High-yield synthesis of poly(m-phenylenediamine) hollow nanostructures by diethanolamine-assisted method and their enhanced ability for Ag^+ adsorption

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Electronic Supplementary Information

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Fig. S1 X-ray diffractograms of PmPD.

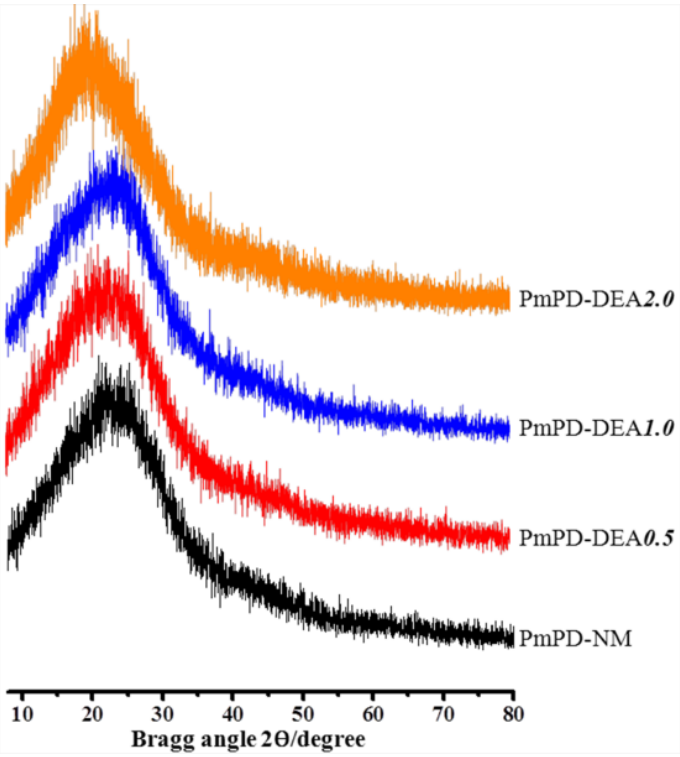

Fig. S2 TG of PmPD prepared with or without the aid of DEA.

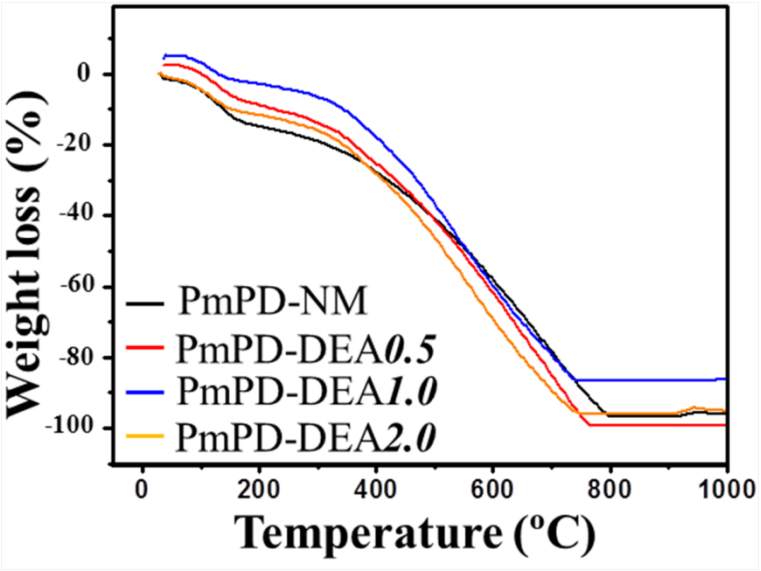

Fig. S3 TEM image of PmPD synthesized with the aid of DPA (~1.0 M)

