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Chloride ions as an agent promoting the oxidation of synthetic dyestuff on BDD electrode

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ABSTRACT

The effect of the presence of chloride ions on anodic oxidation of synthetic dye solution was investigated and compared to other anions (NO_3^-, HCO_3^- and SO_4^{2-}). A boron-doped diamond electrode was used as an anode in bulk electrolysis. Dye degradation was monitored following the relative absorbance removal related to discolouration and aromatic derivates degradation and chemical oxygen demand (COD) removal. The study results showed that not only fast discolouration ($k = 76.8$) but also dye mineralisation is obtained with addition of chloride thanks to the electrogeneration of active chlorine ($HClO/ClO^-$). The comparison effect using others support electrolytes such as nitrates and hydrogen carbonate revealed strong inhibition for NO_3^- concerning dye degradation. Average current efficiency and energy consumption (E) were also investigated. An addition of low chloride concentration (0.02 M) in Na_2SO_4 electrolyte significantly enhances the degradation rate of Cibacron Yellow. An optimised concentration of 0.05 M NaCl leads to an increase by 42% of COD removal after 20 min of treatment and decreases the consumption of energy by 333 kWh (kg COD)$^{-1}$. This result presents Cl^- as a promoting agent of the mineralisation of the dye and is very interesting for a subsequent potential industrial application to dyeing waste water treatment for recycling.

Keywords: Active chlorine; Anodic oxidation; Azo dye; BDD electrode; ACE

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