

The available cotton raw material cannot keep up with this growing demand for natural textile fibers. Knowing this, the forest-based industry is active on developing man-made cellulose fibers from wood as an alternative source for man-made textile fibers.

Superbase – based ionic liquids (SILs) were developed as a safe and green alternative for cellulose dissolution and regeneration. From first generation SILs, [mTBDH][OAc] has demonstrated its potential at pilot scale, but it has stability issues with the water involved in the cellulose spinning process. As such, the bicycling guanidine superbases are a large group of possible structures and allow for tailoring their properties for targeted purposes. Our goal in the GRETE project has been to screen and synthesize stable, but yet water miscible SILs for industrial processes targeting for cellulose utilization. To achieve this, there exists a challenging list of requirements, such as low toxicity, cost, melting point or high recyclability, hydrolytic stability and synthesis efficiency - all these combined with safety and non-toxicity.

As an outcome of the research, we have generated a range of SILs that vary in their hydrophobicity and physical properties. Their individual characteristics prompted us to screen these new structures as a solvents for non-cellulosic fibers (synthetic and natural), in addition to cellulose. It turns out that many of the tested materials can be dissolved in SILs, and the dissolution capacity for a given polymer/material is highly dependent on the hydrophobicity of the superbase of the SIL (i.e. the cation). For example, Nylon-6 represents a challenge for normal solvents, but dissolves readily in highly hydrophobic SILs. On the other hand, more hydrophilic SILs dissolve readily natural fibers, like silk or wool. General trends for dissolution capabilities of different SILs for different materials are presented. The current work opens new doors towards utilization of textile fiber mixtures and for preparation of novel composite or blend materials.