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Abstract

One reason for the evolution of barren ground in coastal areas is a deficiency of dissolved Fe (II) species. A fertilizer that included steel slag and compost was evaluated, in an attempt to supply dissolved Fe (II) to coastal such areas. Basing on previously reported data, it is thought that the presence of fulvic acid (FA) in the compost permits Fe (II) in the steel slag to be eluted in the form of Fe (II) -FA complexes However, in our observation and some previous reports, humic acid (HA) and FA are flocculated and precipitated in seawater, which suggests that FA cannot function as a carrier for the elution of Fe (II) from the fertilizer. To better understand the mechanisms that control the elution of Fe (II) from such a fertilizer, this paper introduced following two topics: (1) the seawater extractable organic matter (SEOM) in the compost and its binding to Fe (II), and (2) the alteration of HA in the fertilizer during fertilization. For the first topic, the SEOM contained less carboxylic and phenolic hydroxyl groups that can serve as binding sites to Fe (II), compared to HA and FA. However, the binding constant of the Fe (II) -SEOM complex was comparable to that of the Fe (II) -fulvic acid complex. These results suggest that SEOM in the compost has strong binding sites to Fe (II) and can serve as a carrier of Fe (II) in seawater. For the second topic, the structural features of the organic matter in the fertilizer were monitored during 6 months of fertilization, in which HA was characterized as an abundant organic matter in the fertilizer. While no significant structural alterations of the HA were observed in the absence of steel slag, the structures were dramatically altered in the presence of steel slag. Higher levels of sulfur and a fatty acid biomarker ($C_{16:1\omega7}$) were found in the HA after fertilization, suggesting that sulfate reducing bacteria are involved in the observed structural alterations.