

## CHAPTER - II

### Scope and Object of the present investigation

Humic, humatomelanic and fulvic acids are the essential components of soil humus. By virtue of the existence of charged sites in their polymeric architecture, these weakly acidic compounds exhibit interesting properties of the class of compounds commonly known as polyelectrolyte. These natural weak acid polyelectrolytes have been found to be widely distributed in soils, sediments, animal wastes, lakes, streams and certain biogenic deposits, where they form water soluble and water insoluble complexes with metal ions. These compounds play a predominant role in weathering process and they are involved in the migration and subsequent deposition of mineral substances in sediments. From a pedological point of view complexing of metal ions by humic substances is important in leaching and podzolization. It is also known that the availability of micronutrients to plants and microorganisms is greatly influenced by the complexation of these metal ions with humus materials. As a result, the study of soil organic matter - metal ion interactions is of considerable interest in soil science and aquatic chemistry. Interest has also been stimulated to study the ability of complexation of toxic heavy metals with soils and sediments by the increasing problems associated with the introduction of certain toxic heavy metals (e.g., Cd, Pb etc.) in the environment. A very important

characteristic of a soluble metal-organic matter complex is its stability constant, the value of which provides a quantitative measure of the affinity of the metal for the ligand. Numerous attempts have been made to reveal the physico-chemical behaviour of this group of natural polyelectrolytes as well as the behaviour of different inorganic and organic cation towards them. To determine the stability constants of the metal complexes, different authors applied different techniques. But none of them is really unequivocal.

The technique of polarography is well known for its versatile application in solving problems of different branches of chemistry. Unfortunately this excellent technique has rarely been utilised by scientific workers in this field.

Besides these, pesticides in general and the organic pesticides in particular occur at present in detectable amounts in many parts of the environment. An understanding of the fate and behaviour of biologically active substances in the total environment is a necessity for the chemicals to be used safely and for new products to be developed which will not produce adverse effect. The interactions of organic pesticides with particular components in surface waters and soil systems according to the chemical properties of the compounds and their behaviour in these systems are thus important. Some of such studies have been done by different authors, yet much is yet to be known with regard to the nature of the complexing sites,

nature of linkages and the extent of such interaction.

Keeping all these in view the object of the present investigations have been chosen. Different aspects covering the present work are as follows:

(a) Studies of some of the physico-chemical behaviour (potentiometric, polarographic and spectrophotometric) of the soil and peat humic and hymatomelanic acids and comparison of the findings with those of some synthetic model humic and hymatomelanic acids.

(b) Studies on the interaction of some heavy metals e.g., Zn(II), Cd(II), Co(II), Cu(II) and Pb(II) with soil and peat humic and hymatomelanic acids at different pH and neutral salt concentrations. Attempts have been made to determine the stability constants of the soluble metal-humic and hymatomelanic acids obtained from different natural sources by a comparatively simpler polarographic technique. The values of the constants have been compared with those of metal-synthetic humic and hymatomelanic acid complexes. Different aspects regarding the interaction such as the influence of hydrogen ion concentration, as well as of neutral salt concentration and the cooperative effect of the neighbouring sites of the humic and hymatomelanic acids etc. have also been worked upon.

(c) Studies on the ability of different inorganic cations having different hydrated ionic volumes and valences, towards

the release of the organic herbicides cations e.g., diquat<sup>2+</sup> and paraquat<sup>2+</sup> from the corresponding humic acid complexes. The result of the study is expected to give a clear picture about the nature of binding of these herbicide cations with humic acids.