

## **Abstract**

Glyphosate is the most commonly used organophosphate herbicide in the world. Due to its extensive use in agriculture glyphosate enters the aquatic environment, where it can negatively impact its functioning. Therefore, determining the possible pathways of glyphosate degradation and its environmental fate is an important research issue. The subject of this study is the thus far scarcely researched glyphosate photodegradation.

The aim of this study was to qualitatively and quantitatively characterize the glyphosate photodegradation in the aquatic environment under the radiation from the solar radiation spectrum. For this purpose, the effects of direct and indirect photochemical reactions of glyphosate in aqueous solutions and marine and riverine water samples were determined. The influence of selected photoactive components of natural waters (dissolved organic matter, nitrate and iron ions) and oxygen on the efficiency of glyphosate photodegradation in the aquatic environment were also investigated.

The purpose of this study was achieved through laboratory experiments involving sample irradiation under a defined radiation regime corresponding to the light conditions in the environment and at the glyphosate concentrations observed in natural waters. The measure of glyphosate degradation was the increase in orthophosphate concentration during irradiation, which was then converted to a decrease in glyphosate concentration. On this basis, the quantum yield and kinetic parameters (reaction rate constant, half-life) of glyphosate photodegradation under UVA–UVB radiation were calculated.

Based on the obtained results, photolysis was found to be an efficient mechanism of glyphosate degradation. It was demonstrated that in the aquatic environment glyphosate undergoes photodegradation through direct and indirect photochemical reactions. It was determined that the photoactive components of natural waters affecting glyphosate photodegradation are dissolved organic matter and iron ions. It was found that, depending on the quality of dissolved organic matter, it can act as a photosensitizer or inhibitor of glyphosate photochemical transformations. It was shown that water oxygenation increases the efficiency of glyphosate photodegradation, indicating the involvement of reactive oxygen species in this process. It was also observed that glyphosate photodegradation is most effective in riverine waters, which may limit further ingress of glyphosate to marine waters.