Mass Spectrometry of Room Temperature Ionic Liquids

Glen P. Jackson, Sheng Dai, Douglas C. Duckworth
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831-6375

Room temperature ionic liquids (RTILs) have provided something of a boon for synthesis, catalysis, electrochemical and separations investigations.[1-4] These novel solvents are unlike conventional molecular solvents in that they are composed entirely of charged ions. It is hoped that RTILs will provide a more environmentally benign media than harmful organic solvents that are currently used to perform the vast majority of reactions and separations in chemical laboratories.[5-7] As more reports emerge each month about novel applications involving ionic liquids it has become apparent that considerable work remains for analytical chemists to determine the nature and content of RTILs before, during, and after their desired applications. This study will present the use of mass spectrometry to determine the content of RTIL and aqueous phases, as applied to liquid-liquid extractions. The approaches presented are applicable to other applications in which the content of the RTIL requires determination.

RTILs have provided very efficient extraction coefficients for metal ions in aqueous media,[8, 9] but very little is known about the nature of the metal ion in the RTIL. Crown ethers dissolved in RTILs can enhance extractions,[9] but the composition of the metal ion complexes in the RTILs are not known. Electrospray ionization (ESI) is used with a quadrupole ion trap (QIT) mass spectrometer in an attempt to provide insight into these issues, and is found to be a useful approach to obtaining gas phase ions of these very-low-volatility liquids. ESI is also used to determine the back extraction of the RTIL into the aqueous phasea potential problem for future applications. The pros and cons of ESI, as applied to RTILs and its trace impurities will be discussed, as well as other ionization strategies.

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