List of Figures

Figure No	Figure Caption	Page No
Figure 1.1	Water distribution across the world	2
Figure 1.2	Classification of technologies available for pollutant removal	3
Figure 1.3	Membrane separation process classification based on their pore size and pressure.	7
Figure 1.4	Number of publications from 2008-2018 on the membrane technology for wastewater treatment	8
Figure 1.5	Current and proposed treatment method for removal of heavy metal	14
Figure 2.1	Schematic representation for green route synthesis of nanoparticles	23
Figure 2.2	Mechanism for photocatalytic degradation of pollutant	29
Figure 2.3	Different techniques for remediation of chromium contaminated water	42
Figure 2.4	Schematic representation of nanofiltration photocatalytic membrane	48
Figure 2.5	Experimental setup representation for As removal	49
Figure 2.6	Schematic representation of photocatalytic membrane reactor	51
Figure 3.1	Schematic representation of (a) particle and (b) membrane synthesis	88
Figure 3.2	(a) HRTEM image of TiO_2 NPs (b) SAED pattern of TiO_2 NPs	93
Figure 3.3	(a) XRD pattern (b) DLS spectra of synthesized TiO_2 NPs (c) XRD pattern of TiO_2 NPs , PVDF and PVDF/ TiO_2 membrane	94
Figure 3.4	(a) FTIR spectra and (b) Fraction value of α and β-phases of pure PVDF and PVDF/TiO_2 composite membranes	96
Figure 3.5	(a) DRS spectrum (b) Band energy of PVDF/TiO_2 composite membranes	97
Figure 3.6	Ternary Phase diagram of PVDF/NMP (a) no TiO_2 (b) 1 wt% TiO_2 (c) 2 wt% TiO_2 (d) 3 wt% TiO_2	98
Figure 3.7	(a) Relative concentration versus time	100
Figure 3.7	(b) Relative concentration versus $t^{0.5}$ for different composite membranes	101

Figure 3.7	(c) Comparison of the thermodynamic and kinetic properties of the polymeric casting solution	103
Figure 3.8	HRSEM images (a) no TiO_2 (b) 1 wt% TiO_2 (c) 2 wt% TiO_2 (d) 3 wt% TiO_2	104
Figure 3.9	Change in (a)Contact angle, (b) pore size,(c) porosity (d) tortuosity with TiO_2 loading	106
Figure 4.1	3D AFM image of different PVDF composite membranes.	123
Figure 4.2	Variation of interaction energy between membrane and BSA	127
Figure 4.3	Inhibition zone formation for different PVDF composites membrane	128
Figure 4.4	The OD_{600} value of the PM1 (control, no TiO_2), PM2, PM3, and PM4 incubated for 24h.	129
Figure 4.5	HRSEM images of PVDF-TiO_2membranes before and after bacterial growth.	130
Figure 4.6	Antibacterial activity of different composite membranes	131
Figure 4.7	(a) Water flux value for different composite membranes before and after filtration of BSA bearing water (b) FRR and (c) % BSA rejection for different PVDF/TiO_2 composite membrane (d) Flux ratio during filtration of HA solution.	134
Figure 5.1	The dead-end filtration cell	148
Figure 5.2	Adsorption capacity of composite membrane at different TiO_2 loading	153
Figure 5.3	Pure water flux before and after BSA filtration	154
Figure 5.4	a) FRR of membranes b) Fouling resistance of membranes	155
Figure 5.5	Comparison of experimental and predicted filtration data and classic fouling models for membrane	157
Figure 6.1	Schematic representation of setup for rejection of Cr(VI) using membrane and reduction of Cr(VI) using photocatalyst	167
Figure 6.2	Schematic representation of the mechanism from Cr(VI) removal	173
Figure 6.3	UV spectra of Cr(VI) solution at different condition	174
Figure 6.4	Effect of NPs loading: (a) Variation of Flux, (b) % rejection & (c) % reduction with time	176

Figure 6.5	Effect of particle size: (a) Variation of Flux, (b) %rejection and (c) % reduction with time	177
Figure 6.6	Effect of pH: Variation of (a) Flux, (b) %rejection and (c) % reduction with time	179
Figure 6.7	Effect of [Cr(VI)]: (a)Variation of Flux, (b) %rejection and (c) % reduction with time	180
Figure 6.8	Effect of transmembrane pressure: (a) Variation of flux, (b) % Rejection and % reduction with time	181
Figure 6.9	Actual vs. Predicted plot of model a) % Rejection b) % Reduction	182
Figure 6.10	3D dimensional response surface and contour plots of % Rejection showing the effect of (a) Particle Loading and Cr concentration (b) pH and Particle Loading; (c) pH and Cr concentration	185
Figure 6.11	3D dimensional response surface and contour plots of % Reduction showing the effect of (a) Particle Loading and Cr concentration (b) pH and Particle Loading; (c) pH and Cr concentration.	187
Figure 6.12	(a)Reusability of PVDF/TiO_2 membrane for Cr (VI) removal (b) Contact Angle value of the membrane after each run	189
Figure 6.13	FTIR spectra of membrane at different operating condition	190
Figure 6.14	BET surface area of membrane before and after Cr removal	190
Figure 6.15	Graph of pH, TSS, COD, and Cr for wastewater before and after treatment for 3 different types of tannery industry	192