

Supporting information

Synthesis, Characterization and Testing of Metallic Nanoparticles/rGO blend Poly methyl methacrylate Membranes for the Effective Removal of Cd²⁺ from Model and Effluent Water

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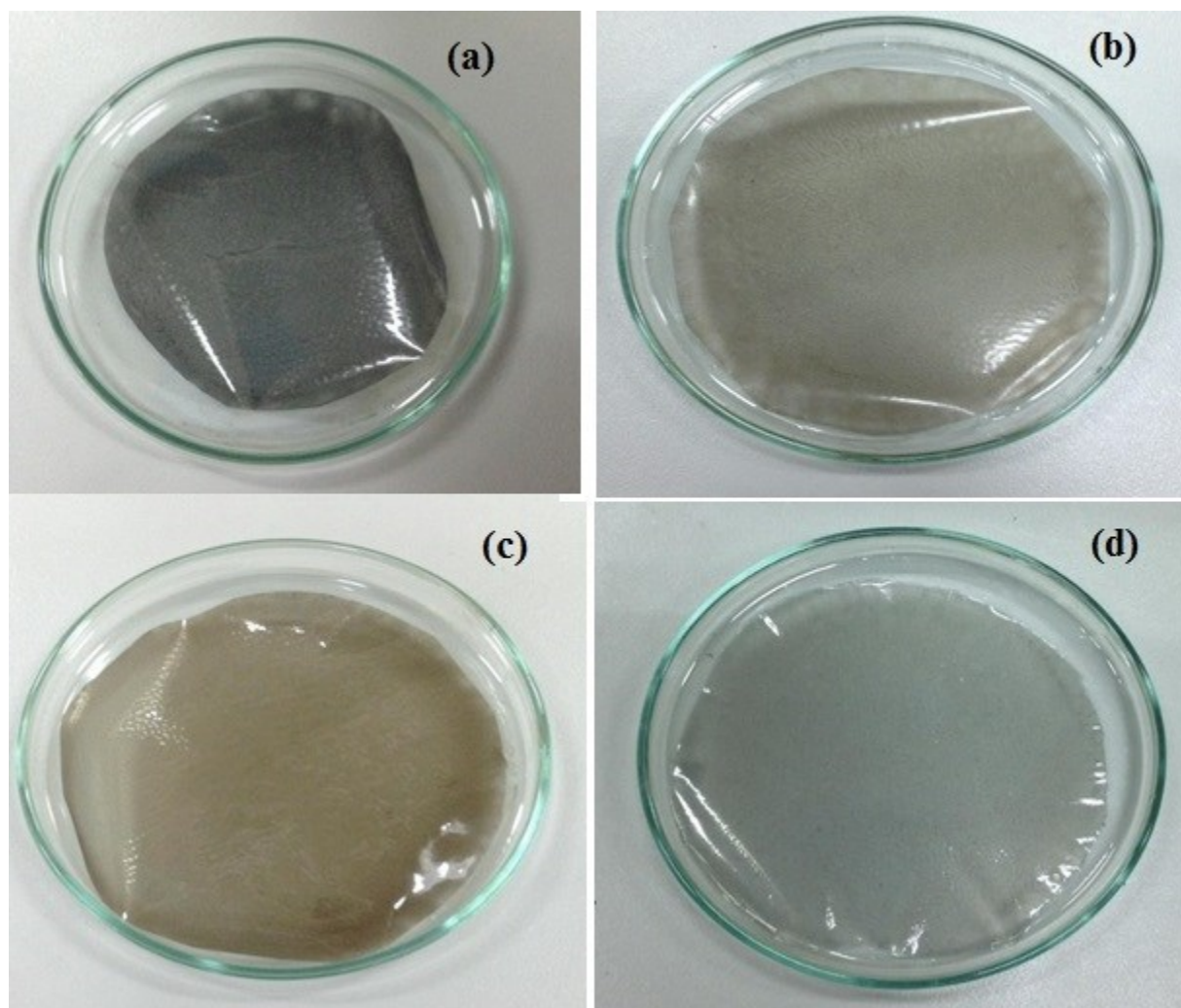
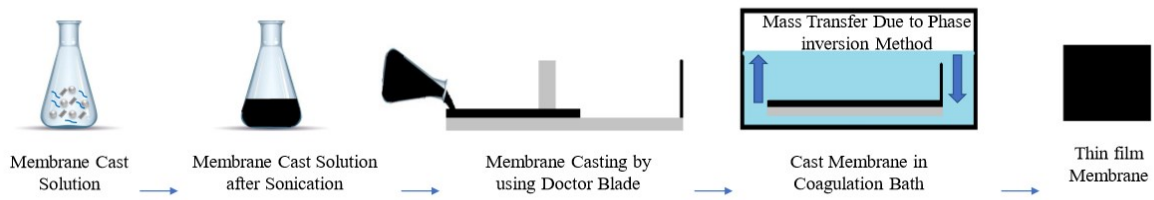
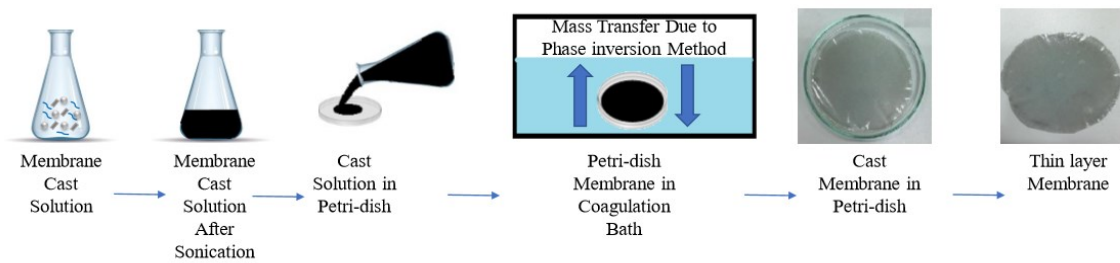


