanding soils. This grouping is very significant in all activities aimed at managing the soils for sustainable productivity. The energy-dispersive x-ray (EDX) analyses of the clays confirm the dominance of Si and Al in the soils. In some of the soils EDX showed the presence of K and Fe as being one of the prominent elemental components of the clay minerals. The geochemical properties of the soils as shown by XRF were dominated by the SiO2, Al2O3 and the Fe2O3 while such elements as MgO, TiO2 and ZrO2 occur in moderate to low quantities. Gibbsite and hematite were the major oxide minerals identified by XRD in the upland soils while lepidocrocites were identified in the floodplain soil types. The other basic elements such as Na2O, K2O and CaO are very low in the soils with very insignificant role to play in their genesis. XRD and XRF are therefore very essential tool in soil clay mineralogy and clan be employed in the study of soil genesis and classification, soil physics and soil chemistry/fertility.