Electrochemical remediation of kaolin-soil contaminated by phenol: effect of several operative parameters

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Electrochemical remediation technology is considered an appealing strategy for the remediation of fine-grained soils, characterized by a low hydraulic conductivity and large specific surface area, contaminated with inorganic, organic, and mixed pollutants. In both Electrokinetic (EK) and Electrochemical Geo-Oxidation (ECGO) technologies, an electric field is imposed on the contaminated soil to remove the pollutants by the combined mechanisms of electroosmosis, electromigration, and/or electrophoresis. Moreover, ECGO uses low voltage and both direct and alternating amperage (DC/AC) applied in a proprietary series to induce reduction-oxidation reactions on soil surfaces at the micro-scale. According to the literature, in this method, each soil particle acts as a micro-capacitor that charges and discharges in a cyclic fashion. The energy burst on discharge at the micro-scale is intense, theoretically allowing the conversion of most organic contaminants to carbon dioxide and water near the conducting particle surface [2-4]. However, the effectiveness of the technology strongly depends on the physical-chemical states of the soils and the contaminants, pH, sorption of contaminants on soil particle surfaces and different effects induced by the hydrogen ions and hydroxide ions generated at the electrodes.

In this work, the effect of several factors, including the intensity and mode of the applied electric field, duration of treatment, nature of supporting electrolytes, on the electrochemical remediation of kaolin-soil contaminated by phenol (200 mg_{Phenol}/kg_{soil}) was investigated. It was found that a proper selection of the operative parameters is the key-factor to improve the electrochemical remediation of the contaminated soil. High removal of phenol from the kaolin up to 88% was achieved after 93 hours of treatment using graphite electrodes and a gradient electric field of 0.15 V cm^{-1}.

[1] A. T. Yeung et al. *J. Hazard. Mater*. **2011**, 195, 11
[2] D. Rahner et al. *Electrochim. Acta* **2002**, 47, 1395
[3] J. Röhrs et al. *Electrochim. Acta* **2002**, 47, 1405
[4] L.M. Zanko et al. *Electrochim. Acta* **2020**, 354, 136690