The degradation behavior of methylmercury in the soil induced by coexisiting Fe and Cu

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Methylmercury (MeHg) is a toxic compound. It forms mainly in reducing environments, and then degrades through biogeochemical processes. In our study, the percent MeHg of total Hg in Guangzhou soil in southern China was found to be variable and exhibited a significant negative correlation with the content of Fe or Cu where annite, a Fe-bearing mineral, was identified and could activate O_2 to generate •OH and $•O_2^{2-}$ and facilitate MeHg degradation under oxic conditions. Cu components in the soil further enhanced the production of $•O_2^{2-}$, and was oxidized to Cu(III) promoting degradation of MeHg directly. Meanwhile, various environmental factors, including water table fluctuation, pH and major ions, are discussed to clarify the behavior of MeHg in subsurface environments. The wetting-drying alternation can initiate MeHg degradation in the soil with the annite mineral. Additionally, the majority of the major ions (K^+, Na^+, Mg^{2+}, Fe^{3+}, Cl^-, SO_4^{2-}, NO_3^-) in the interstitial soil had little effect in the degradation of MeHg with the exception of Cu, which improved the degradation depending on the pH. At acidic pH, Cu increased the production of hydroxyl radical while at alkaline pH there was oxidation to Cu(III). The products including Hg(II) and Hg(0) of MeHg degradation were also identified in this work. These findings help us understand that the distribution of MeHg in soil depends on not only external pollution sources,but also on biogeochemical processes in subsurface environments.