Removal of organic materials and hexavalent chromium from landfill leachate using a combination of electrochemical and photocatalytic processes

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ABSTRACT

Leachate is one of the major problems of municipal waste landfills. Landfills produce a dark black colored liquid with high levels of chemical oxygen demand (COD) and heavy metals and low biochemical oxygen demand (BOD/COD) ratio. The objectives of this study were to evaluate the effectiveness of an electrochemical process using graphite and platinum electrodes and photocatalytic properties of titanium dioxide nanoparticles stabilized on bentonite at different reaction times for removal of chromium and organic materials from leachate. Equipment used in the electrochemical reactor included an anode electrode plate, a commercial platinum electrode and a graphite cathode. We also evaluated the impact of electrical current density (1–4 A/m²), reaction time (1–8 h), concentration of catalyst (1–4 g/L) and UV radiation intensity (3–8 UV lamps). The results showed that the removal efficiency increased with increasing reaction time, current density, intensity of UV radiation and dose of catalyst. Moreover, biodegradability (BOD/COD ratio) was improved. Based on the results, this electrochemical pretreatment process can remove organics materials, heavy metals, reduce organic load and increase wastewater biodegradability. Thus, it can be used as an efficient option for treating sewage and preventing environment pollution.

Keywords: Leachate; Organic matter; Chromium; Electrochemical; Photocatalytic processes

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