Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting Information

Solvent-less method for efficient photocatalytic α-Fe_2O_3 nanoparticles using macromolecular polymeric precursors

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S1: Photographs showing the color/aspect of each precursor.

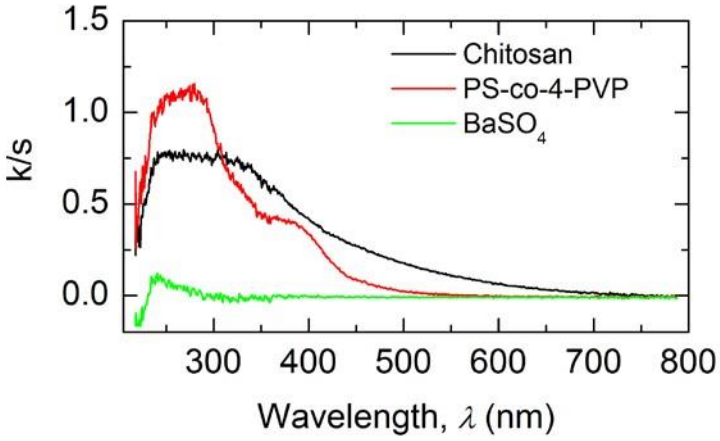
Fe(II)-Chitosan 1:1

Fe(III)-PVP 1:1

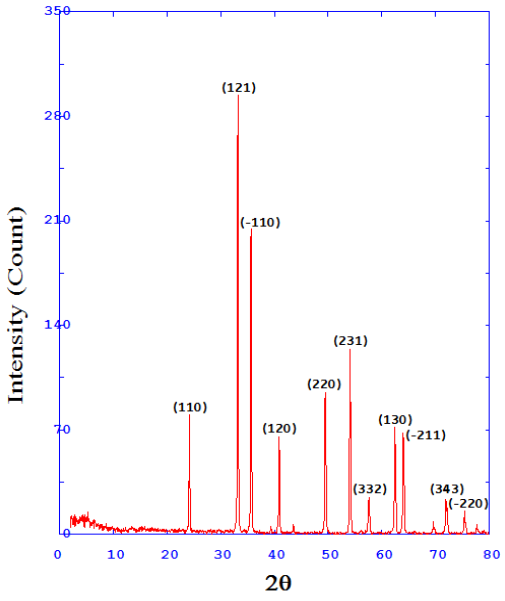
Fe(II)-PVP 1:1

Fe(III)-Chitosan 1:1

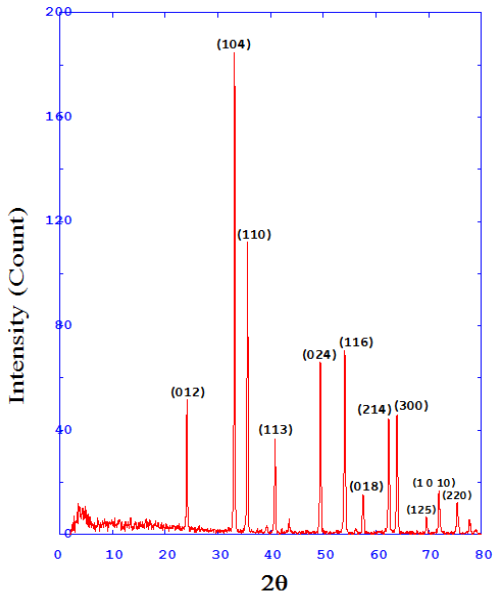
S2: UV-vis range Kubelka-Munk diffuse reflectance spectra of Chitosan, PS-co-4-PVP and the reference $BaSO_4$ under identical conditions to those of the Fe_2O_3 NP loaded carbon photocatalytic materials.



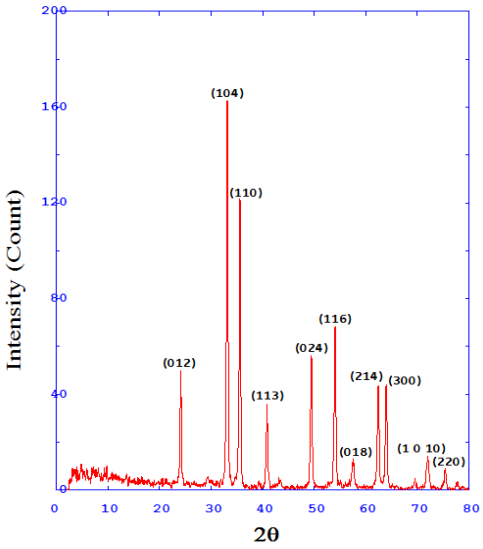
S3: XRD patterns of the as-prepared Fe_2O_3 products.