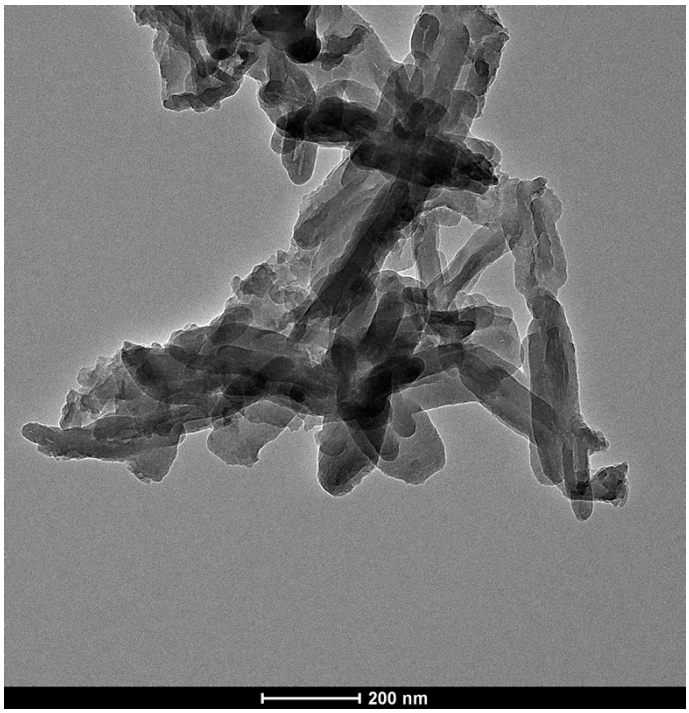

Table S1 Comparison of the Ag^+ adsorbance of other common adsorbents.

Adsorbent	Dosage ($g \cdot L^{-1}$)	pH	Initial conc. (mM)	Adsorbance ($mg \cdot g^{-1}$)	Ref.
Modified vermiculite	20	4	0.1	69	[1]
Activated carbon	1	-	3.0	152	[2]
polyaniline	2	3.3	50	631	[3]
Poly(o-phenylenediamine)	2	5.4	100	533	[4]
Poly(1,8-naphthylenediamine)	2	5.3	82	885	[5]
Poly(aniline-co-5-sulfo-2-anisidine)	2	5.5	185	2034	[6]
PmPD-$NaOH_2$	1.25	5.1	200	1693	[7]
PmPD-DEA***1.0***	1.25	5.1	199.5	2359.3	This study

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2. X. Song, P. Gunawan, R. Jiang, S. S. J. Leong, K. Wang and R. Xu, *J. Hazard. Mater.*, 2011, **194**, 162.

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4. X. G. Li, X. L. Ma, J. Sun and M. R. Huang, *Langmuir*, 2009, **25**, 1675.

5. X. G. Li, M. R. Huang and S. X. Li, *Acta Mater.*, 2004, **52**, 5363.

6. X. G. Li, H. Feng and M. R. Huang, *Chem. Eur. J.*, 2010, **16**, 10113

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Fig. S4 TEM image of PmPD-DEA*1.0* after adsorbing $AgNO_3$ solution.

