Thermodynamic Studies of Some Complexation Systems Involving Methacrylic Acid-Acrylamide Copolymer, Poly(vinyl Pyrrolidone) and Poly(Ethylene oxide)

S. K. CHATTERJEE,* MAMTA CHHABRA, and SHALINI JOHRI

Department of Chemistry, University of Delhi, Delhi-110 007, India

SYNOPSIS

Interpolymer complexes of methacrylic acid-acrylamide copolymer have been prepared by the interaction of its comonomer units with two different homopolymers, and also with a single homopolymer. The stability constants and related thermodynamic parameters (e.g., ΔH^o and ΔS^o) of the mixed complex were found to be significantly different from the single homopolymer complexes. This has been attributed to neighboring group influence and destabilization of various interacting forces at different temperatures. © 1994 John Wiley & Sons, Inc.

Keywords: stability constant • thermodynamic parameters • acrylic copolymer • neighboring group

INTRODUCTION

During the last decade, a considerable amount of work has been reported in the literature regarding polymer–polymer interactions.[1,2] However, very little quantitative information is available regarding the copolymer–homopolymer interactions.[2] Formation of three component interpolymer complexes is interesting in view of the fact that both the comonomer units of the copolymer can interact with either of the component homopolymers. Moreover, the stability constant and related thermodynamic parameters of the complex formed between a copolymer and only one type of homopolymer may be significantly different from the complex formed between the copolymer with two different homopolymer units. One would expect that the sequence distribution of homopolymer units on the copolymer chain would influence the stability of the complex, due to neighboring group influence. Keeping this object in mind, we have studied the interaction of methacrylic acid-acrylamide copolymer (MA-AAm) with poly(vinyl pyrrolidone) (PVP) and poly(ethylene oxide) (PEO). Interestingly, the stability

constant (K) and related thermodynamic parameters of the mixed complex, e.g.,

~MA—AAm~
~EO~~VP~

were found to have much higher values, compared to single homopolymer complexes of the copolymer, e.g.,

~MA—AAm~   and   ~MA—AAm~
~VP—VP~   ~EO—EO~
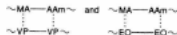
In this article, an effort has been made to explain the discrepancies in terms of neighboring group influence and relative interacting ability of various reacting units involved in the complex formation.

EXPERIMENTAL

Poly(vinyl Pyrrolidone) (PVP)[3]

PVP was supplied by Fluka U.S.A. in the form of white crystalline powder. The weight average molecular weight ($\bar{M}_w$) of the polymer was calculated from viscosity measurements using the following equation: