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Effect of Humic Acids on Agricultural Soil Structure and Stability and Its Implication on Soil Quality

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Abstract : The functional and morphological aspects of soil structure determine the soil quality. The dispersion of colloidal soil particles, especially the clay fraction and rupture of soil aggregates, both of which play an important role in soil structure development, lead to degradation of soil quality. The main objective of this work was to determine the effect of the behaviour of soil colloids on the agricultural soil structure and quality. The effect of commercial humic acid and soil natural organic matter on the electrical and structural properties of the soil colloids was also studied. Agricultural soil, belonging to the sandy loam texture class from northern part of India was considered in this study. In order to understand the changes in the soil quality in the presence and absence of humic acids, the soil fabric and structure was analyzed by X-ray diffraction (XRD), Fourier Transform Infrared (FTIR) Spectroscopy and Scanning Electron Microscopy (SEM). Electrical properties of natural soil colloids in aqueous suspensions were assessed by zeta potential measurements at varying pH values with and without the presence of humic acids. The influence of natural organic matter was analyzed by oxidizing the natural soil organic matter with hydrogen peroxide. The zeta potential of the soil colloids was found to be negative in the pH range studied. The results indicated that hydrogen peroxide treatment leads to deflocculation of colloidal soil particles. In addition, the humic acids undergoes effective adsorption onto the soil surface imparting more negative zeta potential to the colloidal soil particles. The soil hydrophilicity decreased in the presence of humic acids which was confirmed by surface free energy determination. Thus, it can be concluded that the presence of humic acids altered the soil fabric and structure, thereby affecting the soil quality. This study assumes significance in understanding soil aggregation and the interactions at soil solid-liquid interface.

Keywords : humic acids, natural organic matter, zeta potential, soil quality
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