REMOVAL OF HYDROXYCHLOROQUINE AND ACID RED 51 AQUEOUS SOLUTIONS BY THE ELECTRON BEAM PROCESS

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In this study, electron beam (EB) process was employed to remove two emerging pollutants: hydroxychloroquine (HYQ), and Acid Red 51 (AR) in aqueous solution. Change of absorption spectra, pH effect, Chemical Oxygen Demand (COD) and Total Organic Carbon (TOC) were carried out and studied. It was found that all absorption bands decreased with increasing irradiation dose and disappear totally after 4 kGy and 7 kGy applied dose respectively for HYQ and AR. Unprecedented high removal rates of total organic carbon of the order of 98 % were achieved for both pollutants indicating quasi- total mineralization. Furthermore, based on spectrophotometric analysis, it was found that HYQ and AR degradation process follow a pseudo-first order kinetic. In addition, monitoring electron beam irradiation by CG/MS analysis, several by-products were identified indicating that HCQ degradation begins by the cleavage of the C-N bond in the aliphatic tertiary amine chain leading to 4-Amino-7-chloroquinoline and its hydroxylated derivatives. However, for AR degradation, the degradation process was started by hydroxyl radical's attack the chromophore group leading to 2- (2- formylphenyl)-2-carboxylate and 2-(2-(3,6- dihydro-2H-pyran-4-yl-phenyl)-2-carboxylate which are subsequently degrade onto 1,4-hydroquinone, oxalic and malonic acid before their mineralization into carbon dioxide and water. Based on identified intermediates, both degradation mechanistic schemas mediated by hydroxyl radicals have been proposed. Finally, it can be concluded that the electron beam process holds effective, great promise method as a treatment process of wastewater containing persistent organic pollutants.

Keywords: Electron beam process, DCO, TOC, Hydroxychloroquine, Acid Red 51, GC-MS.