Phosphonium ionic liquid conjugated magnetic graphitic carbon nitride nanocomposite:

An effective sample pretreatment tool for selenium separation and determination

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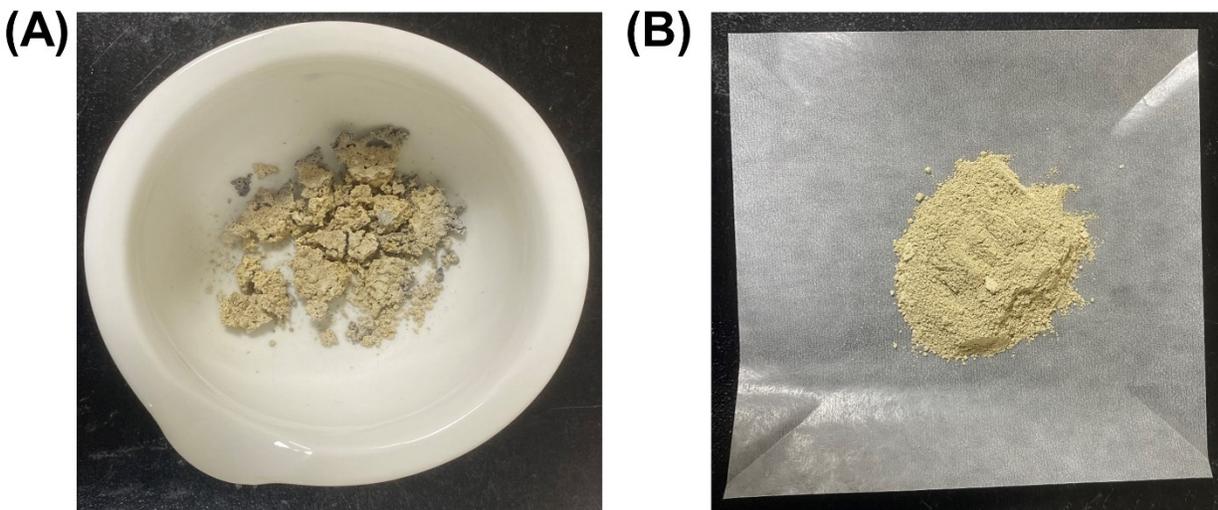
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Fig. S1 Graphitic carbon nitride preparation (A and B). Yellow color bulk-GCN was produced by calcining melamine precursor at 500 ºC for 4 h in a muffle furnace (A), then grounded it into a fine powder using mortar and pestle for a subsequent adsorbent fabrication step (B).
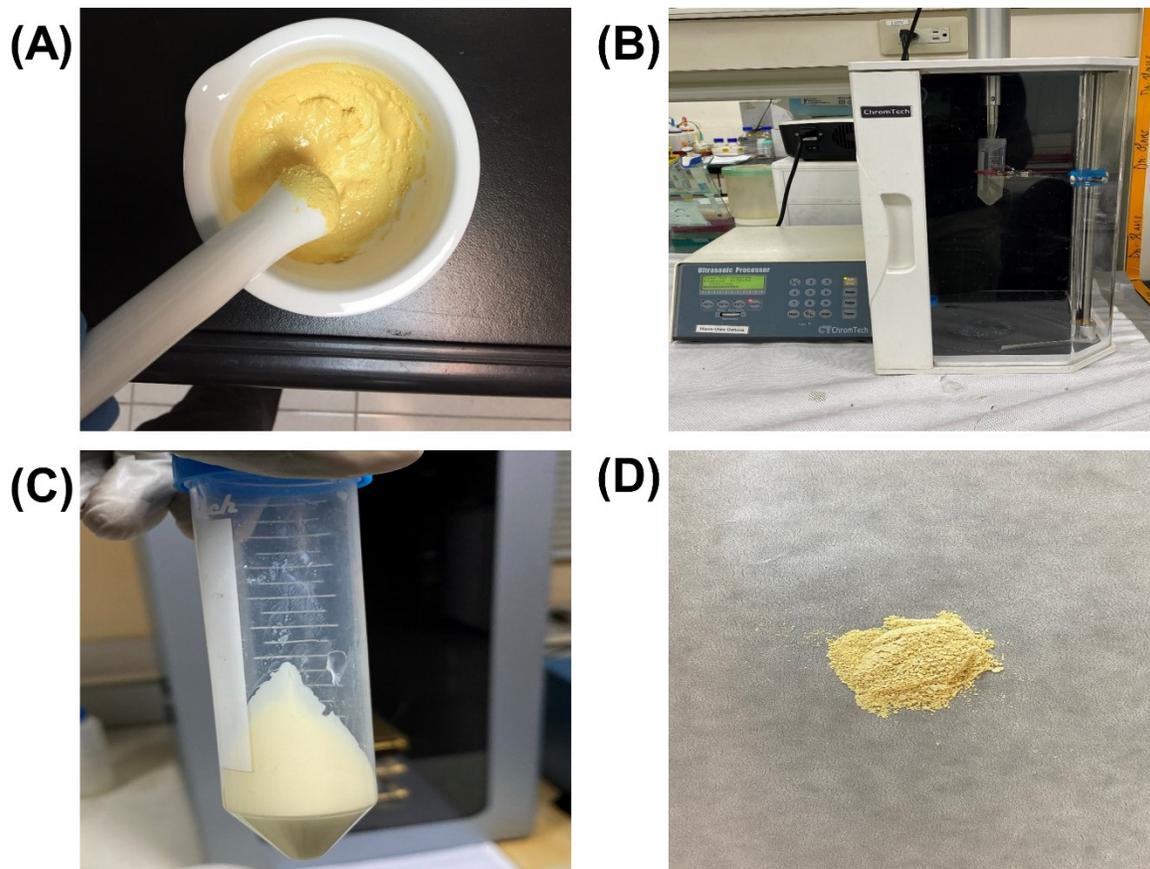
Fig. S2 Phosphorous group containing [hmim]$^+$ [PF$_6$]$^-$ (P–IL) ionic liquid ligand coating (A-D).

