

Interpolymer association between phenolic copolymers and polyelectrolytes: effects of copolymer structure and hydrophobic interactions on the stability of polycomplexes

S. K. Chatterjee*, Vandana Dureja, Shalini Nigam

Department of Chemistry, University of Delhi, Delhi-110007, India

Received: 7 February 1996/Revised version: 16 April 1996/Accepted: 18 April 1996

Summary

Phenolic copolymers have been prepared with two different feed compositions from some typical phenolic monomers, such as, p-Chlorophenol, p-Cresol and p-Aminophenol. They have been characterized by known methods. Some interpolymer complexes of the phenolic copolymers have been prepared with polyelectrolytes, such as poly(methacrylic acid) (PMA) and poly(ethylene imine) (PEI). The degree of linkage, stability constant, enthalpy and entropy changes of the systems were determined at several temperatures. Interpretations have been sought in terms of the various interacting forces involved in the complex formation.

Introduction

Interpolymer complexes occupy a unique position in the field of polymer science in view of their potential applications in medicine and industries (1-3). Though considerable amount of work has been reported in the literature during the last decade on polyelectrolyte and hydrogen bonding complexes in aqueous and organic solvents (1-8), but very little information seems to be available on phenolic copolymer-polyelectrolyte interactions, particularly in water-organic solvent mixtures. Phenolic copolymers provide unique systems in view of the presence of intramolecular hydrogen bonding in them (9-11), and also one could incorporate various coordinating groups (e.g. $-NH_2$, $-OH$, $-COOH$) in these copolymers which could be complexed with the functional groups of specific polyelectrolytes. Polyelectrolyte complexes of phenolic copolymers may possibly find wider application in industries compared to phenolic resins as such. Keeping this object in mind, we have made an attempt to probe into the mechanisms of interaction of p-Chlorophenol-p-Cresol-p-Aminophenol-formaldehyde (PCIP-PC-PAP) copolymer, with two typical polyelectrolytes, such as poly(methacrylic acid) (PMA), and poly(ethylene imine) (PEI) in DMF- H_2O and DMSO- H_2O mixtures. The two solvents, DMF and DMSO differ in their dielectric constant, hydrogen bonding ability, and in the degree of solvation of the component polymers. All these factors are likely to influence interpolymer complex formation. Unlike in pure organic solvents, presence of water in mixed solvent media is likely to make interpolymer complexes more stable due to hydrophobic interactions. One could predict the relative stability of the interpolymer complexes, on the basis of characteristics of solvent media, as well as on the mode of interaction between the pairs of interacting units. Therefore, determination of stability constant (K), and degree of

* Corresponding author