

3. ABSTRACT

Once methods for synthesizing ionic liquids (ILs) were mastered, interest in the use of these compounds increased significantly after it was found that they could find use as effective non-volatile solvents with broad applications in various chemical processes. The initial identification of ILs as environmentally friendly substances due to their low volatility and thus lower risk of release into the environment compared to previously used volatile organic solvents was premature and not supported by adequate studies.

We were among the first to use algal and cyanobacterial growth inhibition tests to conduct an in-depth evaluation of the toxicity of various ionic liquids to photosynthesizing marine organisms. Toxicity tests were conducted on naturally occurring microalgae and cyanobacteria in the Baltic Sea, which are maintained as monocultures in the Culture Collection of Baltic Algae (CCBA) after being isolated from the environment. Organisms for the study were selected from different taxonomic groups (green algae, diatoms, cyanobacteria) and inhabiting different environments (plankton, benthos).

In order to determine the effect of the chemical structure of ionic liquids on their toxicity, imidazolium and pyridinium ionic liquids with different alkyl chain lengths and different anions were selected for the study. The effect of salinity change on the toxicity of the ionic liquids was also evaluated. In the last stage of the study, the potential bioaccumulation of ionic liquids in simple food chains (green algae, barnacles, mussels) was investigated.

The properties of ionic liquids can be changed in a wide range, with respect to their physical and chemical properties, by modifying the structure of cations and the identity of anions. The extensive information obtained in this research on the toxicity of ionic liquids facilitates the development of guidelines for their safe production and use, as well as the potential danger they pose when they appear in natural waters.