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Effect of NaCl additive on solute-solvent interactions in aqueous polyethylene glycol-sodium sulfate two-phase systems

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Highlights

Solvent properties of aqueous poly(ethylene glycol)-8000-sodium sulfate aqueous two-phase systems containing 0.215 M NaCl and 0.5 M osmolyte (sorbitol, sucrose, trimethylamine N-oxide) and poly(ethylene glycol)-10000-sodium sulfate aqueous two-phase system containing 0.215 M NaCl are characterized
Partitioning of eight organic compounds and six proteins in the systems are examined
Partition behavior of all solutes is considered in terms of solute-solvent interactions
It is established that NaCl additive interacts with the solutes in the presence of exceeding amount of sodium sulfate

Abstract

Partition behavior of eight small organic compounds and six proteins was examined in poly(ethylene glycol)-8000-sodium sulfate aqueous two-phase systems containing 0.215 M NaCl and 0.5 M osmolyte (sorbitol, sucrose, TMAO) and poly(ethylene glycol)-10000-sodium sulfate-0.215 M NaCl system, all in 0.01M sodium phosphate buffer, pH 6.8. The differences between the solvent properties of the coexisting phases (solvent dipolarity/polarizability, hydrogen bond donor acidity, and hydrogen bond acceptor basicity) were characterized with solvatochromic dyes using the solvatochromic comparison method. Differences between the electrostatic properties of the phases were determined by analysis of partitioning of sodium salts of dinitrophenylated (DNP-) amino acids with aliphatic alkyl side-chain. The partition coefficients of all compounds examined (including proteins) were described in terms of solute-solvent interactions. The results obtained in the study show that solute-solvent interactions of nonionic organic compounds and proteins in polyethylene glycol-sodium sulfate aqueous two-phase system change in the presence of NaCl additive.

Keywords: Aqueous two-phase system; partitioning; proteins, solute-water interactions; solvatochromic comparison method; solvent properties

1. Introduction

Aqueous two-phase systems (ATPSs) formed in aqueous mixtures of a single polymer and specific salt, such as polyethylene glycol (PEG) and sodium sulfate, phosphate or citrate, are