High-performance biohybrid blends composed of guar gum and deep eutectic solvents

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Physical ionogels are an emerging class of functional materials, resulting from the simple mixing of ionic species and a polymer matrix [1]. For this purpose, guar gum constitutes a promising candidate as polymer matrix. Guar is a galactomannan composed of a β-1.4 mannose backbone bearing α-1.6 galactose moieties randomly distributed in C-6 position with interesting attributes linked to its natural origin, such as a semi-rigid character and an ability to impart viscoelasticity in solvent medium. This polysaccharide also displays a moderate hydrophilicity, a relatively high thermal stability and very high molecular weights polymers are commercially available. Over the last few years, our group has investigated the synergistic interactions between guar gum chains and imidazolium-based ionic liquids (ILs) to prepare high-performance ionogels [1-3]. ILs are salt with particularly low molten temperature, high thermal and chemical stability, low volatility and exceptional conductivity [4]. However, imidazolium derivatives are expensive and originate from a quite hazardous multi-step synthesis. In order to circumvent these limitations, we explore here another class of neoteric solvents, i.e. Deep Eutectic Solvents (DES) [5], which are typically prepared by simply mixing two H-bonding small molecules, as an alternative of ILs to prepare guar/DES blends with interesting attributes. Literature survey showed the possibility to exploit nontoxic and biosourced molecules to safely design relevant DES with tailorable properties [6-8]. This talk is inscribed in this context and aims at presenting the results concerning i) the elaboration of a large series of choline chloride-based DES and ii) the preparation and the characterization of guar/DES blends. In particular, the solvent ability of DES to dissolve guar is discussed, and the properties of the most promising guar/DES blends are investigated by rheological measurements, thermogravimetric analysis, broadband dielectric spectroscopy and small and wide angle X-ray scattering measurements.