

OXIDATION OF COPPER (I) IN SEAWATER

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The oxidation kinetic of Cu(I) with oxygen has been studied as function of copper(I) concentration (5-383nM), pH (7.1-8.3), bicarbonate concentration (0-9mM), temperature (5-35°C), salinity (5-36.7). The effect of pH and peroxide concentration (200-2000nM) in the oxidation kinetic of Cu(I) with peroxide has also been considered. The goal of this work is to obtain an equation that describes the dependency of the rate constant (k) for each factor in order to understand the behaviour of copper in natural waters.

Under the experimental conditions studied the oxidation kinetic of Cu(I) is described by a pseudo-first order rate constant. The half-life time in seawater (S=36.7, pH=8 and T=25°C) is 8.08 minutes. The rate constant is not affected by initial Cu(I) concentrations in the range studied. It increases with pH. The increase in the bicarbonate concentrations also induces the rate constant to increase until 5mM. This effect is due to the interaction of Cu(I) and Cu(II) with carbonate and bicarbonate ions. The temperature increases the oxidation rate, with an enthalpy calculated of $40.36 \pm 0.8 \text{ kJmol}^{-1}$. The rate constant decreases with the increase of ionic strength due to higher ionic interactions and its dependence has been fit to a second order-degree equation.

The studies with increasing hydrogen peroxide concentrations show a decrease in the oxidation rate due to the back-reaction of Cu(II) with peroxide .

The studies have been compared with other works (Moffett and Zika, 1983,1987; Sharma and Millero, 1988a,1988b) at micromolar concentration and lower oxidation rate constant have been obtained at nanomolar levels.

References:

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