Hydrophilic Ionic Liquids Adsorption in Aqueous Solutions at the Gas-Liquid Interface

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Emulsified systems have huge technological potential in separation processes, chemical reactions and materials synthesis, among others. From the industrial and environmental point of view, there is a vital need for efficient and green separation agents, namely surfactants. It was recently shown that some of the ions composing ionic liquids present an amphiphilic character allowing them to be used as a new class of surfactants capable of promoting or stabilizing common dispersions or emulsions.[1] This possibility prospects an attractive application - that of replacing some toxic surfactants used nowadays. Apart from the studies concerning the ionic liquids self-aggregation and micelle formation in aqueous environment essentially focused on long cation side alkyl chain lengths, the surface activity of short alkyl chain length imidazolium-based ionic liquids in aqueous solutions is a poorly studied field.
In this work, we report the surface adsorption and the water surface tension reduction by short side chain length imidazolium-based ILs. The selected ionic liquids allowed the study of the alkyl chain length, the number of alkyl substitutions and the presence of double bounds, hydroxyl groups or aromatic rings at the cation side alkyl chain influence on the surface adsorption. On the other hand, the anion influence was further studied, through the aqueous surface adsorption, with the counter-cation 1-butyl-3-methylimidazollium coupled with different anions such as chloride, bromide, tetrafluoroborate, trifluoromethanesulfonate, trifluoroacetate, dicyanamide and hydrogenosulfate. In addition, the application of the Gibbs adsorption isotherm, maximum surface excess concentration, and minimum surface area/molecule at the air-water interface were estimated and discussed. The surface activity of each ionic liquid and their derived properties were obtained from experimental measurements of surface tensions carried out with the Pt/Ir Wilhelmy plate method at 298.15 K and atmospheric pressure.

[1] Blesic, M.; Marques, M. H.; Pechkova, N. V.; Seddon, K. R.; Rebelo, L. P. N.; Lopes, A., *Green Chem.* 9 (2007) 481-490.