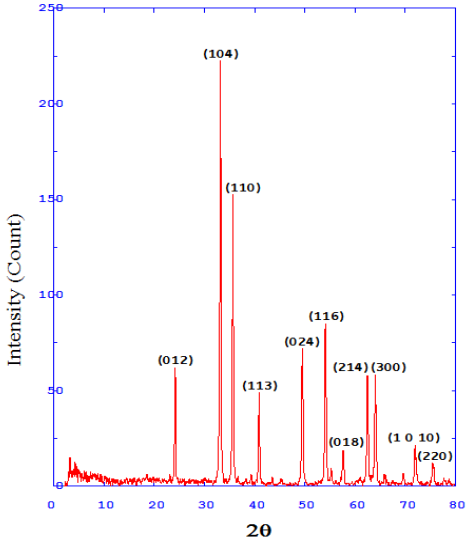
XRD pattern from precursor Chitosan●$(FeCl_3)_y$ 1:1



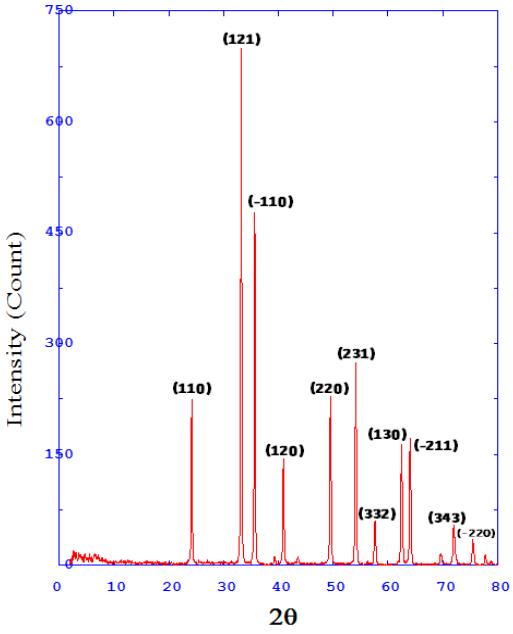
XRD pattern from precursor PSP-co-4-PVP ●$(FeCl_3)_y$ 1:1



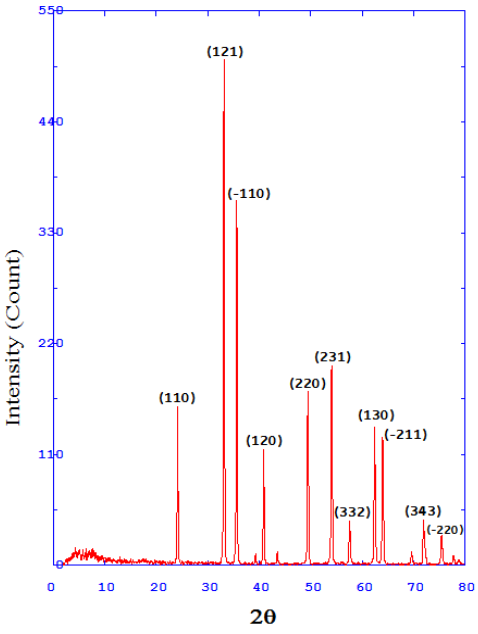
XRD pattern from precursor Chitosan●$(FeCl_3)_y$ 1:5



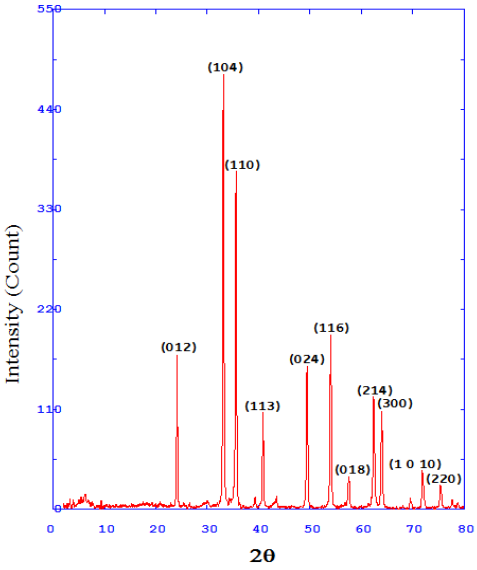
XRD pattern from precursor PSP-co-4-PVP●$(FeCl_3)_y$ 1:5



