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High throughput synthesis and Characterisation of Protic Ionic Liquids

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Ionic liquids (ILs) are tailorable solvents with a vast number of potential cation and anion combinations. ILs have many potential applications in fuel cells, organic and inorganic synthesis and as biological solvents. Currently the tailorability of ILs is underutilised with most studies optimising the choice of IL for a specific application using < 20 candidates. Protic ILs (PILs) are a subset of ILs which are simple to synthesise, through proton transfer from a Bronsted acid to a Bronsted base. Here we developed a high throughput (HT) automated method to synthesis and dry a library of 48 PILs, comprising alkyl carboxylic acids paired with alkylamines.[1] Desirable properties were identified using visual screens for surface tension, viscosity and melting points. HT analysis of their liquid nanostructure was obtained using small and wide angle X-ray scattering (SAXS/WAXS) at the Australian Synchrotron. The nanostructure consisted of polar and non-polar domains, with intercalation of the alkyl chains on the cation and anion and charge alternation of the polar groups. The nanostructure depended on the relative length of the alkyl chain on the cation and anion, and to our knowledge has not previously been reported. The HT methodology and screens are widely applicable to the synthesis and drying of PILs, are at least 20 times faster, and significantly less labour intensive than conventional techniques. Our method can be scaled up and combined with design of experiment methodologies to develop vast libraries of PILs .

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