

# Switchable Ionic Liquids in Biorefining: from fractionation and pretreatment to catalysis and nanocellulose

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For centuries the Nordic countries have been relying on their natural resources, particularly forest, to make value-added products exported throughout the world and, at the same time, helping the societies to create wealth, job opportunities and social welfare. The global changes taking place today have gradually rendered these industries less competitive and profitable upon increasing competition from, particularly, Asia and South America when the consumption of such bulk products like paper and pulp have declined in the western world. The rise of the digital era, i.e. increasing use of electronic information and documentation, has meant that the volumes needed are in the decline in the developed world whereas the developing world still has room for growth in these products. Consequently, the industry has been forced to adapt and change, moving a lot of production capacity to there where the demand is. At the same time, increasing efforts are made to transform and trim the production in the original 'homeland' mills partly towards new, more innovative and more sophisticated products but also 'back-to-basics' i.e. packaging solutions based on cellulose. Moreover, importantly, there is a strong incentive and drive to move towards production of various value-added, modern biorefining solutions covering the areas of bio-based energy, transportation and chemical commodities.

To meet the future challenges we have been developing an entirely new concept for biorefining utilizing 'switchable' ionic liquids (SILs) to fractionate biomass to its constituents while still to a large extent retaining their native structure [1-11]. Further, the very same SIL technology can be used for CO<sub>2</sub> or other acid gas capture and mitigation, productions of superior nanocellulose, as a medium of catalytic reactions including both bio- and supported heterogeneous catalysis as well as pre-processing/pretreatment and detoxification of biomass for e.g. fermentation processes.

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