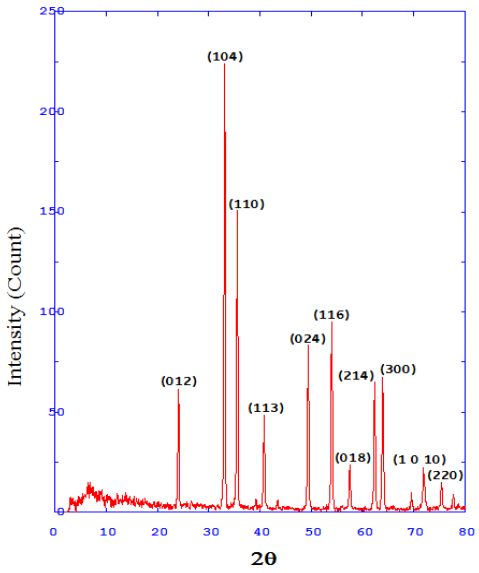
XRD pattern from precursor Chitosan●$(FeCl_2)_y$ 1:1



XRD pattern from precursor PSP-co-4-PVP ●$(FeCl_2)_y$ 1:1

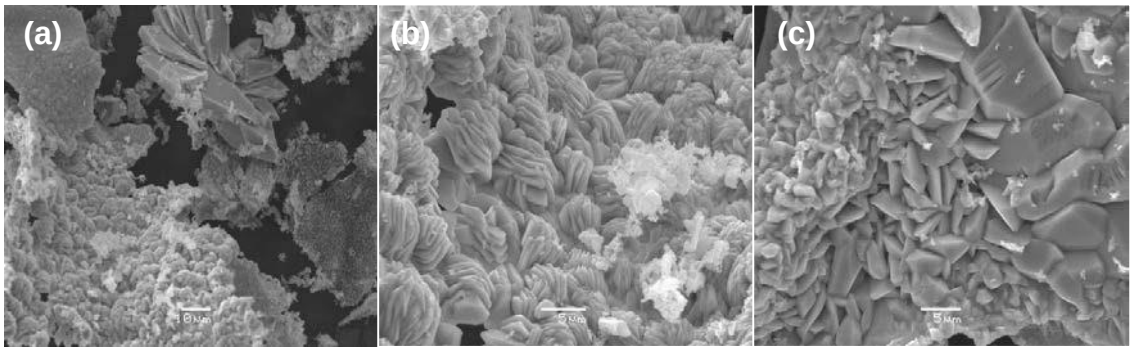


XRD pattern from precursor Chitosan●$(FeCl_2)_y$ 1:5

