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Quantitative Determination of Protein Solubility in Ionic Liquids

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Proteins are often utilised for a range of applications in the pharmaceutical, biological, chemical and food industries[1-2]. The ideal solvent for hydrophilic proteins is usually buffered water due to its minimal cost, and ability to mimic the native environment of proteins, however many proteins are hydrophobic and have poor solubility in water. Because of this, organic solvents have been investigated as an alternative solvent for biocatalysis[3] and protein extraction[4], but often have detrimental effects on the protein stability and structure. We propose to use ionic liquids (ILs) as an alternative solvent, or as an additive in aqueous solutions, to quantify the solubility and stability of proteins. Initially the model protein lysozyme will be tested in ILs from highly dilute to neat. A novel, high throughput method has been developed to quantitatively determine the solubility of lysozyme. The aim is to explore specific-ion effects and how these differ for concentrated IL solutions compared to conventional dilute salts. A variety of techniques including UV/vis spectroscopy, Fourier-transformation infrared spectroscopy, circular dichroism and small angle x-ray scattering will be used to describe the stability and structure of the protein, and to gain insight into its interactions with ILs. It is hoped that any solubility trends present for lysozyme or specific ions can then be extrapolated to other proteins. Further studies will be done to compare any variations in the specific ion effects on different proteins and to begin building a database of quantified protein solubility and stability in ILs.

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