

Research Paper :

Clay mineralogical composition of some soils from Eastern Vidarbha region of Maharashtra in relation to soil properties

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ABSTRACT

Eastern Vidarbha region of Maharashtra experience subhumid climate with annual rainfall 1250 mm. The soils of the region are mostly developed from weathered granite-gneiss / sandstone / schists or alluvium deposited by the river Wainganga / Pranhita. The soils under study were clay to clay loam textured (Clay 32.10 to 64.10 %). These soils had comparatively high sand (10.50 to 40.00 %). The bulk density and hydraulic conductivity ranged between 1.21 to 1.82 Mg m⁻¹ and 0.490 to 2.50 cm hr⁻¹, respectively. These soils were neutral to slightly acidic, noncalcareous and free from salt accumulation. Organic carbon was low to moderate. The X - ray diffractograms suggested the dominance of smectite (MgEgly peak around 1.688 to 1.788 nm) in soils from Pawani, Adyal, Tumsar, Mohadi, Lakhani, (Dist. Bhandara), Mul, Chimur and Nagbhid (Dist. Chandrapur). In these soil clay smectite ranged from 46 to 68 per cent. It was also further confirmed by high CEC (40.00 to 51.2 cmol (p+) kg⁻¹) and fairly high Ca²⁺ and Mg²⁺. The soils from Brahmapuri (Dist. Chandrapur) and Armori (Dist. Gadchiroli) showed the dominance of kaolinite (0.719 nm peak) which was further confirmed by low CEC (20.00 to 23.4 cmol (p+) kg⁻¹) and low exchangeable Ca²⁺ and Mg²⁺. The soils from Jawahar nagar and Sakoli (Dist. Bhandara) showed mixed mineralogy where smectite, illite and kaolinite ranged between 15 to 24 per cent, 14 to 20 per cent and 40 to 47 per cent, respectively. The correlation study indicated the significant positive correlation between smectite and bulk density, pH, CEC ex. Ca and ex. Mg where as significant negative correlation was obtained between illite and kaolinite with bulk density, pH, CEC, ex. Ca and ex. Mg.

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The chemical behaviour of any soil is dependent on soil colloids of which clay constitutes major portion. Soil clays provides a large surface area for physical - chemical activity, thus behaviour is controlled to a large extent by soil clays. Soil properties like swelling, plasticity; moisture retention and release, ion exchange, ion fixation and release, buffering, retention of pesticide residues etc. depends to a large extent on the nature and quantity of the clay minerals present in the soils. Singh *et al.* (1993) reported the dominance of kaolinite in acid soils of Chotanagpur plateau and illite in alluvial soils due to the presence of K - feldspar and biotite in the parent material. It has been shown that the dominance of Mg²⁺ in the exchange complex is conducive for the formation of smectite in the neutral or alkaline environment (Sahu *et al.*, 1986). The magnitude of cation exchange capacity (CEC) of the soils depends on the type of clay minerals and the pattern of their distribution. A thorough knowledge and appreciation of minerals in soil is critical to understand the use of soil for betterment of mankind and to protect environment. Identification and characterization of clay material aid in evaluating the soils in relation to genesis and classification. The information in general about

physical, chemical and mineralogical details will definitely held in suggesting significant sound data set for profitable agriculture as well as many more secondary application. Most of the earlier work on nature and distribution of clay minerals in Indian soils was mainly confined to identification of the dominant clay mineral (Ghosh and Kapoor, 1982; Ghosh and Datta, 1996) but the information on quantitative mineralogy was lacking. While studying clay mineralogy of Vertisols of central peninsular India, the dominance of smectite was reported by many workers (Kaswala and Deshpande, 1986; Pal and Deshpande, 1987; Pharande and Sonar, 1997; Padole and Thakare, 1999). Systematic information on the clay mineralogy of the soils and its relationship with physical and chemical properties of the soils in Maharashtra, particularly of Eastern Vidarbha region is lacking. Therefore, an attempt has been made to study the mineralogy of clay fraction of the soils of Eastern Vidarbha region of Maharashtra in relation to physical and chemical properties.

MATERIALS AND METHODS

Twelve surface (0-0.30m) soil samples from Bhandara, Chandrapur and Gadchiroli districts of Eastern