Electrochemical Degradation of Bisphenol A in Water with/without Ce(IV) Addition

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This study investigates the degradation of bisphenol A (BPA) by electrooxidation on a boron-doped diamond (BDD) anode with/without Ce(IV) addition in 1 M Na₂SO₄ and real environmental water matrices: municipal wastewater treatment plant primary and secondary effluents (MWTPPE and MWTPSE, respectively), river water (RW), and groundwater (GW). The results show that the BPA degradation and TOC removal increased along with the current density (0.25–0.75 A/cm²), while the BPA degradation decreased but the TOC removal increased when the temperature rose (25°C–75°C). Similar efficiencies of BPA degradation or TOC removal were observed in pH 3–10 phosphate buffer solutions. At 0.5 A/cm² and 75°C in 1 M Na₂SO₄, complete BPA degradation was achieved using electrolysis (E), E+Ce(IV), Ce(IV); however, the BPA degradation or TOC removal was in the order Ce(IV) > E+Ce(IV) > E, and complete TOC removal was only attained using E alone. In MWTPSE, the BPA electrochemical degradation efficiency achieved by adding chemical Ce(IV) was similar to that by adding Ce(IV) regenerated (R-Ce(IV)) from real spent thin-film transistor liquid-crystal display (TFT-LCD) Cr-etching solutions; nevertheless, the TOC removal was better for the former than for the latter. The rates of formation and degradation of *p*-benzoquinone (an intermediate from BPA electrochemical degradation) followed the order E+Ce(IV) > E > E+R-Ce(IV). Without electrolysis, the *p*-benzoquinone could almost not be degraded when using Ce(IV) alone. Similar degradation efficiencies of BPA in MWTPPE, MWTPSE, RW, and GW were observed ($k = (3.68\text{--}6.07) \times 10^{-3} \text{ s}^{-1}$), but the complete TOC removal could not be obtained in RW, despite reaching complete *p*-benzoquinone degradation in the four matrices.

Keywords: electrochemical degradation; bisphenol A; *p*-benzoquinone; boron-doped diamond (BDD) electrode; mineralization

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