The Solubility Behavior of Poly(ethylene Oxide) Materials

Attention is called to the paper by Bailey and Callard[1] describing the solubility properties of aqueous solutions of poly(ethylene oxide) for the purpose of pointing out the striking similarity in the behavior of this surface inactive material and that of certain lower molecular weight surface-active agents composed of poly(ethylene oxide) chains to which a hydrophobic group like octyl phenol is attached.[2] It is interesting, and to some degree surprising, that the poly(ethylene oxide) chain displays the same type of inverse solubility behavior with respect to temperature as the lower molecular weight nonionic surfactant. The direct effect of pH on these two solute types is equivalent insofar as the data are comparable. The effects of added electrolyte on the dilute solution cloud points are the same, both in their salt concentration dependence and in the order of effectiveness of anions and cations. The order of anion effectiveness on the solubility of these materials is, according to expectation, in the order of decreasing ion radius (and increasing ion hydration) while the reverse is true of the cations. This is also in general agreement with the turbidity data of Doscher et al.[3] for a similar nonionic amphipathic material.

It would be of interest to observe the effects, if any, of organic liquids of varying polarity on the cloud point behavior of Bailey's material. These compounds exert profound effects on the poly(ethylene oxide)-octyl phenol adduct type, probably through their influence on the solubilization phenomenon.[2] Since there is little reason to expect linear poly(ethylene oxide) to micellarize in aqueous solution, any effects of this type which are observed would be of some moment. The introduction of branching may produce notable modifications in the solubility behavior of poly(ethylene oxide) in the presence of added salts and nonpolar liquids.

References

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3. T. M. Doscher, G. E. Myers, and D. C. Atkins, Jr., *J. Colloid Sci.*, **6**, 223 (1951).

WILLIAM N. MACLAY

The B. F. Goodrich Company
Research Center
Brecksville, Ohio

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