New Halogen-free Ionic Liquids – Synthesis, Properties and Applications

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Ionic liquids are generally considered as green solvents mainly due to their lack of vapor pressure. In fact, environmental and safety problems arising through the volatility of organic solvents can be avoided by the use of these innovative liquids.
However, typical ionic liquids consist of halogen containing anions (such as $[AlCl_4]^-$, $[PF_6]^-$, $[BF_4]^-$, $[CF_3SO_3]^-$ or $[(CF_3SO_2)_2N]^-$) which restrict to some extend their 'greenness'. The presence of halogen atoms may cause serious concerns if the hydrolysis stability of the anion is poor (e. g. for $[AlCl_4]^-$ and $[PF_6]^-$) or if a thermal treatment of spent ionic liquids is desired. In both cases additional effort is needed to avoid the liberation of toxic and highly corrosive HF or HCl into the environment. Moreover, the presence of fluorine atoms in the anion has a significant impact on the cost of the ionic liquid production which may restrict technical application of these materials seriously.
In our contribution, we present synthesis, properties and application of several new, halogen-free ionic liquids (such as e. g. 1-*n*-butyl-3-methylimidazolium ([BMIM]) [*n*-$C_8H_{17}OSO_3$]). Most of the investigated systems are based on anions known from technical surfactants or modifiers. The resulting new ionic liquid systems are characterized by their high technical availability (at relatively low cost) and by their well documented toxicology (at least for the anion part) thus making these systems highly interesting candidates for industrial bulk applications.