

Effect of the Chemical Reduction by Ferrous Ions on Chromate  
Toxicity to Daphnia magna

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The reaction kinetics of hexavalent chromium with ferrous ions were studied to determine the influence of reduction on the toxicity of chromium to aquatic organisms. The changes in chemical forms of the chromate in the presence of ferrous ions were examined in a bioassay system using Daphnia magna as a test organism. This study demonstrated that the reaction kinetics of chromate with ferrous ions showed a significant decrease of chromate concentration with the pseudo first-order kinetic constant ( $k$ ) for the reduction of Cr(VI) being determined as 0.0118 ( $\text{min}^{-1}$ ). The concentration of Cr(VI) remaining in the solution decreased as the ratio of ferrous ion to chromate increased, revealing a non-stoichiometric reaction due to oxygenation and the moderately alkaline pH of the solutions. The toxicity test indicated that the bioavailability of chromate to Daphnia magna was reduced in the presence of Fe(II) and that it decreased further with increasing Fe(II) concentrations. However, the toxic effect of chromate to aquatic organisms was not controlled kinetically in the presence of ferrous ions. It was also found that LC50 of chromate to Daphnia magna decreased as the test period increased from 24-h to 48-h in the presence of Fe(II).

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