Figure S1: Images of various synthesized PMMA/rGO/Ag₂O (1a); PMMA/rGO/CuO (b); PMMA/rGO/Fe₂O₃ (c); PMMA/rGO/ZnO (d) membranes.



Diagrammatic Presentation of Doctor Blading and Phase Inversion Method



Diagrammatic Presentation of Phase Inversion Method in Petri-dish

Figure S2: Phase Inversion method Types: Doctor Blading (a); Petri-Dish method (b).

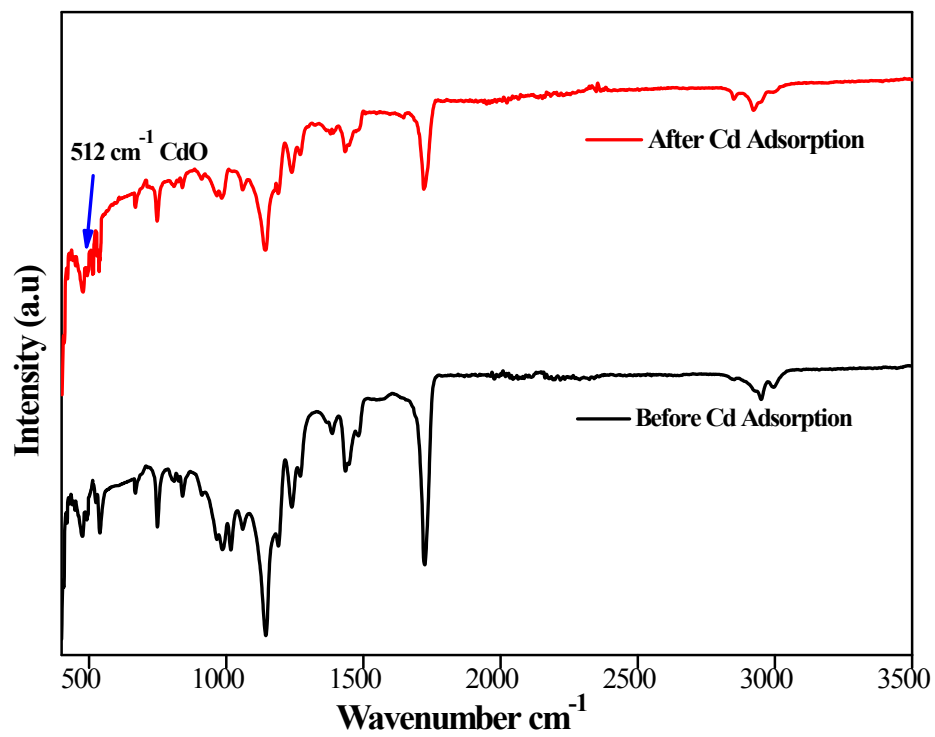


Figure S3: FTIR spectra of PMMA/rGO/Ag₂O membranes before and after Cd²⁺ ions removal from waste tonner.

