**Electrochemical treatment for removal humic acids from aqueous solutions using platinum anodic electrode: effect of supporting electrolytes**

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**Highlights**

* Electrochemical removal of humic acids was investigated.
* The effects of NaCl and NaClO4 electrolytes were studied.
* Humic acids removal was faster in the presence of NaCl.

**1. Introduction**

Humic acids (HA) are the soluble fraction of humic substances at alkaline and neutral pH and are produced by biotic and abiotic degradation of dead organic matter. HA have a broad molecular weight distribution and contain several functional groups such as aromatic, carboxylic and phenolic groups [1]. Owing to their solubility, HA are common water contaminants, hence procedures for their removal from water have been extensively investigated [2,3]. Among them, electrochemical treatment is very promising because of its efficiency and ease of use. Depending on the operating conditions and the type of pollutant, a diversity of reactions can occur at the electrodes and in solution [4]. Recently, the removal by electrocoagulation of humic acids (HA) has been analyzed using aluminum as sacrificial electrode, indicating that HA removal rate increased with ionic strength and electric current density [5].

**2. Methods**

In the present work, the electrochemical treatment of HA solutions has been investigated in the presence of different electrolytes (i.e. NaCl and NaClO4) using a platinum-coated titanium anodic electrode and a graphite cathodic electrode, under amperostatic conditions. Investigations were carried out with the following experimental conditions: HA concentration = 50 mg L-1; salt concentration = 0.08 mol L-1; current density = 6.12 A m-2; ΔV = 5.0 V; pH =7.0. HA concentration was measured by using spectroscopy technique.

**3. Results and discussion**

Fig. 1 shows the time-dependence of humic acids concentration, as determined by the absorbance signal at 320 nm, in the presence of NaCl and NaClO4, respectively. As it can be seen, during the electrochemical process, HA concentration rapidly decreases with both electrolytes; interestingly, when NaCl is used, HA concentration reaches a stable value in about 2 h. The results indicate that humic acids removal is faster in the presence of NaCl, probably as a consequence of chlorine formation by oxidation of Cl-, which acts as oxidizing agent for HA. The UV-Vis spectra of HA at time zero and at the end of the electrochemical treatment are reported in Fig.2. The figure shows a marked blue shift of HA spectrum with both electrolytes, which is probably associated with the reduction of the conjugation of HA aromatic groups during the oxidation process. Detailed products characterization of the electrochemical treatment of HA is under investigation.



**Figure 1.** Time-dependence of HA concentration in the presence of different electrolytes; λ = 320 nm, [HA] = 50 mg L-1, salt concentration = 0.08 mol L-1, current density = 6.12 A m-2, ΔV = 5.0 V, pH =7.0.

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**Figure 2.** UV-Vis spectra of HA at time zero (●), in the presence of 0.08M NaClO4 at 2h (○) and in the presence of 0.08M NaCl at 2h (▲); [HA] = 50 mg L-1, current density = 6.12 A m-2, V = 5.0 V, pH =7.0.

**4. Conclusions**

The effects of NaCl and NaClO4 electrolytes on HU removal from wastewater was investigated. Findings highlighted that with both electrolytes HA concentration rapidly reduced. In particular, humic acids removal was faster in the presence of NaCl. A blue shift of HA spectrum was observed probably due to the reduction of the conjugation of HA aromatic groups during the oxidation.

**References**

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