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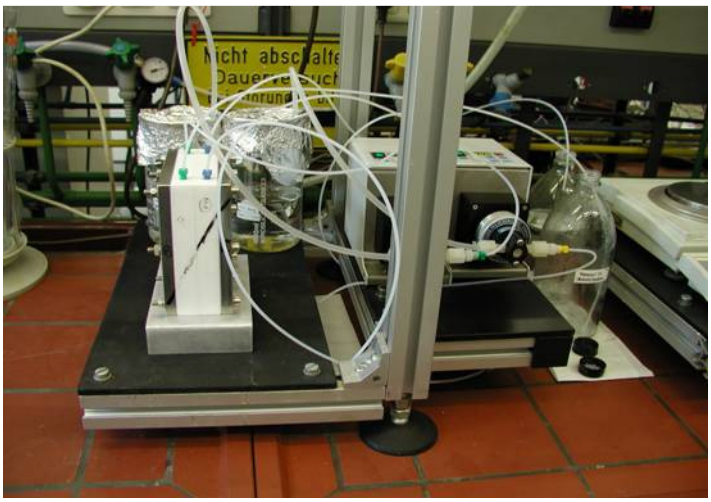
Production of valuable ionic liquids by an ion-exchange membrane dialysis system

Ionic liquids (ILs) have gained much application recently as a very important class of non toxic, non volatile environmentally friendly solvents in (bio)catalysis -applicable to many ionic, polar and nonpolar structure groups- and as efficient electrolytes (**WASSERSCHEID AND WELTON 2003**). In this field, the production of some valuable ILs by means of dialysis with ion exchange through a membrane can represent a feasible and eco-friendlier alternative for obtaining high-purity ILs. Membrane-based systems are an efficient and cost-effective mechanism for selective separation and purification in downstream processes; they have proven so in the separation of organic compounds, among other application examples (**KÖNIG AND RIEDL 2002**). Among them, ion exchange membranes (IEM), based on polymeric charged symmetric membranes, have become of common use for separation in liquid-liquid extraction processes. Their main advantage is their more continuous mode of separation compared to ion exchange resins. And among membrane systems, Donnan-dialysis is particularly interesting because, unlike electrodialysis, it does not need electric energy.



The aim of our work is to apply this concept to efficiently obtain 1-ethyl 3-methyl imidazolium acetate (EMIMAc), an IL with an important application as electrolyte in electrophoresis. EMIMAc is currently produced by metathesis assisted with a heavy metal salt, with a high production cost compared to other ILs (**BASIONICS BASF 2004**). Besides inhibition effects from impurities, potential health and environmental hazards may result due to residual heavy metal content in the product.

As reagents, 1-ethyl 3-methyl imidazolium chloride (EMIMCl) and sodium acetate (NaAc) solutions were employed. A module system was used, consisting of an IEM with flow channels at each side and an equivalent length of 10 m, which was set up in lab scale for a continuous countercurrent operation at T_{AMB}, with laminar flow from both solutions at each side of the membrane. This process is followed by additional vacuum distillation, which results in a highly purified IL. It is shown that a degree of conversion to EMIMAc of as high as 99% was achieved in the product and that the experimental results were in good accordance with the ion transfer curve modelling.

BASIONICS BASF: *Ionic liquids Catalogue.* BASF, 2004.
KÖNIG A., RIEDL W. : Membrangestützte Flüssig-Flüssig-Extraktion bei der Caprolactamherstellung. *Chem Ing Tech*, 74 (2002), 645-646.
WASSERSCHEID P., WELTON T.: *Ionic liquids in synthesis.* Wiley-VCH. Weinheim, 2003.