

Formation and characteristics of Spodosols formed on sandstone in the extremely high rainfall area of Sarawak, Malaysia

ABSTRACT

Two Spodosols occurring in Sarawak, Malaysia, were studied to elucidate the physico-chemical properties of the soils and to explain their formation. The pedons derived from sandstone are located at the elevation of 30 to 60 m above sea level. Under high temperature and extremely high rainfall prevailing in the area, the weatherable minerals in the sandstone have been mostly weathered and removed from the soil system, resulting in the accumulation of resistant minerals such as kaolinite, quartz and/or muscovite in the topsoil. The soil materials were subjected to podzolization which eventually formed spodic horizon in the soils at varying depths. At 60 m above sea level where the drainage is excessive, the spodic horizon is about 50 cm thick (having Bh_s and Bs horizons (Arenic Alorthods), while at the lower position with poorer drainage condition, the thickness of Bs horizon is only about 7 cm (Lithic Alaqoud). The spodic horizon in both pedons is compacted, not penetrable by plant roots. The samples from spodic horizons contain carbonyl group conjugated with aromatic ring (having band at 1615 cm⁻¹). This peak is probably attributed to the vibrations of aromatic C=C structural vibrations and C=O stretching of amide, quinone and H-bonded conjugated ketone groups. Carbonyl group occurring in the soils was probably involved in the metal complexation (or ligand exchange) during the podzolization process. The migration of the organo-metallic complexes and its deposition into the subsoil leads to the formation of spodic horizon. The spodic horizon in both profiles is characterized by low pH and high exchangeable Al with trace amount of hematite. Throughout the profiles, basic cations and CEC are very low, consistent with the sandy nature of the soils.

Keyword: Chemical weathering; Sandstone; Spodosols; Spodic horizon; Sarawak