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Nickel removal from low permeable kaolin soil under unenhanced and EDTA-enhanced electrokinetic process

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Abstract. This paper represents a set of experimental tests on remediation of nickel-contaminated kaolin by Electrokinetic method. For this purpose, we conducted unenhanced and EDTA-enhanced Electrokinetic tests in one, three, and five days of treatment. In unenhanced tests, we used deionized water as an electrolyte in the anode and the cathode compartments. In the EDTA-enhance tests, we used ethylenediaaminetetra acetic acid 0.1 Molar in the cathode and sodium hydroxide 0.1 Molar in the anode. The average nickel removal for unenhanced tests after three and five days of treatment was 19 and 23 percent, respectively. High buffer capacity of the soil is responsible for low removal efficiency in the unenhanced tests, which maintained pH close to the initial amount that restrained nickel as an adsorbed or precipitated forms. The average nickel removal for EDTA-unenhanced tests after three and five days of treatment was 22 and 12 percent, respectively. Lower ionic mobility of EDTA-Ni complex in comparison with Ni^{+2}, which is the main transportation mechanism for this complex, could be responsible for less removal efficiency in EDTA-enhanced test.

Keywords: acid enhanced; bench-scale experiment; electrokinetic treatment; kaolin; nickel

1. Introduction

Soil pollution is one of the worldwide problems, which has involved many environmentalists and governments. Heavy metal contamination is a type of soil pollutions that attracts more concern recently. Lead, chromium, nickel, cadmium, and arsenic are the significant heavy metal contaminants at numerous industrial sites (Taylor *et al.* 1997). In low permeable soils such as clays, the traditional methods, like *in-situ* soil flushing and chemical treatment, are high-priced and inefficient (Yeung *et al.* 1996). Electrokinetic remediation (EKR) is a technique which has considerable potential for *in-situ* remediation of low permeable soils (e.g., clay and silt) (Reddy *et al.* 2001).

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