

# Environmental Impact of Prior Pesticides Occurring in Wetland Ecosystems

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## ABSTRACT

The use of pesticides can contaminate surrounding waterbodies and harm non-targeted aquatic organisms. Wetlands are known to rapidly degrade and eliminate organic pollutants. However, there is a lack of research on the fate and impact of pesticides in wetland ecosystems. Therefore, this study aims to explore the occurrence and concentration of pesticides entering wetlands near agricultural fields and evaluate the potential risk of priority pesticides considering their toxic mode of action. To identify pesticides in the wetland, sampling was conducted at 10 representative points for 10 times in per month. Grab samples were collected in 1L amber bottles. After filtration, citrate buffer and internal standards were added to the sample. To enrich the sample, a solid-phase extraction (SPE) was applied. Elution solvents were alkaline and acidic ethyl acetate/methanol solutions. Extracts were concentrated to 0.1 mL, reconstituted with water/methanol (9:1), and filtered through a 0.45 µm filter. The samples were then analyzed using high performance liquid chromatography-high resolution mass spectrometry (HPLC-HRMS). The lowest PNECs values from the NORMAN Ecotoxicology Database were used to calculate the Risk Quotient (RQ) values. For the mode of action (MOA), the MOA data of the Fungicide Resistance Action Committee (FRAC) were used. A total of 76 pesticides were detected out of approximately 300 target substances. The 4 prior pesticides included orysastrobin, metalaxyl, tebuconazole, and carbendazim. The highest detected concentration of orysastrobin was approximately 3,300 ng/L. Pesticide concentrations tended to decrease from wetland inflow to outflow. Orsastrobin's mode of action is associated with group C (respiration), metalaxyl is with group A (nucleic acids metabolism), tebuconazole is with group G (sterol biosynthesis in membranes), and carbendazim is with group B (cytoskeleton and motor protein). Therefore, it is expected that the organisms in the wetland would be strongly affected by group C (respiration), the group corresponding to the highest detected MOA of orysastrobin. To explore the potential risk of the pesticides detected, risk quotient (RQ) values were calculated. The results showed that the RQ value of orysastrobin was up to 17 at the inflow point, but decreased to 4 at the outflow point. The decrease indicates that pesticides are under rapid degradation/break-down within the wetland. Despite the self-purification ability of wetlands, some pesticides require proper management to reduce their impact.

**Keyword:** Pesticide / Wetland / HPLC-HRMS / Mode of action (MOA) / Risk Quotient (RQ)