Colloid-facilitated Hg transport in Hg-contaminated soils: effect of ionic strength, humic acid and flow interruption

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Colloidal Hg release and transport in soils is of significance due to its high Hg concentration and toxicity. However, the contributions by organic matter and Fe oxide colloids on Hg transport are not well studied. In this study, colloid mobilization and its effect on Hg transport were investigated in three contaminated soils: MS and MN [spiked with HgS and $Hg(NO_3)_2$] and OR (contaminated soil from Oak Ridge). Column experiments were conducted to examine the effect of ionic strength changes, flow interruption and humic acid on colloid release from Hg contaminated soils under saturated conditions. Lowering the ionic strength (5 to 0.05 mmol/L) in solution resulted in release of colloidal Hg from all three soils (MN, MS and OR). Colloids generated during the ionic strength reduction consisted of hematite, kaolinite and quartz, which were different from the colloids release from water dispersible colloids. Speciation of Hg in the leachate of MN and OR soils by MINEQL revealed that theoretical dominant soluble mercury species were dissolved organic matter bond Hg (DOM-Hg). Flow interruption for 7 days, total Hg concentration for both OR and MN soils increased substantially at 45 and 578 $\mu g\ L^{-1}$ respectively. Total Hg in soil leachate were dominated by colloidal Hg (47% and 58 %). The total Hg evolution was decoupled with concentration of the Fe(II), Mn and DOC changes. Humic acid (20 mg/L) initiated colloid Hg release from MS soils, but can't enhance Hg release from MN soil. This research demonstrated the importance of ionic strength, humic acid and flow interruption on colloid-facilitated Hg transport in Hg-contaminated soils.