Fate of Iodine during the Microbial Transformation of Natural Iron Minerals

JUNXIA LI[12], XIANJUN XIE[1], HAILING ZHOU[1], XIAOBIN XUE[1]

[1] State Key Laboratory of Biogeology and Environmental Geology & School of Environmental Studies, China University of Geosciences, 430074 Wuhan, China

[2] Environmental Soil Chemistry Group, Delaware Environmental Institute and Department of Plant and Soil Sciences, University of Delaware, Newark, Delaware 19716, United States

Iodine, as an essential trace element for human thyroid, has been reported to occur in groundwater, which potentially has bad effects on the human health. Our previous studies reported that high iodine concentration in groundwater was related to the organic-iron complexs of quaternary unconsolidated sediment formed from fossil lakes, rivers and sloughs. To better understand the iodine mobilization from the sediment into groundwater, a series of batch experiments involving the *Shewanella oneidensis* MR-1 were conducted on the shallow (depth: 4 m) and deep (depth: 247 m) sediment samples under aerobic and anaerobic conditions. The results indicate that the release of sediment iodine and microbial transformation of iron minerals were observed for the shallow sediment under anaerobic condition, whereas no evident changes of solution iodine and iron phases occurred for the deep sediment. It indicates that the transformation of iron minerals resulted from MR-1 is the main factor causing the sediment iodine release into solution. Moreover, the results of sediment Fe(II)/Fe_{total} ratio, XRD and SEM-EDS analysis indicate that iron phase of shallow sediment is composed of approximately 15% Fe(II), while for the deep sediment, the Fe(II)/Fe_{total} ratio is around 35%, and Fe(II)-contained minerals, such as pyrite and maganitite, were identified in deep sediment. It suggests that the long-term reductive transformation of iron minerals might lead to the distinguishing phase of iron mineral between shallow and deep sediment, more importantly, which potentially releases the sediment iodine into groundwater, thereby causing the formation of high iodine groundwater. In addition, the iodine species in solution is predominated by iodide, which is consistent with that of our previous studies. Overall, this study provides more supports and new insights to the mechanism of high iodine groundwater and hydrogeochemical cycling of iodine in groundwater system.