Bulk-GCN paste was created by pulverizing 2.0 g of bulk-GCN powder and 4.0 g of P-IL (A).

After that, 25 mL of a 1:1, V/V mixture of absolute ethanol and acetonitrile was added to the paste

(B). Finally, the final product was centrifuged at 6000 rpm (C) and dried at 80°C (D).
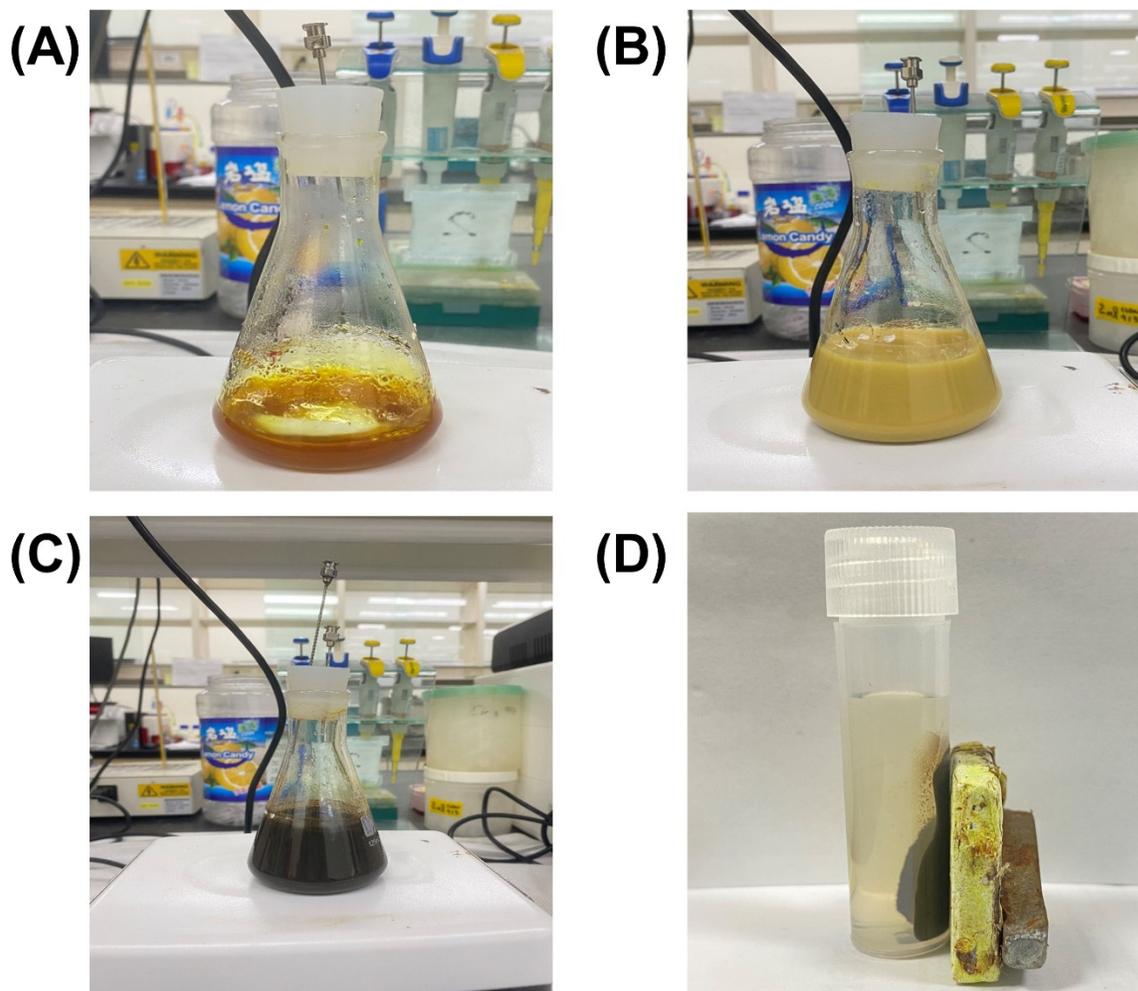
Fig. S3 Magnetic nanoparticle (Fe_3O_4) co-hybridization (A-D). Mixture of $FeCl_3.6H_2O$ (1.838 g) and $FeCl_2.4H_2O$ (0.703 g) in 10 mL of ultrapure water under 80 °C (A), was later mixed with the 50 mL of (2:1) water