MECHANISM OF AZO DYE DEGRADATION BY IONIZING RADIATION: DEGRADATION OF SULFANILIC ACID AZOCHROMOTROP AND ITS PARENT COMPOUNDS IN AQUEOUS SOLUTION

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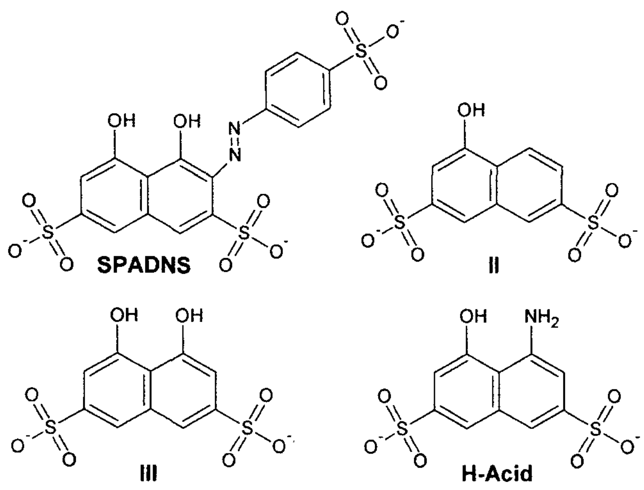
Mechanistic studies were made on $^{\bullet}$OH radical and hydrated electron reaction with Sulfanilic Acid Azochromotrop (SPADNS) as model azo dye. SPADNS contains 4,5-dihydroxynaphthalene 2,7-disulfonic acid part and 4-sulfophenylazo group. To establish the details of the reaction mechanism the reactions of two simpler molecules without 4-sulfophenylazo part were also studied: one of them contained one (in position 4, II), the other two (in positions 4 and 5, III) –OH groups. $^{\bullet}$OH radicals react with these molecules with radical addition to the naphthalene 2,7-disulfonic acid part. The adduct cyclohexadienyl type radical may decay in radical-radical reactions, or undergoes a (pH dependent) water elimination to naphthoxy radical, radical decay takes place on the ms timescale. $^{\bullet}$OH radical addition on the azo bond in dyes has low importance. Degradation efficiencies are 0.6–0.8. The hydrated electron in the case of the two simpler molecules reacts with the rings, while in the case of dye with the azo bond. Electron scavenging is followed by protonation, this reaction in the case of II and III yields cyclohexadienyl, while with the dye hydrazo radical. The efficiency of degradation with II and III is 0.2–0.6, while for the dye it is close to 1.



SPADNS

II

III

H-Acid