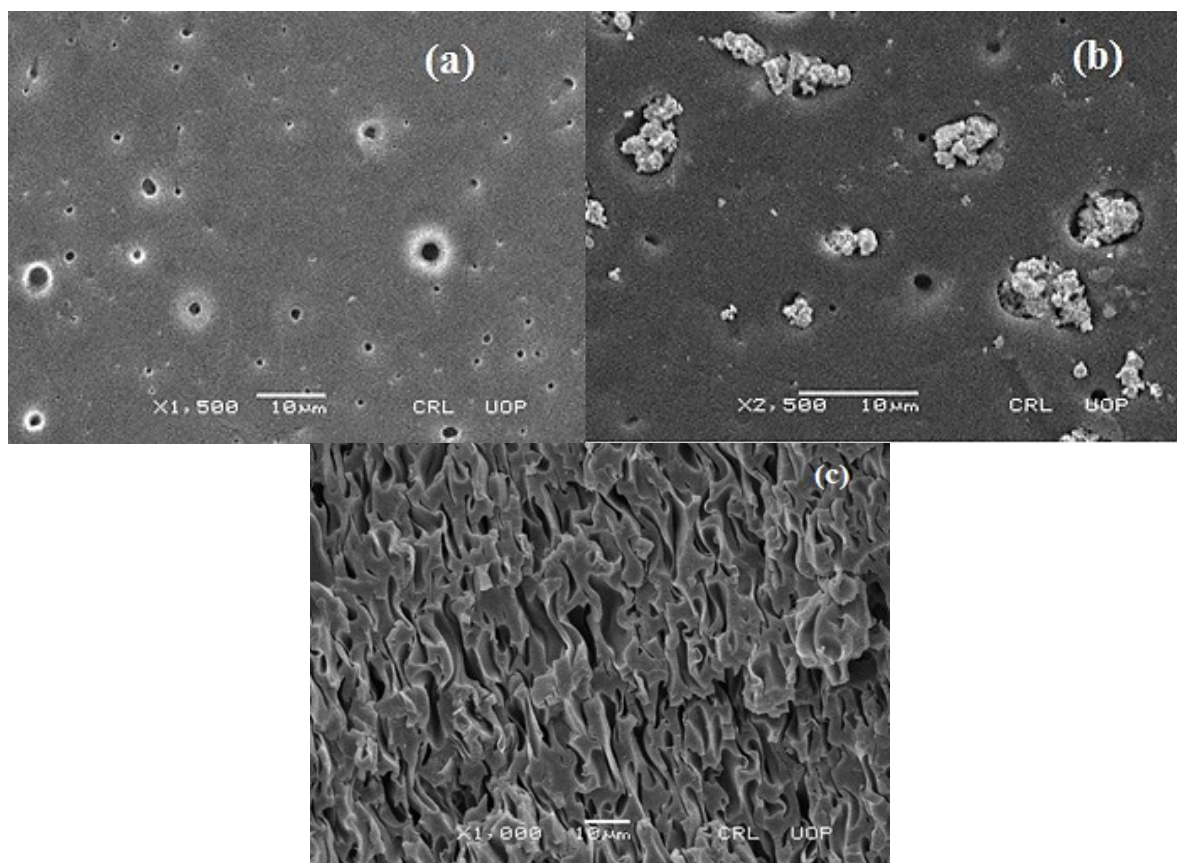


Figure S4: SEM images of PMMA/rGO/Ag₂O membrane: (a) before and (b) after extraction of Cd²⁺ ions from real sample (tonner), and (c) represents the cross sectional image

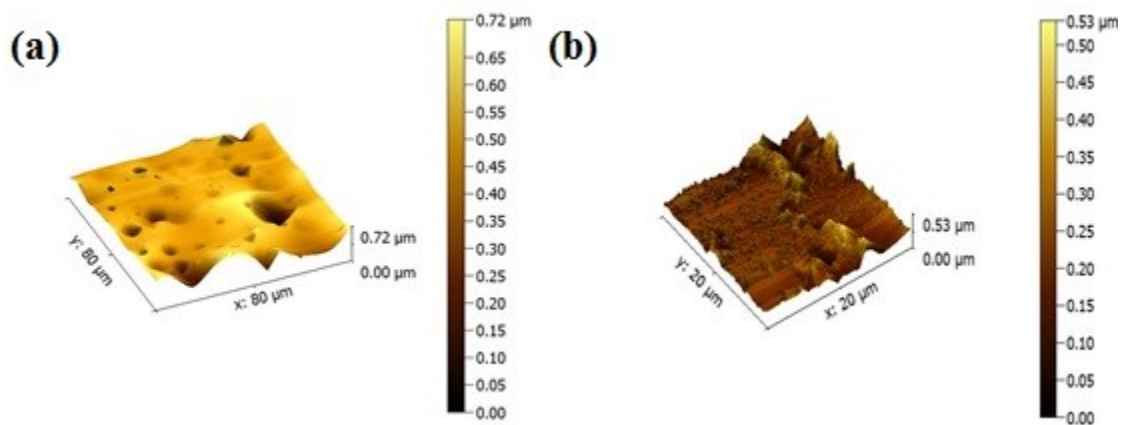


Figure S5: AFM 3-D image of PMMA/rGO/Ag₂O membrane: (a) before and (b) after extraction of Cd²⁺ ions from real sample (tonner)

