Embryotoxic and Histopathological Effects of the Azimsulfuron-Based Herbicide on *Danio rerio*

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Abstract

One of the widely used herbicides in rice fields in Kazakhstan is the pesticide "Gulliver" which active ingredient is Azimsulfuron. It enters aquatic ecosystems via wastewater and can affect the development of fish, which are an important food product. The effect of this herbicide on the embryogenesis and organ histopathology of zebrafish (*Danio rerio*) was studied. Zebrafish embryos were exposed to the pesticide at concentrations of 15.4, 30.8, and 154 µl/L. Developmental abnormalities were observed in all experimental groups, the severity of which depended on the herbicide concentration. At a concentration of 15.4 µl/L, moderate embryogenesis abnormalities were observed at 24 hpf, which subsequently decreased by 96 hpf. At a concentration of 30.8 µl/L, the frequency of developmental abnormalities increased from 24 to 72 hpf. The pesticide's greatest embryotoxic effect was observed at a concentration of 154 µl/L, as early as the 24 hpf stage, manifesting as developmental delays, impaired morphogenesis, and increased embryonic mortality. Destructive processes of varying severity were detected in the gills and liver of zebrafish that survived exposure to azimsulfuron. These results demonstrate the pronounced embryotoxic effect of azimsulfuron and confirm the need for further assessment of its environmental safety for aquatic ecosystems and organisms in intensive rice cultivation areas.

Keywords

Ecotoxicology, pretilachlor, pyribenzoxim, genotoxicity.