

List of Figures

Fig 1.1	Flow diagram of carpet manufacturing process and photo of a carpet industry effluent.	1
Fig 1.2	Appearance and structure of Direct Blue 199 dye.	2
Fig 2.1	Crystal structures of TiO ₂ rutile (tetragonal), brookite (orthorhombic) and anatase (tetragonal) polymorphs.	15
Fig 3.1	Schematic diagram of UV-photochemical reactor.	32
Fig 3.2	Open Pan Reactor (OPR).	33
Fig 3.3	Calibration curve for the dye (Direct Blue 199) determination.	38
Fig 3.4	Synthesis process of undoped TiO ₂ photocatalysts.	39
Fig 3.5	Synthesis process of Fe doped TiO ₂ photocatalysts.	41
Fig 3.6	Synthesis process of I doped TiO ₂ photocatalysts.	43
Fig 3.7	Regeneration process of Fe doped TiO ₂ photocatalysts.	45
Fig 3.8	Adsorption study of dye on the synthesized photocatalysts.	51
Fig 3.9	Self-degradation study of the dye in open sunlight.	52
Fig 3.10	Self-degradation study of the dye in UV-PCR.	53
Fig 3.11	Kinetic study of dye degradation with synthesized photocatalysts.	54
Fig 4.1	FTIR analysis of collected wastewater.	59
Fig 4.2	XRD pattern of undoped and Fe doped (1-10%) TiO ₂ photocatalyst.	60
Fig 4.3	Intensity variation of the peak (101) and shifting of angle with doping.	61
Fig 4.4	Effect of Fe concentration on crystallite size.	62
Fig 4.5	UV-vis diffuse spectra undoped and (1-10% Fe doped TiO ₂).	64
Fig 4.6	Plots of $[F(R_{\alpha})h\nu]^{1/2}$ vs. photon energy.	65
Fig 4.7	Variation of band gap energy with Fe concentration.	66
Fig 4.8	FTIR spectra of undoped and Fe doped (1-10%) TiO ₂ photocatalysts.	67

Fig 4.9	XPS survey spectrum and resolution scan over (a) Ti 2p (b) O 1s (c) and Fe 2p (d) of 4% Fe doped TiO ₂ photocatalysts.	70-71
Fig 4.10	XPS survey spectrum and resolution scan over (a) Ti 2p (b) O 1s (c) and Fe 2p (d) of 5% Fe doped TiO ₂ photocatalysts.	72-73
Fig 4.11	TEM image of undoped TiO ₂ photocatalyst.	74
Fig 4.12	SAED image of undoped TiO ₂ photocatalyst.	75
Fig 4.13	Particle size distribution of undoped TiO ₂ photocatalysts.	75
Fig 4.14	TEM image of Ti _{0.96} Fe _{0.04} O ₂ photocatalyst.	76
Fig 4.15	SAED image of Ti _{0.96} Fe _{0.04} O ₂ photocatalyst.	76
Fig 4.16	Particle size distribution of Ti _{0.96} Fe _{0.04} O ₂ photocatalysts.	77
Fig 4.17	EDX analysis of undoped and (1-10%) Fe doped TiO ₂ photocatalysts.	80-82
Fig 4.18	Pictorial representation of dye degradation mechanism by synthesized Fe doped TiO ₂ photocatalysts.	85
Fig 4.19	FTIR analysis of photodegraded simulated dye solution.	86
Fig 4.20	Kinetic study of dye degradation for system 16.	88
Fig 4.21	Performance of regenerated Ti _{0.96} Fe _{0.04} O ₂ photocatalyst for photodegradation of wastewater (Direct Blue 199) in photocatalyst reactor with quartz tube.	90
Fig 4.22	XRD spectra of regenerated Ti _{0.96} Fe _{0.04} O ₂ photocatalysts.	90
Fig 4.23	Digital Coloured pictures show the photodegradation of industrial wastewater in the photochemical reactor in quartz tube using (a) fresh Ti _{0.96} Fe _{0.04} O ₂ photocatalyst (b) regenerated Ti _{0.96} Fe _{0.04} O ₂ photocatalysts.	91
Fig 4.24	Comparison for best photocatalyst among synthesized undoped TiO ₂ , Ti _{0.96} Fe _{0.04} O ₂ and P-25 for photodegradation of industrial wastewater.	92
Fig 4.25	XRD spectra of undoped and 1-10% Fe doped TiO ₂ photocatalysts.	94
Fig 4.26	Characteristics peak (101) of anatase of TiO ₂ .	95
Fig 4.27	Effect of I concentration on crystallite size.	96
Fig 4.28	UV-vis diffuse spectra of undoped and 1-10% I doped TiO ₂ .	97
Fig 4.29	Plots of $[F(R_{\alpha})h\nu]^{1/2}$ vs. photon energy.	98
Fig 4.30	Variation of band gap energy with I concentration.	99

Fig 4.31	FTIR spectra of undoped and I doped (0-10%) TiO ₂ photocatalysts.	100
Fig 4.32	XPS survey spectrum and resolution scan over (a) Ti 2p (b) O1s (c) and I 3d (d) of 3% I doped TiO ₂ photocatalysts.	102-103
Fig 4.33	XPS survey spectrum and resolution scan over (a) Ti 2p (b) O1s (c) and I 3d (d) of 4% I doped TiO ₂ photocatalysts.	104-105
Fig 4.34	TEM image of Ti _{0.97} I _{0.03} O ₂ photocatalyst.	107
Fig 4.35	SAED image of Ti _{0.97} I _{0.03} O ₂ photocatalyst.	108
Fig 4.36	Particle size distribution of Ti _{0.97} I _{0.03} O ₂ photocatalyst.	108
Fig 4.37	EDX analysis of (1-10%) I doped TiO ₂ photocatalyst.	111-113
Fig 4.38	Pictorial representation of dye degradation mechanism by synthesized I doped TiO ₂ photocatalysts.	114
Fig. 4.39	FTIR analysis of treated industrial wastewater.	116
Fig 4.40	Kinetic study of dye degradation for system 46.	117
Fig 4.41	Performance of regenerated Ti _{0.96} I _{0.03} O ₂ photocatalyst for photodegradation of wastewater.	119
Fig 4.42	XRD spectrum of the regenerated Ti _{0.97} I _{0.03} O ₂ photocatalyst.	120
Fig 4.43	Digital Coloured pictures show the photodegradation of wastewater (Direct Blue 199) in the photochemical reactor in quartz tube using regenerated Ti _{0.97} I _{0.03} O ₂ photocatalyst.	121
Fig 4.44	Comparison for best photocatalyst among synthesized undoped TiO ₂ , Ti _{0.97} I _{0.03} O ₂ and P-25 for photodegradation of wastewater (Direct Blue 199).	122