Electrochemistry in Ionic Liquids: "Green" Approach to the Classical Organic Reactions

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Nowadays there is an increasing need for developing and producing more chemical products to satisfy all the society requirements. In this sense, research in green chemistry plays a central role in improving quality life while maintaining industrial interests. For instance, current green chemistry research has focused on the use of environmentally friendly substitutes for organic solvents in several important fields, such as organic-inorganic synthetic procedures, polymerization, catalysis and gas separation.

A plausible strategy to make greener several chemistry processes is based on the combination of electrochemistry and Ionic Liquids (ILs) as green solvents for obtaining high value added products (Figure 1). Some of the advantages that electrochemical techniques offer include easy control, high process selectivity, mild chemical and process conditions, safe operation, novel chemistry available and electron as inexpensive reagents. In addition, there has been a growing investment and research insights in many ILs. Indeed, the versatility of the ILs opens a wide door for choosing which working conditions fit best with the goal aimed.

From an electrochemical point of view, since an IL is a liquid consisting of only ions, high ion content is guaranteed, which obviously assures from moderate to high conductivities as well as wide electrochemical windows, from -2.20 V to 1.70 V.[1] Since these Room Temperature Ionic Liquids (RTILs) are credible alternative reaction media to organic volatile solvents, it was decided to study the electrochemical approaches to two of the most important organic chemical reactions: 1) Nucleophilic Aromatic Substitution Reaction of either hydrogen (NASH) or heteroatom (NASX)[2] and 2) Electrocarboxylation Processes in those "green" solvents.

In the case of NASH or NASX reaction, the fact that RTILs provide a reaction environment that is completely different from that offered by conventional solvents, a modification of the mechanism leads to tune the reaction products or even a change to the outcome of a reaction is possible, meaning such fundamentally mechanistic studies are mandatory prior to more ambitious goals. Thus, the aim of this communication is to use electrochemistry and RTILs so as to design new systems for obtaining high added value products using environmental friendly conditions.

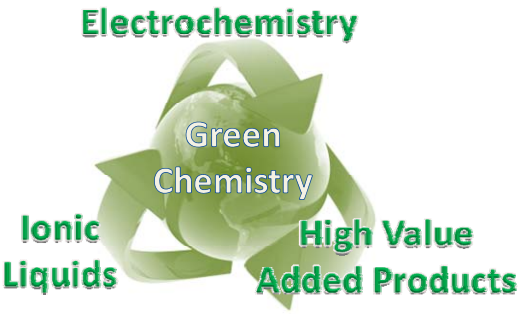

Fig. 1 – General scheme of the purpose of this communication: to show the combination of Electrochemistry and Ionic Liquids in order to obtain High Value Added Products, keeping Green Chemistry as a central scientific point of view

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References

1 D. S. Silvester; R. G. Compton, *Z. Phys. Chem.*, **2002**, *220*, 1247.
2 H. Cruz; I. Gallardo; G. Guirado, *Green Chem.* **2011**, *13*, 2531.