# Preliminary results of Cr(VI) reduction by zero-valent magnesium (ZVM) powder

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We investigated the feasibility of using zerovalent magnesium (ZVM, $Mg^0$) as a possible reductant in the remediation of groundwater contaminated by hexavalent chromium. Recently, zerovalent iron (ZVI) barriers are widely applied to the remediation of soils and groundwaters contaminated by various redox-sensitive contaminants including chromate, nitrate, and chlorinated hydrocarbons. Although ZVI is an effective reductant, deactivation and clogging of the barrier due to the precipitation of secondary iron oxides have been a concern of the application. In contrast to iron, magnesium is less toxic and the solubility of magnesium hydroxide is substantially higher than that of iron.

In this study, 20 μM Cr(VI) was reacted with 0.5 g/L of commercial zero-valent magnesium powder at the initial pH's of 2 – 7 in 0.01 M NaCl. Dissovled concentrations of Mg(II) and Cr(VI) were determined by atomic absorption spectrometry (AAS) and diphenylcarbazide method using UV-vis spectrophotometer, respectively. The solution pH could not be maintained at a constant value in the range of pH examined because ZVM was itself oxidatively dissolved in solution by water and dissovled oxygen. Since these oxidation reactions of ZVM are proton-consuming reactions, the initial pH 7 was rapidly increased and reached a plateau at 10 within 60 min by the oxidative dissolution of 0.05 g/L ZVM. When the ZVM concentration was increased to 0.5 g/L, the initial pH 2 was also increased to 10 within 90 min in the absence of Cr(VI). In the presence of 20 μM Cr(VI), dissolved Cr(VI) was effectively removed below detection limit (10 μg/L) within 20 h while the initial pH 7 increased to 10 within 90 min and remained constant during the rest of the reaction period. The rates of Cr(VI) reduction increased with decreasing pH. At the initial pH 2, the removal of Cr(VI) was achieved within 20 min with an increase of pH to 2.64, which further increased to 9 in 240 min. These preliminary results indicate that further research is warranted to examine whether ZVM may be a good alternative of ZVI in the subsurface remediation.

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# Diel biogeochemical processes in rivers; Stable isotopes variations of dissolved oxygen and inorganic carbon

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Data are presented from five rivers in Montana, USA (see Fig. below) which were sampled over a 24-h period (between Jul-2003 to Jul-2007) to examine diel changes in the isotopic composition of dissolved oxygen gas ($\delta^{18}$O-DO) and dissolved inorganic carbon ($\delta^{13}$C-DIC) and other chemical and physical variables (pH, T, DO, SC, PAR). Additionally, a mesocosm experiment was performed to document similar diel cycles under controlled laboratory conditions. The field data all show a decrease in $\delta^{18}$O-DO and an increase in $\delta^{13}$C-DIC during the day, with the reverse pattern at night. These trends were also seen in the mesocosm experiment, and are explained by the different rates of photosynthesis vs. respiration vs. gas exchange at each site. The magnitude of the diel isotopic changes were greater in streams with higher biological productivity.