The hydrolysis behavior of methyl parathion absorbed by various minerals

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Abstract: Although the hydrolysis mechanisms of methyl parathion solution have been discussed extensively, the hydrolysis behavior of methyl parathion absorbed by the various mineral is still not clear. Given their ubiquity in soils and aquatic sediments, four various minerals such as goethite, Al_2O_3, montmorillonite and kaolin are considered in our work. Despite of their high adsorption capacity, all four minerals were found to improve the hydrolysis rate of methyl parathion and the order was: FeOOH > Al_2O_3 > montmorillonite > kaolinite, indicating that the catalytic ability of metal oxide on the hydrolysis process of methyl parathion was better than that of clay minerals that related to their special surface area and structure. Based on the comparisons of minerals structure after sorption and desorption and the identification of hydrolysis products by gas chromatography mass spectrometer (GC/MS) and liquid chromatography high-resolution mass spectrometer (LC/HRMS), three surface-catalyzed mechanisms of FeOOH and Al_2O_3 on promoting methyl parathion hydrolysis were probable attributed to the decrease of electron cloud density of P atomic, the surface chelation and the combination with hydroxyls function resulted from the interaction between minerals and methyl parathion. However, the surface-catalyzed mechanisms of montmorillonite and kaolinite on promoting methyl parathion hydrolysis were attributed to their surface acidification and surface

chelation. Finally, other influence factors on the hydrolysis behavior of adsorbed methyl parathion, such as pH, metal cationic (eg Cu^{2+}, Fe^{2+}, Mn^{2+}, Na^{+}), anionic （HCO_3^-、Cl^-、HPO_4^{2-}） and organic matter (HA, EDTA) had been also investigated in this work. This study provided meaningful information to elucidate the hydrolysis behavior of methyl parathion absorbed by various minerals in the environment. The results could help to understand the migration, transformation and the final fate of methyl parathion in natural environment.

Keywords: methyl parathion; hydrolysis; minerals