Abstract of the Thesis

The Thesis entitled “Effects of radiation on waste water containing organic pollutants” by Jhimli Paul Guin consists of Four Chapters. The work described in the thesis is mainly focused on radiation treatment of aqueous solutions of the representative organic pollutants viz. reactive red 120 (RR-120), ibuprofen (IBP) and 4-nitrophenol (4-NP).

Chapter 1 describes the environmental impacts of organic pollutants viz. textile dyes, pharmaceuticals and nitrophenols and their discharge statistics into water bodies. A brief discussion on the overviews of advanced oxidation processes used for the waste water treatment including a general introduction of use of radiation technology and the interaction of radiation with matter is also included in this Chapter.

Chapter 2 gives the brief principle and descriptions of instruments such as UV-Vis spectrophotometer, Chemical Oxygen Demand (COD) / Biological Oxygen Demand (BOD) / Total Organic Carbon (TOC) analyzer, pH meter, Fourier Transform Infra-Red (FTIR) Spectrophotometer, High Performance Liquid Chromatography (HPLC), Electron-Spray-Ionization (ESI-) and Gas-Chromatography (GC-) mass spectrometer. It also consists of a brief description of the chemicals, methodologies and procedures used for gamma radiolysis, pulse radiolysis, electron beam radiolysis, photocatalysis and ozonolysis employed at different stages of present work.

Chapter 3 describes the radiation induced decolouration and mineralization of the textile dye RR-120 on gamma and electron beam radiolysis under varying oxidizing and reducing radiolysis conditions. The enhancement of biodegradation by radiation treatment led to carry out more explorative studies on the influence of low dose gamma-irradiation pretreatment on the microbial decolouration and degradation of RR-120 dye. The mechanism of dye degradation was also investigated. The comparative results of gamma and electron beam radiolysis in presence of K$_2$S$_2$O$_8$ with other AOPs viz. photocatalysis and ozonolysis in terms of oxygen-equivalent chemical-oxidation capacities (OCC) for the mineralization of simulated textile dye waste water were discussed. The pulse radiolysis studies helped to reveal the favorable reaction of SO$_4$• (produced by the radiolysis of K$_2$S$_2$O$_8$) with SDBS (the most robust organic component of STDWW) producing benzyl and hydroxycyclohexadienyl type of radicals enhancing the extent of mineralization of STDWW during radiolysis in the presence of K$_2$S$_2$O$_8$.

Chapter 4 describes the results of gamma radiolysis of the aqueous solutions of IBP, a model pharmaceutical compound, in the presence and absence of K$_2$S$_2$O$_8$. The pulse radiolysis of IBP under different radiolytic conditions helped to understand the mechanism of efficient mineralization of IBP during gamma radiolysis in the presence of K$_2$S$_2$O$_8$. The results of gamma and pulse radiolysis of aqueous solutions of 4-NP under different radiolytic conditions were also discussed in this chapter.

The Thesis is concluded with the summary of the key findings and the bibliography.