

Organic matter effect on Fe(II) oxidation kinetics in the Labrador Sea

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The Fe(II) oxidation rate was studied in one latitudinal and one longitudinal transect crossing the Labrador Sea in 2016. The studies considered the temperature, pH, salinity and total organic carbon (TOC) content and were carried out at three different conditions: recreating in situ conditions, fixing temperature (15°C) and fixing both temperature (15°C) and pH (8). The pseudo-first-order kinetic rate, k' (min⁻¹), variability was controlled by temperature (77%) when recreating in situ conditions, by pH (75%) at a fixed temperature of 15°C and by salinity and TOC (80%) when samples were fixed in both temperature and pH, 8. Sources and characteristics of TOC affected the oxidation of Fe(II). An empirical equation for the calculation of Fe(II) oxidation rate constants was obtained, considering the in situ conditions of temperature, pH, and salinity for the North Atlantic.

In this study, we observed that organic matter produced positive and negative effects on the Fe(II) oxidation rate. For that reason, we obtained a theoretical approach that considers the effect of inorganic interactions and temperature on oxidation kinetics was included to explain the effects of organic ligands on the Fe(II) oxidation rate. This approach with values of both pH and total dissolved inorganic carbon was applied in this work to account for the role played by organic ligands on the Fe(II) oxidation kinetics. The comparison between experimental data with inorganic Fe(II) complexation models revealed an important contribution of organic matter, retarding the oxidation of Fe(II) at the surface and close to coastal areas. In the open ocean, below the photic zone, the Fe(II) oxidation rates are similar to the values expected according to the inorganic Fe(II) oxidation rate model.