INAGAKI LABORATORY (September 1960~)

Head: Dr. Hiroshi Inagaki

In 1960 this laboratory was established after Dr. Inagaki was appointed professor of this University. Since 1954 he had been a member of Horio Laboratory of this Institute, and his research works made during the period 1954–1960 are included in the list of publications attached to the end of this description. In the following the research projects having been made to date and being now in progress will be mentioned briefly.

I. Polymer Electrolytes in Solution[1-8]

Our first concern was to treat the problem of the expansion of a charged polymer chain, which may be reflected on the intrinsic viscosity of its solution. Thus the extraneous salt concentration dependency of the intrinsic viscosity was studied using the system sodium carboxymethyl cellulose and water, and the concept of "*effective charge*" of polyelectrolyte was deduced from the experimental results. In this connection, the osmotic pressure of polyelectrolyte solutions was investigated, and an attempt to analyze the osmotic pressures in terms of the effective charge was made. This project has been again taken in this year to study the influence of stereospecificity upon polyelectrolytic properties using isotactic poly (2-vinyl pyridine).

II. Solution Properties of Neutral Polymers[9-16]

The weight average molecular weight is the most important information for discussing thermodynamic properties of polymer solutions. The light scattering method has been known to be a quite promising tool for this purpose. Thus our first attention was payed to constructing a light scattering photometer which allows one to determine the molecular weight as well as the radius of gyration of solute molecule. Using the apparatus thus constructed the thermodynamic properties of polyvinyl alcohol in water were studied. At the same time, the apparent specific volume of macromolecules in solution was discussed on the basis of the statistical thermodynamical theory.

III. Application of Ultracentrifugal Methods[17-25]

In addition to the light scattering method, ultracentrifugal methods are investigated for determining the weight average molecular weight. The Archibld theory has been extended to thermodynamically non-ideal multicomponent systems. The validity of the derived equation has been tested experimentally using two Theta solvent systems as well as various good solvent systems of polystyrene and polymethyl

methacrylate.

IV. Excluded Volume Effect and Conformations of Stereospecific Polymers[26-32]

The configurations of flexible chain polymers in solution deviate from the statistics of random flight when the long ragne interactions act between segments -the excluded volume effect. This effect upon the intrinsic viscosity $[\eta]$ has been experimentally studied. Recently a tentative equation for determining the unperturbed dimensions of chain polymers with $[\eta]$ and M_w relationships has been proposed, and its validity is tested experimentally. Syndiotactic and isotactic propylene polymers have been prepared and investigated of thier unperturbed dimensions using our equation. A hypothesis for retention of chain conformations in solution has been proposed on the basis of experimental result. The formation mechanism of primary nuclei of dilute solution grown single crystals is studied in due course of the above investigation.

As an extension of this subject, we have been studying the behavior of a single macromolecule influenced by the excluded volume effect in the shearing flow field. Our primary concern is to find out experimentally the general feature of non-Newtonian intrinsic viscosities in regard to various molecular parameters such as solute molecular weight, solvent power etc.

V. Copolymers in Dilute Solutions[33-38]

Dilute solution properties of random and block copolymers are studied. One of the purposes is to establish a physical method which enables us to determine the mode of monomer arrangement. The other one is to explain the properties as functions of the monomer composition as well as the mode of monomer arrangement. In parallel to the block polymer studies we have been studying the terminal group effect on the dilute solution properties.

VI. Rheological Properties of Polymer Solutions[39-41]

One of the staffs (T.K.) had been engageing in the study of rheological properties, specifically of normal stress phenomona, of polymer solutions in collaboration with the Physical Chemistry Laboratory, Dept. of Industrial Chemistry of this University. A summary of the study will appear in Ref. 41.

VII. Gel Permeation Chromatography

Columns containing crosslinked polystyrene gels prepared in the presence of diluents have been found to be capable of fractionating polymeric samples in organic solvents (Moore: 1964). We are studying now preparation of a new type of the gel in order to improve the mechnical stability of gel, and the fractionation mechanism.

Publications

(* indicates an article published in Japanese)

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