

Use of carboxymethyl-beta-cyclodextrin (CMCD) as flushing agent for remediation of metal contaminated soil

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Abstract. One of the major challenges in remediating soil and ground water is the presence of mixed organic and inorganic contaminants. Due to their very different behavior, research has to a large extent focused on remediation of either organic or inorganic contaminants rather than mixed waste. Cyclodextrins (CDs) are a group of non-toxic sugar based molecules that do not sorb to soil particles and do not experience pore size exclusion. Thus, they have good hydraulic properties. CDs enhance the solubility of organic compounds by forming inclusion complexes between organic contaminants and the non-polar cavity at the center of the CD. By substituting functional groups to the cyclodextrin molecule it can form complexes with heavy metals. Previous studies have shown that carboxymethyl cyclodextrin (CMCD) can simultaneously complex organic and inorganic contaminants. The aim of this study is to compare how strongly CMCD complexes several common heavy metals, radioactive elements and a common divalent cation. Results from batch experiments show that CMCD has the ability to complex a wide array of heavy metals and radioactive elements. The solubility of metal oxalates and metal oxides clearly increased in the presence of CMCD. Logarithmic conditional formation constants ranged from 3.5 to 6 for heavy metals and from 3 to 6 for radioactive elements. Calcium, which may compete for binding sites, has a logarithmic conditional formation constant of 3.1. Batch experiments performed at two different temperatures showed little temperature effect on conditional formation constants. The results indicate that CMCD is a potential flushing agent for remediation of mixed waste sites.

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