

Potential application of metallic Mg milling scraps in the contaminant treatment processes

Hyungyu Ryu

Environmental Geochemistry Lab.

Dept. of Earth System Sciences, Yonsei University

Metallic magnesium (zero-valent magnesium, ZVMg, Mg^0) is currently attracting attention as a powerful reductant of environmental contaminants. Developing cost-effective implementation of ZVMg is one of the most important issues for the practical application of ZVMg in the contaminant treatment processes. Mg milling scraps (MS-ZVMg) were obtained from a die casting factory and compared the reactivity with those of three reagent-grade ZVMg (RG-ZVMg) particles using Cr(VI) as a model contaminant which is relatively well known for its toxicity and reaction mechanism.

Batch experiments were conducted by reacting 1.0 g/L of the MS-ZVMg or the other three RG-ZVMg particles from different commercial vendors with 19.5 μM Cr(VI) at the initial pH of 6.24 ± 0.15 under oxic conditions. The MS-ZVMg effectively decreased Cr(VI) within 24 h and showed a comparable reactivity to those of the RG-ZVMgs. The sonication treatment of MS-ZVMg substantially improved the reactivity of MS-ZVMg by about 3 times, but not those of RG-ZVMg particles. FT-IR analysis showed that removal of C-H stretch indicating residual lubricant oil on the surface of MS-ZVMg particles explains the increased reactivity of the sonicated MS-ZVMg. In addition, sonication treatment effectively maintained the reactivity of every types of ZVMg particles up to 6 cycles. The increasing reactivity of MS-ZVMg was also achieved by washing it with an organic solvent. Our results successfully demonstrated the potentiality of practical and cost-effective application of ZVMg in the treatment processes of contaminants.