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Metabolism, transportation, and redistribution difference of atrazine and acetochlor from estuary to bay

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Abstract

Agricultural activities are the cause of pollution in several watersheds, mainly due to the discharge of herbicides. Herbicides suffer continual degradation and they present special patterns during the transport from watershed to bay. The spatial distribution of atrazine, its dealkylated chlorotriazine metabolites, and acetochlor in water, suspended particulate sediment (SPS), and surface sediment were investigated from estuary to bay. The concentrations of atrazine and deethyl-atrazine(DEA) and deisopropy-latrazine (DIA) were generally higher in the coastal zone than estuary and bay. The water distance of metabolites demonstrated that atrazine degradation was active from estuary to bay and DIA had the shortest half-distance of 1.6 km. In contrast, acetochlor concentration decreased with an increase of seawater depth and had the longer half-distance of 8.5 km than atrazine and its metabolites. Didealkyl-atrazine (DDA) had the highest concentration in SPS (7.6 ng/L) and sediment (7.0 ng/g) among all these herbicides, which indicated that it had the biggest sorption capacity. Both the spatial distribution and the vertical contents in water, SPS, and sediment demonstrated that these herbicides presented different response during the transport from the estuary to bay. Despite the significant difference in contents of atrazine, DEA, DIA, and acetochlor in the water and sediment, their spatially averaged value in SPS was very close, indicating that SPS had saturated sorption capability. The water-

particle phase partition coefficient (K_p) analysis indicated that the partition process was more active in the estuary than in the bay for atrazine and its metabolites, and the metabolites had stronger capacity than the atrazine. The K_p of acetochlor was the highest among the herbicides, which illustrated that acetochlor was strongly phase partitioned in the coastal and bay zones, thereby causing similar distribution of acetochlor in the three matrices. The correlation between K_p and the corresponding octanol-water partitioning coefficient indicated that the hydrophobicity of atrazine and its metabolites were important factors for the partition between seawater and SPS. The current tides and bathymetry were the critical factors in determining the spatial distribution of herbicides in the water and sediment, resulting in low load in the estuary zone.

Key words: Typical herbicides; Phase partition; Diffuse pollution; Suspended particulate sediment; Semiclosed bay

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