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Zebrafish (*Danio rerio*) for studying ionic liquid toxicity

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PURPOSE OF THE ABSTRACT

Zebrafish (*Danio rerio*) has become increasingly central in scientific research since the 1960s. They are one of the most used test animals among vertebrates due to their easy maintenance and importantly their rapid development of transparent embryos. The genetic structure of zebrafish is very close to humans, making them a valuable model for the areas of genetics and genomics.

Despite the fact that the low vapor pressures of ionic liquids (ILs) minimize their impact on the atmosphere, their effect on water ecosystems and on aquatic organisms cannot be ignored. The structure and the lipophilicity of ILs affect their interaction with various organisms and biomembranes. Moreover, some ILs are bio-accumulative and might induce cell damage and rupture, eventually leading to cell death.

The effect of 11 amidinium, imidazolium, and phosphonium based ILs with various chain lengths was investigated using zebrafish. The viability and behavioral alteration in the locomotor activity and place preference, after IL treatment of five days postfertilization larvae, were recorded. Two ILs were chosen for long-term experiments, containing behavior and histological damage evaluations for adult fish. Most of the used ILs are surface-active and therefore their aggregation was believed to have an effect on their interactions with the fish. For achieving information on how IL aggregation is linked to the toxicity of ILs, the critical micelle concentrations were determined.

The results show that long-chain ILs are significantly more toxic than short-chain ILs, and the anion chain length was shown to be less significant than the cation chain length, when assessing the impact of ILs on the viability of the organisms. Most of the ILs interacted with the tested organisms in their monomeric form inducing mortality. However, the aggregations of the IL anion lowered the toxicity of surface-active ILs when the anion carbon number in the chain was > 16. The ILs used in the long-term tests showed no significant effect on the zebrafish behavior, breeding, or histology within the used concentration range.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

zebrafish | ionic liquids | toxicity | critical micelle concentration

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