and absolute ethanol solution mixture contain, 0.15 g of P–IL@GCN NSs (B). Finally, Fe_3O_4 was co-precipitated with P–IL@GCN NSs by adding 15 mL of ammonia solution, which caused the solution color shift from yellow to pure black (C), demonstrating the successful synthesis of final magnetic nanocomposite solid-phase adsorbent (MNC-SPE) (D).
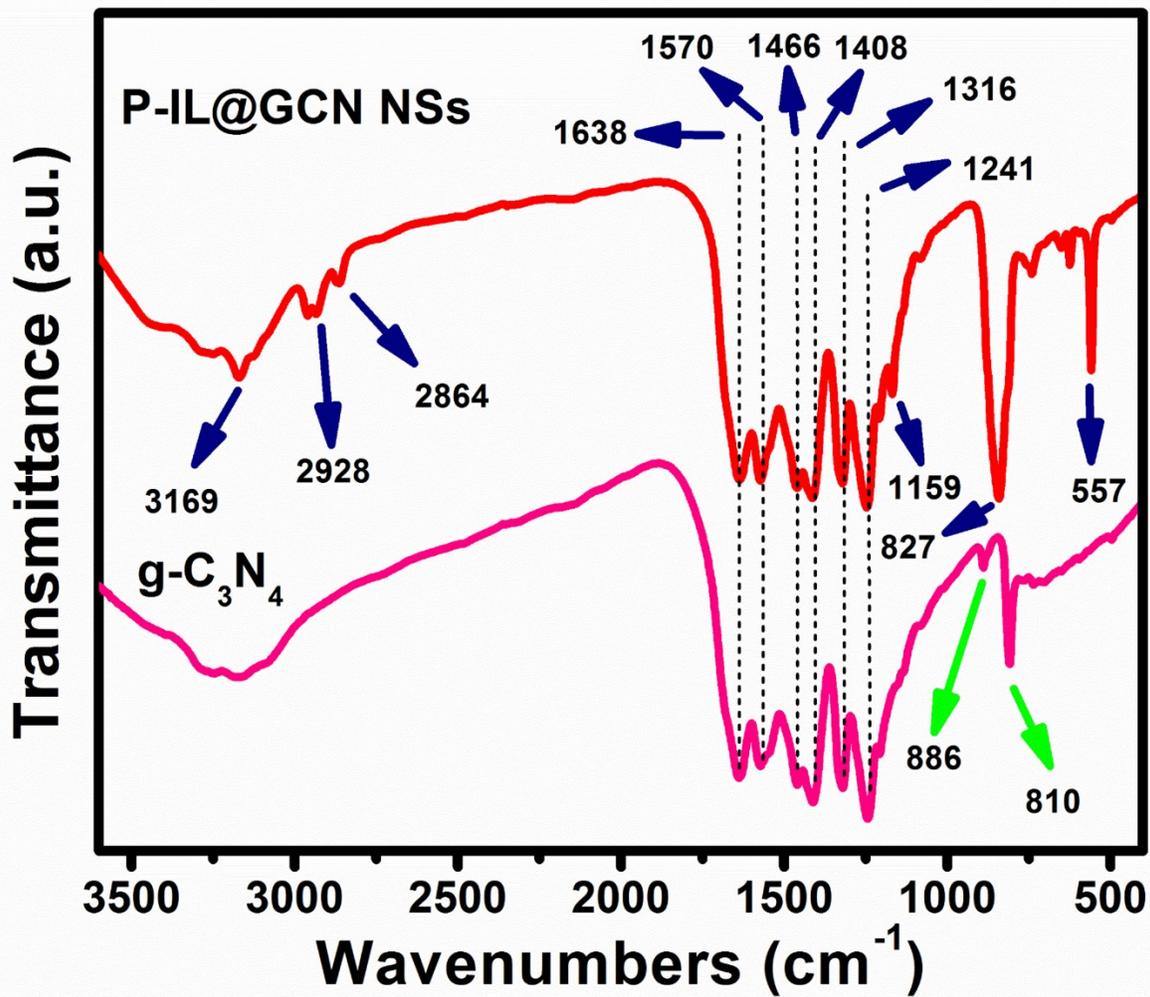
Fig. S4 Surface functional group characterization. FTIR spectral data of pure bulk-GCN (g-C_3N_4) (pink spectra) and P–IL integrated GCN NSs (red spectra).
