Polymer Flooding for Enhanced Delivery of Groundwater Remediation Agents

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Abstract. The addition of a viscous polymer flood to more "traditional" groundwater remediation schemes could enhance the delivery of treatment agents to less permeable and often bypassed zones, thus increasing the efficiency of the techniques. Polymer floods have been utilized with success in enhanced oil recovery efforts, but in groundwater systems, polymer/amendment compatibility must first be demonstrated. We present the results of compatibility screening tests between polymers and two remediation amendments: chemical oxidants and bio-agents. The continued ability of the amendments to degrade contaminants of concern in the presence of the polymer, and the retention of polymer solution viscosity after exposure to the amendments, serve as measures of compatibility. Our experiments have established the compatibility of xanthan polymers with both potassium permanganate ($KMnO_4$) oxidant and a reductive dechlorinating consortium. For the chemical oxidant case, the xanthan posed a relatively low oxidant demand, and the oxidation rate of a test contaminant was unaffected by the presence of polymer. Solution viscosity was also maintained after long-term (72 hour) exposure to the oxidant. Biodegradation of a test contaminant was not significantly affected in microcosms containing xanthan solutions, and viscosity was also maintained during the experimental period. Preliminary column experiments have shown conservative transport of the oxidant within a polymer solution, while additional two-dimensional tank experiments have provided an estimate of increased sweep efficiency. These results allow us to design future tank experiments to quantify expected increases in treatment efficiency.