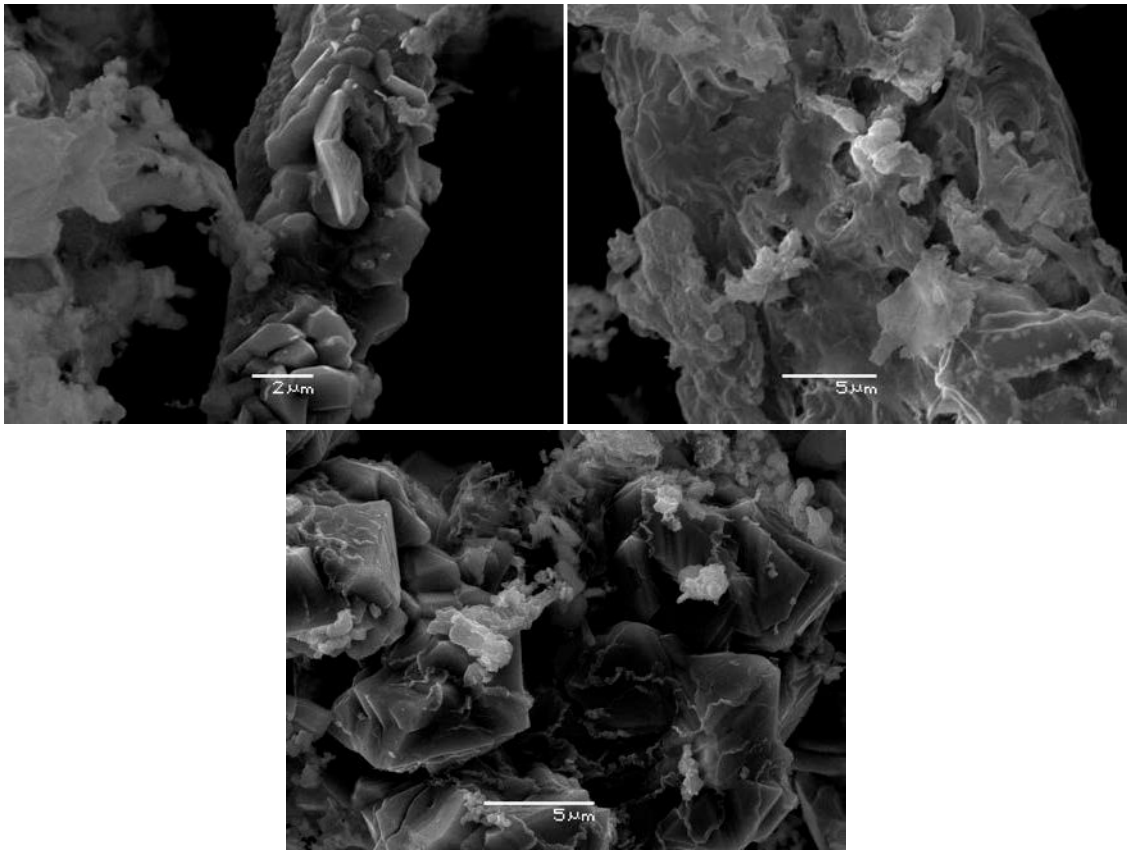


XRD pattern from precursor PSP-co-4-PVP●$(FeCl_3)_y$ 1:5

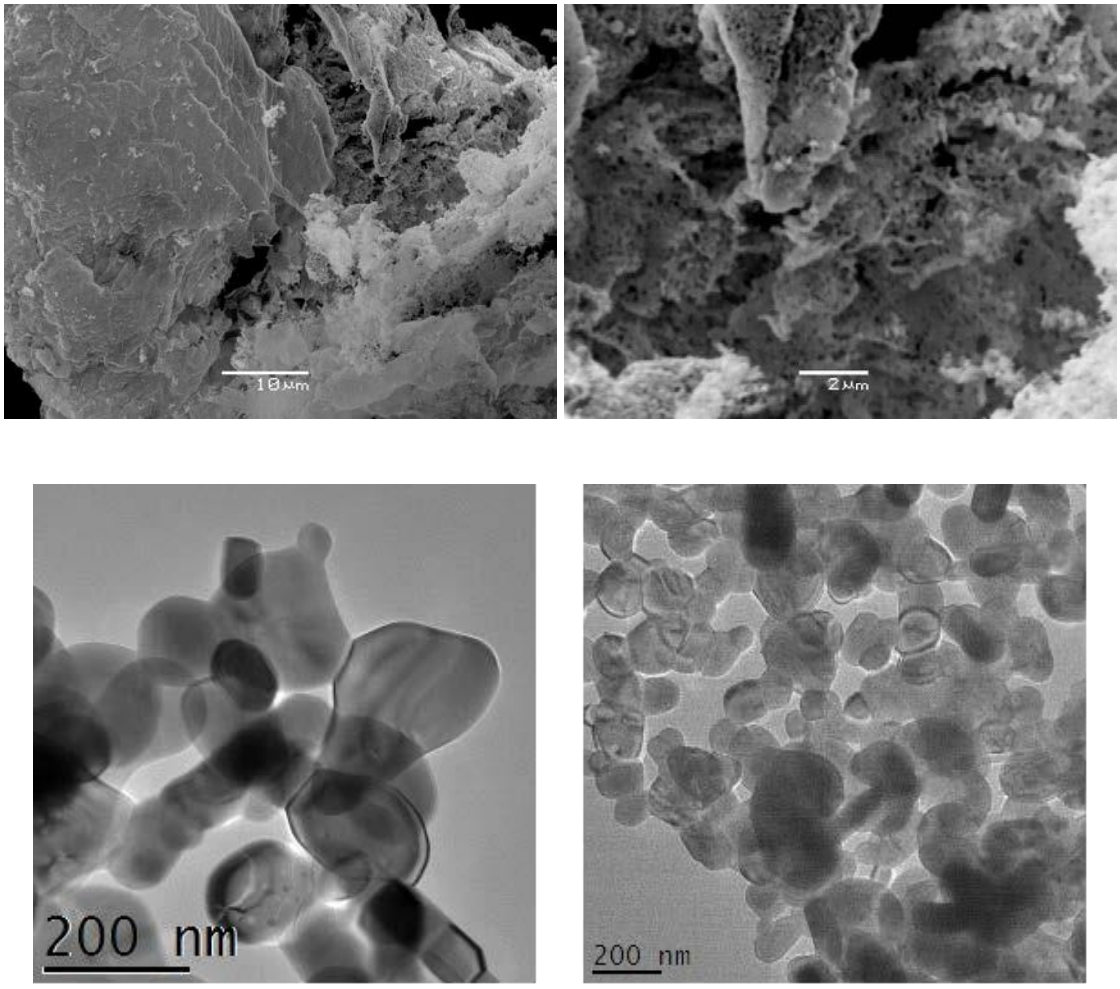
S4: SEM images (a), (b) and (c) of pyrolytic product from the precursor PS-b-4-PVP●$(FeCl_3)_y$ 1:1 from different zones.



