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Ionic liquids comprising alkyl betainate cation and iodosulfuron-methyl anion as novel effective herbicides with reduced environmental impact

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Iodosulfuron-methyl-sodium is known as a plant protection product that is widely applied to control monocotyledonous and dicotyledonous weeds in cereal cultivation. According to recent reports, such ALS-inhibiting herbicides are often characterized by high selectivity, high efficiency at low doses and low toxicity to animals. However, their use often requires use of additives, so called adjuvants that can exhibit more detrimental influence on ecosystem than applied herbicide itself.

This study was focused on successful synthesis of new bio-based ionic liquids (ILs) starting from the renewable resource glycine betaine (a derivative of natural amino acids). ^{1}H and ^{13}C NMR spectroscopy was utilized to identify products of O-alkylation and subsequent ion exchange reactions The next stage involved assessment of their potential impact on the environment octanol-water partition coefficient (expressed by analysis of products' log KOW values) and herbicidal activity tests performed on plants at the four-leaf stage. Generally, the developed method allowed synthesis of ILs with high yields (<85%) and purity. The values of log KOW¬¬ indicate low risk of their migration into groundwater as well as their bioaccumulation in the environment. Greenhouse studies confirmed their excellent herbicidal efficacy toward oilseed rape, indicating that they are an attractive replacement for the currently available formulations. Therefore, it can be concluded that tuning the appropriate cation−anion combination during the molecular design of ILs enables creation of compounds with the desired properties.

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