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Biocompatibility of ionic liquids and their recovery from aqueous solutions

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Transformation of fuel and chemical industry based on fossil raw materials to biorefineries based on renewable biomaterials require development of new approaches in products separation or in biomass pretreatment processes. Solvent extraction may have important role in biorefineries what will require development of novel solvents. Ionic liquids (ILs) could be candidate as nonvolatile effective solvent. Their biocompatibility is an important parameter for their successful application in bioprocesses. Organic acids are important platform chemicals for production of wide variety of organic chemicals and fuels. They can be effectively extracted with phosphonium ionic liquids but not adequate care was paid to their biocompatibility with microbial acid producents what is addressed in this work.

Results of biocompatibility tests of newly developed ILs [1] with bacterial producent of lactic acid *Bacillus coagulans* (*B. coagulans*) will be presented. The most commercially available hydrophobic phosphonium and ammonium ILs are more or less toxic to *B. coagulans* what is connected probably with their not enough low solubility in water. Influence of cation and anion structure on IL biocompatibility was studied. New ILs based on trioctyldodecylphosphonium cation and branched carboxylate anions are compatible with *B. coagulans* and are liquid at room temperature [1]. ILs with n-decanoate anion are good solvents when diluted with dodecane but pure IL is solid what could be technological problem, thus application of branched carboxylate anions could be solution.

Hydrophobic ILs are more expensive comparing to molecular solvents and it is important recover them from diluted process aqueous solutions what is important also from environmental point of view. It was found that hydrophobic phosphonium ILs can be effectively adsorbed by neutral polymeric adsorbent from aqueous solutions saturated with ILs. Capacity of packed column for decontamination of model water saturated with phosphonium IL was more than 298 BV (bed volumes) while full column capacity of continuous work was not achieved after 40 hours of operation.

[1] Marták, J., Antony, F.M., Liptaj, T., Polakovič, M., and Schlosser, Š., Extraction of butyric acid by novel hydrophobic phosphonium carboxylates with a pour point below 273 K and enhanced biocompatibility, Journal of Molecular Liquids, 417 (2025) 126569.