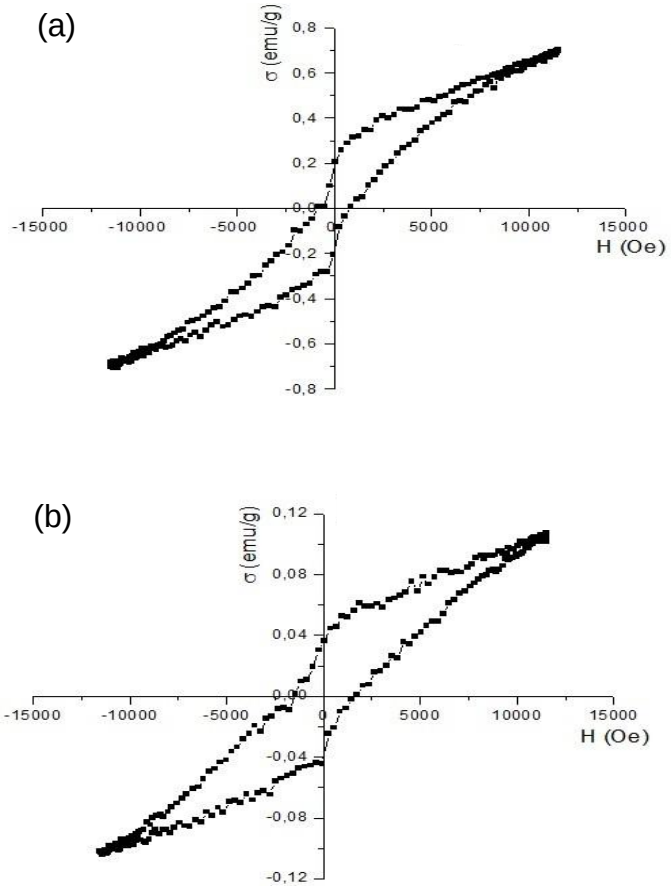
S_5: SEM images of the pyrolytic precursor from PS-co-4-PVP$(FeCl_3)_y$ in 1:5 ratio.



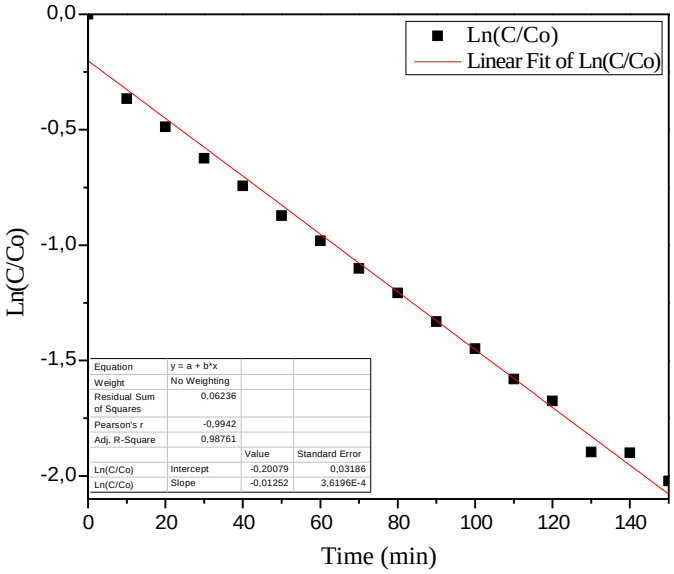
S6: SEM and TEM images for the pyrolytic precursor from Chitosan$(FeCl_2)_y$ 1:5



