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BOOK REVIEW

Formation and Properties of Clay-Polymer Complexes, by B. K. G. Theng, Elsevier Scientific Publishing Company, Amsterdam and New York. Developments in Soil Science 9. 1979. xii + 362 pp. $58.75 (Dfl. 132.00).

There is obviously a strong case for studying the formation and properties of clay-polymer complexes. Clay-polymer complexes are widespread in their occurrence. The complex formed between clays and polymeric organic constituents of soils exerts a profound effect on soil properties. Through combination of clays with organic polymers new materials with interesting and novel properties can be produced, valuable in a wide range of industries.

Dr. Theng has assembled in a coherent and clearly presented form the diverse information on the formation and properties of such complexes that is currently available. This is no easy task. The information comes from many sources, most notably from soil science and clay studies, as well as from colloid science and many other areas of applied chemistry. Dr. Theng has searched widely and brought together a wealth of references.

He introduces the book with a chapter on the structure and surface chemistry of the clay minerals. This is essential for an appreciation of the topic, although one might have wished for more attention to the hydrous oxides and their surface chemistry, as these materials often determine the clay-polymer interaction. A similar chapter on relevant aspects of polymer chemistry would also have been welcome. Nevertheless, some attention is given to polymer chemistry in the second chapter dealing with "Polymer Behavior at Clay and Solid Surfaces."

The importance of the entropy factor in the binding of organic polymers to clay surfaces is rightly given prominence. An important difference between adsorption of polymers and that of small organic molecules is the dominant role that the entropy factor often plays in polymer adsorption. There is now substantial experimental and theoretical work which shows that release of adsorbed solvent molecules following adsorption of a polymer leads to a substantial net gain of translational entropy. Thus, strong adsorption can take place even when heats of adsorption are small or even negative. Correspondingly, increase in temperature may have little effect on the strength of adsorption, or even increase it.

The remainder of the book is divided into two parts and deals respectively with synthetic polymers (83 pp.) and naturally occurring organic materials (159 pp.). The latter materials include proteins, nucleic acids, viruses, polysaccharides, lignosulphonates, and humic substances.

It is not surprising to find, with such a wide range of materials, that the information available does not present a particularly coherent picture. Lack of critical detail relating to both the clay surfaces and the constitution of the organic polymer often makes interpretation difficult. Dr. Theng is generally scrupulous in the attention he gives to inclusion of essential details in reporting on the studies which have been made and prefers to report accurately what has been found, rather than develop his own hypotheses regarding the processes which occur. At the present stage of development of the subject, this is probably the correct approach. From the data assembled, however, it becomes very clear that interactions between surface and polymer are often secondary to those between molecules within the adsorbed phase, notably water, and between these molecules and ions at the surface. If a criticism can be made of the author's general treatment, it is that he gives insufficient attention to the role of water or other solvents at the solid surface and to the differences that arise between constant charge surfaces of 2:1 type minerals and constant potential surfaces of the hydrous oxides. Nevertheless, this work is an important contribution to the literature, and Dr. Theng is to be warmly congratulated in producing a worthy complement to his earlier text on "The Chemistry of Clay-Organic Reactions." Dr. Theng has done exceptionally well in organizing and arranging the material to develop a text that will be an essential reference volume for all those interested in the complexes formed by clays and other solids with organic polymers for many years to come.

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