Elucidation of the Interplay between Fe(II), Fe(III) and Dopamine with Relevance to Iron Solubilization and ROS Generation by Catecholamines

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Dopamine (DA) is an important allelopathic compound that is released into the ocean at up to hundreds of micromolar by *U. obscura* when it is physiologically stressed in order to provide protection from feeding by the natural enemies. The acceleration in the oxidation of Fe(II), the indispensable nutrient and the bioavailable form of iron, in the presence of DA is thought to contribute to the unavailability of iron uptake by the microorganisms. An understanding of iron oxidation as well as iron oxides dissolution in the presence of DA under natural condition is critical to understanding the effect of DA on iron bioavailability and transformation in the natural environments. In this study, the generation of H_2O_2 through the autoxidation and iron-catalyzed oxidation of DA, the formation of the dominant complex via the direct reaction with Fe(II) and Fe(III) in both oxygen saturated and deoxygenated conditions and the oxidation of Fe(II) in the presence of DA at pH 7.4 were investigated.The results of this study show that the presence of DA can significantly accelerate the oxidation of Fe(II) resulting in rapid generation of a substantial amount of H_2O_2. Mobilization of iron from amorphous ferric oxide by DA through both ligand-induced dissolution and reductive processes was operating at the pH used in the studies described here. As DA is more effective in inducing AFO dissolution in the presence of oxygen, we conclude that the reductive mechanism of DA-mediated AFO dissolution predominates. These results indicate that even though DA can significantly reduce the bioavailability of iron in the nature environments, it can maintain amount of iron in the soluble form and prevent it from precipitating out as iron oxides.