Ecologically non-invasive decontamination of Natura 2000 locality from old deposits of hexavalent chromium and bivalent nickel by modular electrocoagulation combined with Ca(OH)₂ addition

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Abstract: A modular electrocoagulation unit supported by $Ca(OH)_2$ addition to treated water was operated in the vicinity of Natura 2000 site for removal of Cr^{6+} or Ni^{2+} from contaminated groundwater. The process was performed at a constant flow rate of 350 L/h. Day 0 concentrations of Cr^{6+} and Ni^{2+} started at 91.6 mg/L for Ni^{2+} and 43 mg/L for Cr and during testing were decreased by 15-25 %. Residual concentrations of $Cr_{tot.}$ and Ni^{2+} below the required limits of 0.5 mg/L for $Cr_{tot.}$ and 0.8 mg/L for Ni^{2+} can be achieved with electrocoagulation unit and total removal efficiencies often exceeded 98 %. The overall economy assessment showed its feasible application for removal of Cr^{6+} and Ni^{2+} on sites with requirements of high environmental protection standards. The polluted area was about 150 x 150 m (22 500 m²), and it contained approximately 78 750 m³ of water contaminated with Cr^{6+} and Ni^{2+} (over 41 mg/l and 91 mg/l respectively). The modular arrangement might allow a scaling up. The process output could be thus increased according to the number of EC modules in operation.

Keywords: Natura 2000; electrocoagulation; water treatment; site remediation; chromium; nickel; removal