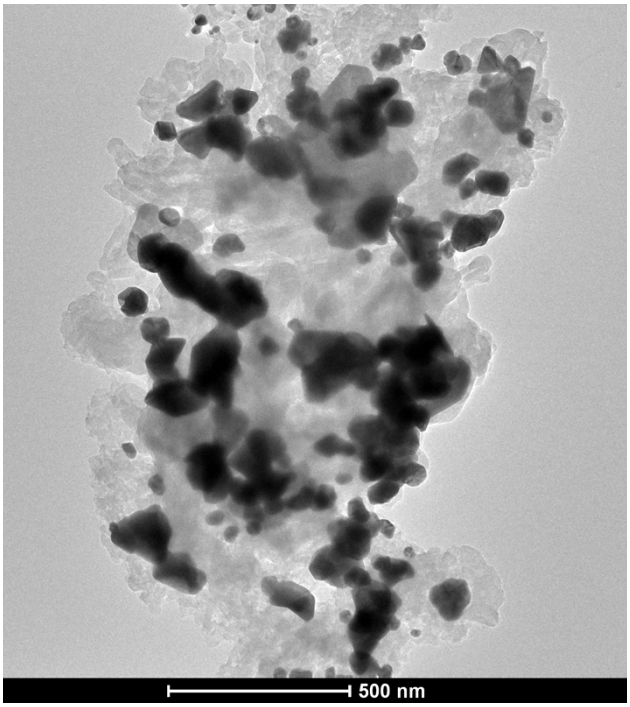
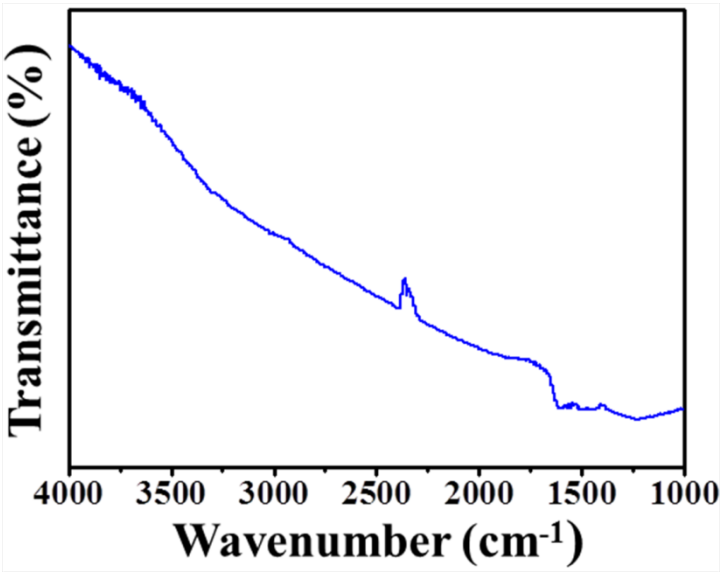
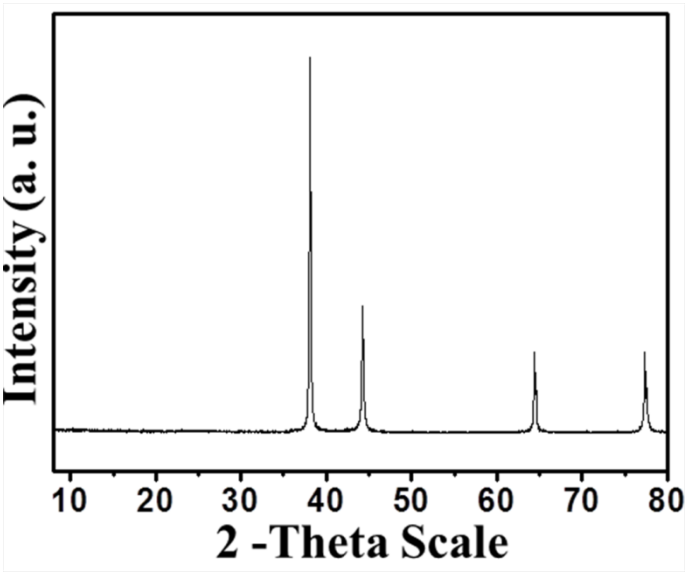


Fig. S5 FTIR of PmPD-DEA*1.0* after adsorbing $AgNO_3$ solution.



The FTIR spectrum of PmPD-DEA***1.0*** after Ag^+ adsorption further confirms the redox sorption mechanism. The broad peaks between 3500-3000 cm^{-1} due to -NH- stretching vibration in the polymer tremendously declines after Ag^+ adsorption, which may suggest that they are oxidized to –N= groups. Notably, the peak at 1500 cm^{-1} representing benzenoid amine structure has disappeared on Ag^+ adsorption indicating that the benzenoid ring has been oxidized to quinoid ring.

Fig. S6 XRD of the PmPD-DEA*1.0* after Ag^+ adsorption.



XRD patterns were indexed using Jade 5.0.

38.02, 44.21, 64.39, 77.29° are corresponding to the (111), (200), (220) and (311) reflections of the face-centered cubic (fcc) structure of metallic silver, respectively.

Scheme S1. Reaction of benzenoid amine and quinoid imine with Ag^+.