

## List of figures

<b>Figure no.</b>	<b>Figure caption</b>	<b>Page no.</b>
Figure 3.1	(a) COD reduction (%), (b) Turbidity reduction (%) v/s temperature change of PRE at the fixed condition of 7 pH, 0.4 kg/m <sup>3</sup> catalyst dose, 120 min time, and 120 RPM	42
Figure 3.2	(a) COD reduction (%), (b) Turbidity reduction (%) v/s pH of raw PRE, CuSO <sub>4</sub> , FeSO <sub>4</sub> , FeCl <sub>3</sub> and CuSO <sub>4</sub> +FeCl <sub>3</sub> at optimum temperature of 80, 70, 60, 70°C and fixed time (120 min) and 120 RPM	45
Figure 3.3	(a) COD reduction (%), (b) Turbidity reduction (%) v/s dose (kg/m <sup>3</sup> ) for CuSO <sub>4</sub> , FeSO <sub>4</sub> , FeCl <sub>3</sub> and CuSO <sub>4</sub> +FeCl <sub>3</sub> at optimum temperature of 80, 70, 60, 70°C and pH 9, 9, 5, 7, time (120 min), and 120 RPM	48
Figure 3.4	(a) COD reduction (%), (b) Turbidity reduction (%) v/s time (min) for CuSO <sub>4</sub> , FeSO <sub>4</sub> , FeCl <sub>3</sub> and CuSO <sub>4</sub> +FeCl <sub>3</sub> at optimum temperature of 80, 70, 60, 70°C; pH 9, 9, 5, 7; dose 0.6, 0.6, 0.2, 1.0 kg/m <sup>3</sup> , respectively, and at 120 RPM	49
Figure 3.5	FTIR spectra of sludge precipitated from PRE and treated wastewater with different catalysts	52
Figure 3.6	SEM image of sludge formed after catalytic thermolysis (a) CuSO <sub>4</sub> (b) FeSO <sub>4</sub> (c) FeCl <sub>3</sub> (d) CuSO <sub>4</sub> +FeCl <sub>3</sub>	54
Figure 3.7	TGA, DTG and DTA plots of sludge obtained after catalytic thermolysis: (a) TGA, (b) DTG, and (c) DTA	58
Figure 4.1	Design expert plot, predicted vs. actual plot for CuSO <sub>4</sub> coagulant (a) Final pH (b) COD reduction (c) turbidity reduction (d) TDS reduction (e) color reduction.	78
Figure 4.2	Design expert plot, predicted vs. actual plot for FeCl <sub>3</sub> coagulant (a) Final pH (b) COD reduction (c) turbidity reduction (d) TDS reduction (e) color reduction.	79
Figure 4.3	Design expert plot, predicted vs. actual plot for CuSO <sub>4</sub> + FeCl <sub>3</sub> coagulant (a) Final pH (b) COD reduction (c) turbidity reduction (d) TDS reduction (e) color reduction.	80
Figure 4.4	Design expert plot; response surface 3D plot for CuSO <sub>4</sub> coagulant (a) Final pH (b) COD reduction (c) turbidity reduction (d) TDS reduction (e) color reduction.	81
Figure 4.5	Design expert plot; response surface 3D plot for FeCl <sub>3</sub> coagulant (a) Final pH (b) COD reduction (c) turbidity reduction (d) TDS reduction (e) color reduction	82
Figure 4.6	Design expert plot; response surface 3D plot for CuSO <sub>4</sub> + FeCl <sub>3</sub> coagulant (a) Final pH (b) COD reduction (c) turbidity reduction (d) TDS reduction (e) color reduction	83
Figure 4.7	XPS survey of flocs obtained after coagulation and flocculation using (a) CuSO <sub>4</sub> (b) FeCl <sub>3</sub> (c) CuSO <sub>4</sub> + FeCl <sub>3</sub>	98
Figure 4.8	(a) Cu2p3 (b) Fe2p XPS core level spectra of flocs in after coagulation and flocculation using CuSO <sub>4</sub> , FeCl <sub>3</sub> and CuSO <sub>4</sub> + FeCl <sub>3</sub>	99
Figure 4.9	SEM image of flocs formed after coagulation and flocculation (a) PRE (b) CuSO <sub>4</sub> (c) FeCl <sub>3</sub> (d) CuSO <sub>4</sub> + FeCl <sub>3</sub> coagulants	100
Figure 5.1	(a) TGA (b) DTG (c) DTA analysis of sludge S1 and S2 obtained after	115

Soxhlet extraction		
Figure 5.2	FTIR analysis of original sludge (S1) and sludge after Soxhlet extraction (S2)	118
Figure 5.3	SEM-EDX analysis and color mapping of sludge (a) OPS sludge (S1), (b) OPS Soxhlet extraction (S2)	120
Figure 5.4	XRD analysis of original sludge (S1) and sludge after Soxhlet extraction (S2)	121
Figure 5.5	GC-MS spectra of liquid extracted from sludge using Soxhlet extraction method	122