S7: Magnetic measurements of α-F_2O_3 nanoparticle product from the precursors (a) PS-co-4-PVP• ($FeCl_3$)y and (b) Chitosan•($FeCl_3$)y (b) at room temperat**ure.**



S8: (a) Reaction rate constant versus irradiation time of MB with α-Fe_2O_3·PS-co-4-PVP, and (b) Reaction rate constant versus irradiation time of MB with α-Fe_2O_3·Chitosan.



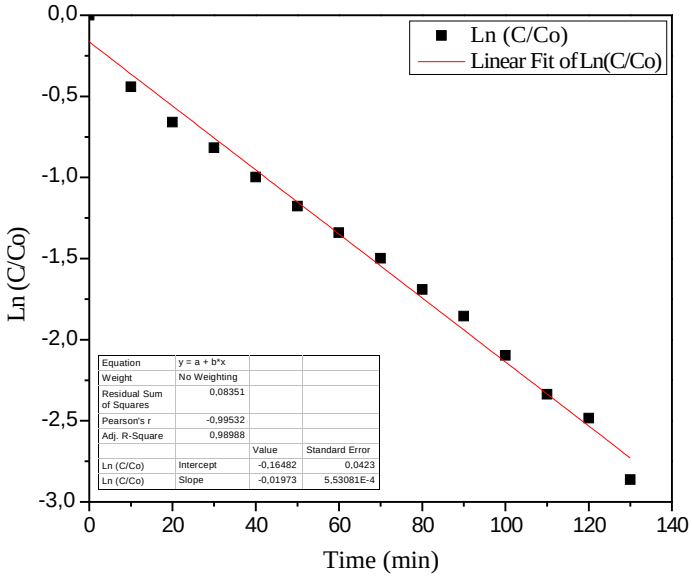


Table S1. Experimental details of the reactions for the formation of the precursors. In all cases, the metallic salt weight was 0.5 g.

Precursor	**Molar Ratio M/polymer**	**Polymer Weight (g)**
PSP-*co*-4-PVP•$(FeCl_3)_y$	(1) 1:1	0.38
	(2) 1:5	1.94
PSP-*co*-4-PVP•$(FeCl_2)_y$	(3) 1:1	0.53
	(4) 1:5	2.63
Chitosan•$(FeCl_3)_y$	(5) 1:1	0.27
	(6) 1:5	1.36
Chitosan•$(FeCl_2)_y$	(7) 1:1	0.37
	(8) 1:5	1.85

Table S2. IR data for coordinated macromolecular precursors.

Macromolecular Precursor or Polymer	**Wave Number (cm^{-1}) ν(OH-Fe) + ν(NH_2-Fe)**
Chitosan	3447.68[1]
(III) 1:1 molar ratio	3442.20
(III) 5:1 molar ratio	3434.06
(IV) 1:1 molar ratio	3423.12
(IV) 5:1 molar ratio	3432.52

[1]Free Chitosan ν(OH-Fe) + ν(NH_2-Fe) vibrations

On coordination of Chitosan, the ν(OH-Fe) + ν(NH_2-Fe) vibrations shifted to lower wave number.

Macromolecular Precursor or Polymer	**Wave Number (cm^{-1})** **ν(C_5H_5N)** **Pyridine Ring Vibrations**
PS-*co*-4-PVP	1590.02
(I) 1:1 molar ratio	1624.42
(I) 5:1 molar ratio	1623.59
(II) 1:1 molar ratio	1618.78
(II) 5:1 molar ratio	1617.33

[1] Free PS-*co*-4-PVP ν(C_5H_5N) Pyridine Ring Vibrations.

On coordination of PS-*co*-4-PVP, the ν(C_5H_5N) Pyridine Ring Vibrations shifted toward higher wave number.

S9: IR spectra from all precursors 1 – 8 and also from PS-co-4-PVP and Chitosan for comparison.