Abstract:
An electrochemical advanced oxidation process employing a boron-doped diamond anode for the treatment of synthetic waters and secondary effluents of wastewater treatment plants (WWTP) was studied. The efficiency and formation of transformation products (TPs) for this treatment process were investigated at different current densities for bisphenol A (BPA) spiked to synthetic water and WWTP effluents. A complete removal of the parent compound was achieved in WWTP effluents. Higher applied current densities resulted in faster removal. At the same time, a correlation between the applied current density and the ozone concentration measured in the bulk solution was revealed. Hence, the observed transformation of BPA is likely due to the generation of reactive oxygen species such as hydroxyl radicals and ozone. Based on a suspected target screening approach, four known TPs and two unreported (new) TPs were identified by LC–MS analysis. These results suggest a transformation pathway following three steps: hydroxylation of the aromatic ring, followed by oxidation of the isopropylidene bridge and finally a ring opening and formation of organic acids and other small molecules. The presence of chloride ions in WWTP effluents can result in the generation of excessive concentrations of chlorate and perchlorate during electrochemical oxidation. Applying a current density of 208 mA cm$^{-2}$, a complete
elimination of BPA was achievable after 15 min (Q/V = 430 mA h L\(^{-1}\)); however, the oxidation resulted in concentrations of chlorate and perchlorate of 2.85 and 5.65 mg L\(^{-1}\), respectively. These values were directly dependent on the exposure time and desired degree of BPA removal.