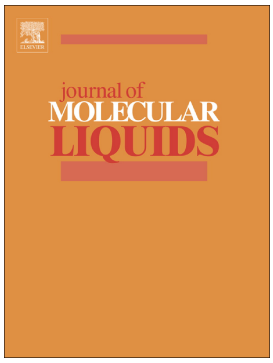

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Salting-out and salting-in effects of organic compounds and applications of the salting-out effect of Pentasodium phytate in different extraction processes

Gabriel Grundl, Martina Müller, Didier Touraud, and Werner Kunz*

Abstract

The influence of different uncharged and charged organic compounds on the Lowest Solution Temperature (LST) of a water/dipropylene glycol propyl ether (DPnP) mixture is investigated. Depending on the additives' nature, a salting-out or salting-in behavior could be observed. For the binary mixture, a salting-out effect is associated with a decrease of the LST with increasing additive concentrations. The reverse effects are observed with increasing salting-in additive concentrations. Typical sugars, short carboxylate sodium salts, ammonium organic salts and amino-acids were found to be salting-out, whereas all studied sweeteners and organic acids showed a salting-in behavior. The Pentasodium phytate ((Phy^{5-}, $5Na^{+}$)) was found being the most efficient organic salting-out compound. Three possible applications were investigated in order to compare the salting-out effect of (Phy^{5-}, $5Na^{+}$) to classical inorganic salts. First, the liquid-liquid extraction of 5-hydroxymethylfurfural (HMF) was investigated and compared to former results obtained using lithium, sodium and aluminium sulfate salts. Secondly, we considered a liquid-liquid, ethanol-water separation and compared the results to the one obtained using ammonium sulfate and potassium pyrophosphate. Finally, the salting-out effect of (Phy^{5-}, $5Na^{+}$) on glycerol was investigated and also compared to the inorganic salts, sodium chloride and lithium sulfate as well as potassium and sodium phosphates.

Due to higher water solubility, (Phy^{5-}, $5Na^{+}$) allowed a more pronounced separation of HMF than the tested sulfate salts. This high water solubility drives also to a more pronounced separation of ethanol in comparison to ammonium sulfate; potassium pyrophosphate being the most water soluble and most efficient salt to separate ethanol and water. The use of (Phy^{5-}, $5Na^{+}$) and potassium pyrophosphate showed a salting-out effect on glycerol in contrast to the inorganic salts sodium chloride and lithium sulfate for which a salting-in effect on glycerol was observed. The salting-out effect of sodium triphosphate was limited by its water solubility.

Keywords: salting-out, salting-in, organic compounds, pentasodium phytate, separation