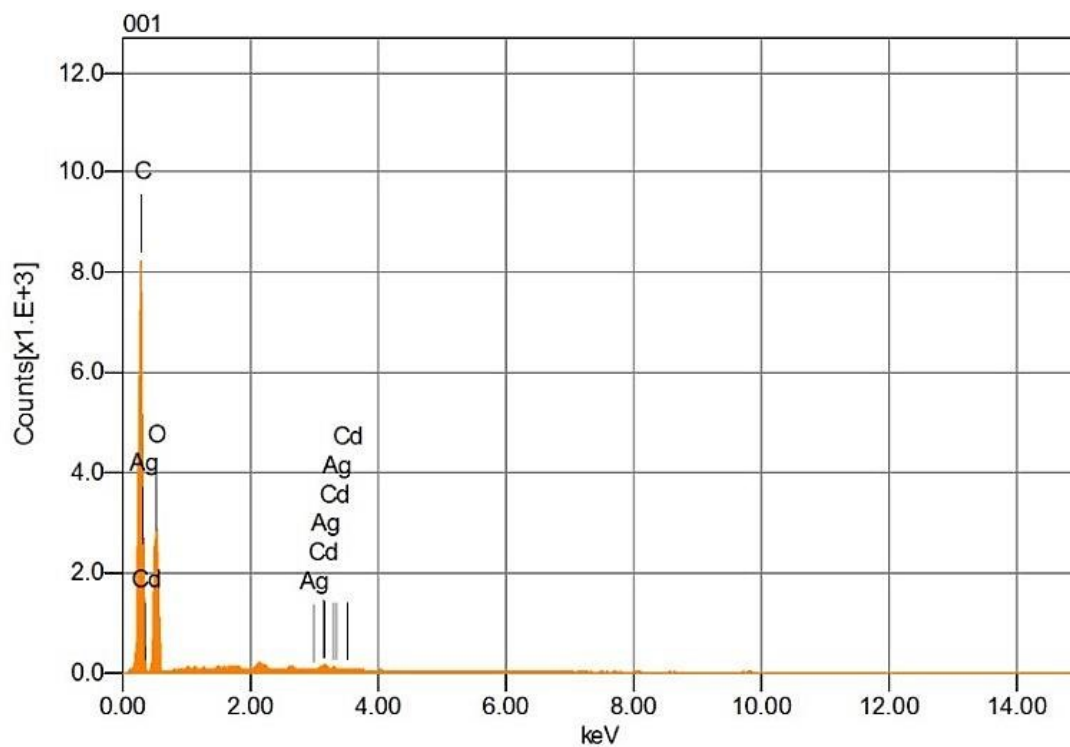


Figure S6: EDX analysis for Cd²⁺ ion removal from waste water (tonner) after extraction using PMMA/rGO/Ag₂O membrane

Table S1: Composition of PMMA, rGO and metallic nanoparticles incorporated hybrid membranes.

1a: PMMA/rGO/Ag₂O

Membrane Code	Polymer (PMMA)	Fillers		Solvent	Time of evaporation (mins)
		rGO	Ag ₂ O	Acetone (wt.%)	
M1	0.5	0.1	0.4	99	8.5
M2	1	0.2	0.8	98	7.5
M3	1.5	0.5	1	97	7
M4	2	0.8	1.2	96	6.5
M5	2.5	1	1.5	95	5.5

1c: PMMA/rGO/Fe₂O₃

Membrane Code	Polymer (PMMA)	Fillers		Solvent	Time of evaporation (mins)
		rGO	Fe ₂ O ₃	Acetone (wt.%)	
M6	0.5	0.1	0.4	99	9
M7	1	0.2	0.8	98	8.7
M8	1.5	0.5	1	97	7.5
M9	2	0.8	1.2	96	6.5
M10	2.5	1	1.5	95	6

1b: PMMA/rGO/CuO

Membrane Code	Polymer (PMMA)	Fillers		Solvent	Time of evaporation (mins)
		rGO	CuO	Acetone (wt.%)	
M11	0.5	0.1	0.4	99	11
M12	1	0.2	0.8	98	10

M13	1.5	0.5	1	97	9.7
M14	2	0.8	1.2	96	9
M15	2.5	1	1.5	95	8.5

1d: PMMA/rGO/ZnO

Membrane Code	Polymer (PMMA)	Fillers		Solvent	Time of evaporation (mins)
		rGO	ZnO	Acetone (wt.%)	
M16	0.5	0.1	0.4	99	12
M17	1	0.2	0.8	98	11.5
M18	1.5	0.5	1	97	10
M19	2	0.8	1.2	96	9.7
M20	2.5	1	1.5	95	9

Table S2: Composition of membrane casting solutions.

Combination	PMMA (g)	Acetone (wt. %)	rGO (g)	(Ag ₂ O/Fe ₂ O ₃ /CuO/ZnO) NPs
				(individually) (g)
C1	0.5	99	0.1	0.4
C2	1.0	98	0.2	0.8
C3	1.5	97	0.5	1.0
C4	2.0	96	0.8	1.2
C5	2.5	95	1.0	1.5