Glycine betaine: a by-product of sugar production process as a promising feedstock for development of novel multifunctional biologically active compounds

([1] *Faculty of Chemical Technology, Poznan University of Technology, Berdychowo 4, 60-965, Poznań, Poland*) ○Michał Niemczak,[1] Tomasz Rzemieniecki,[1] Damian K. Kaczmarek,[1] Witold Stachowiak,[1] Adriana Olejniczak[1]

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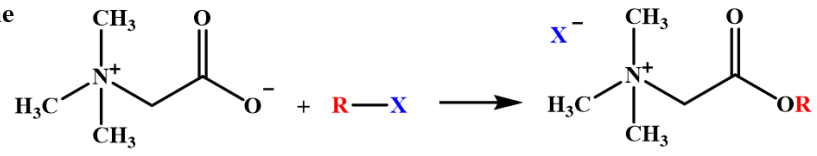
To reduce the environmental impact of new chemicals, it is essential to source substances from renewable materials and ensure they are highly biodegradable. Their synthesis should ideally use non-toxic, reusable reaction media. Glycine betaine, a biodegradable and non-toxic compound, meets these criteria and can account for over 25% of the waste mass from sugar beet processing. By *O*-alkylating its carboxylate group, specific quaternary ammonium salts (QASs) with ester groups, known as esterquats, can be synthesized. These betaine esters hydrolyze rapidly into low-toxicity substances, thereby reducing environmental pollution compared to entirely synthetic QASs.[1,2]

Currently known methods for the synthesis of alkylated derivatives of glycine betaine require the use of toxic reagents. Additionally, the majority of these methods are time-consuming and involve numerous unit operations. Therefore, an attempt was made to improve the process and establish more favorable synthesis conditions for commercial production. Optimization of betaine *O*-alkylation allows for process simplification, cost reduction, and decreased energy expenditure. The conducted research paves the way to scaling up the synthesis of betaine esters to a large laboratory and industrial scale. Furthermore, promising results regarding their cleaning and herbicidal properties, along with ecotoxicity assays, underscore their significant potential for commercial applications.

***O*-alkylation of glycine betaine with halogenoalkanes**



R = straight alkyl chain
X = Cl, Br

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