Phase Behaviour of Mixtures of Nature based Ionic Liquids with Volatile Fatty Acids

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Abstract

The use of industrial waste streams as biomass source is one of the best ways to simultaneously reduce environmental problems and save resources. Various technologies have been developed for biomass conversion, usually with the focus on sugar derivatives, thermochemical treatment and biogas platforms. The volatile fatty acids (VFAs) platform is an emerging and promising route to economically convert biomass into valuable products. [1] Microbial electrosynthesis (MES) is an upcoming technology in microbial electrochemical research that provides an attractive route for the production of valuable products, such as VFAs. MES offers new solutions for waste treatment and can add value to waste in a sustainable way. This technology uses electrons derived from the cathode to reduce carbon dioxide and other chemicals into a variety of organic compounds. Among them are acetic, butyric and lactic acid. However, these compounds are present in low concentrations in an aqueous solution, which makes their separation challenging. [2]

Low volatile hydrophobic ionic liquids could offer a solution to this problem, as they have been applied as extractants for removal of compounds form aqueous phases due to their specific physicochemical properties. [3, 4] Compared to the conventional separation methods (e.g. distillation, adsorption, precipitation) it is expected that ionic liquids can be used to separate VFAs from the diluted aqueous media using much less energy and generating less wastes. [5]

In this work, hydrophobic nature-based ionic liquids are evaluated as extractants for the separation of VFAs (acetic, propionic and butyric acid) from water. The liquid-liquid equilibrium (LLE) of the ternary system comprising water, VFAs and ionic liquids (e.g., tetraalkylammonium oleate) was determined at 25 °C and atmospheric pressure. The obtained results were used to evaluate the influence of the cation, anion and length of the VFAs on the LLE data. Additionally, this work will contribute to the development and optimization of an extraction route for recovery of the VFAs from fermentation broths.

References