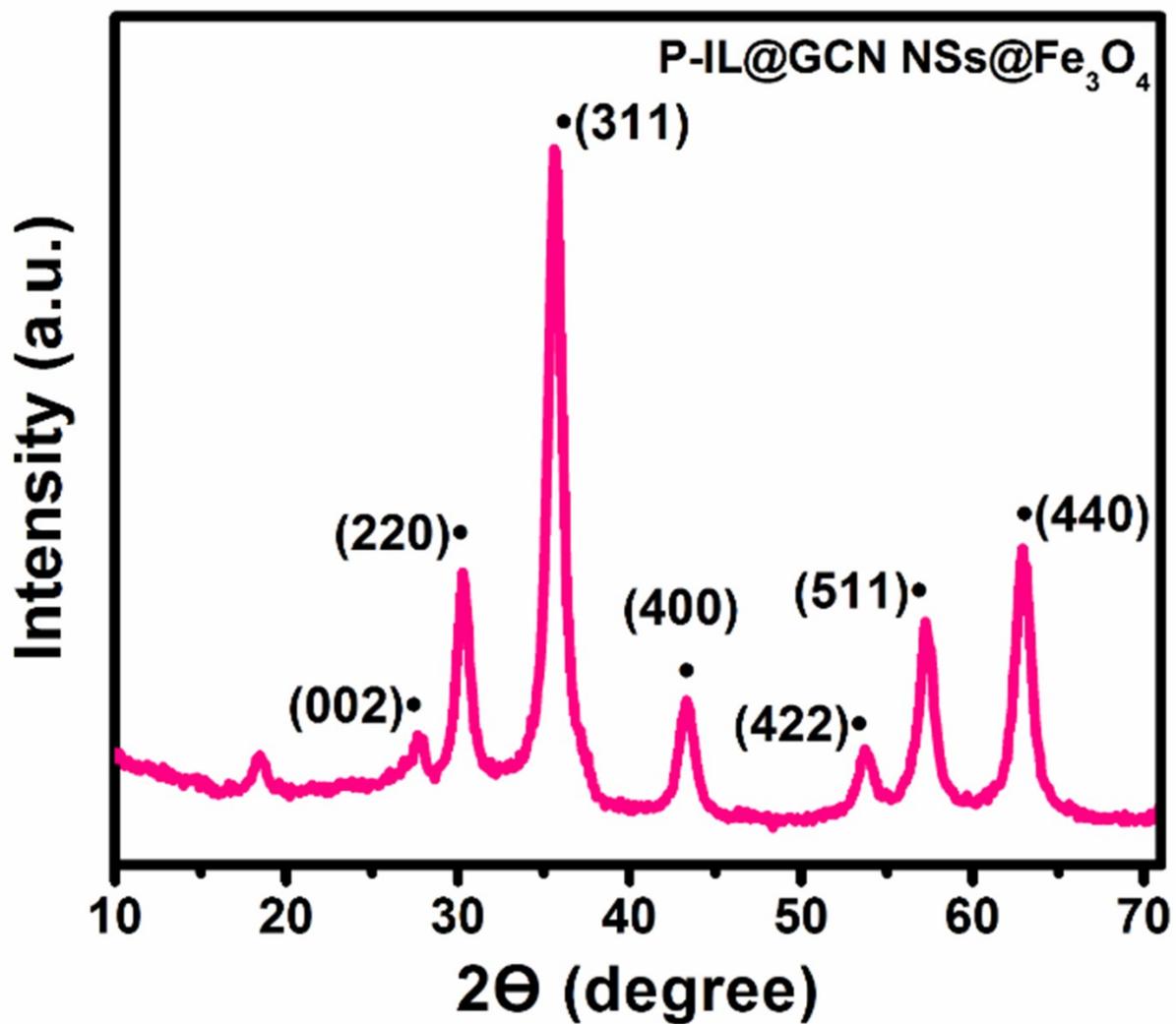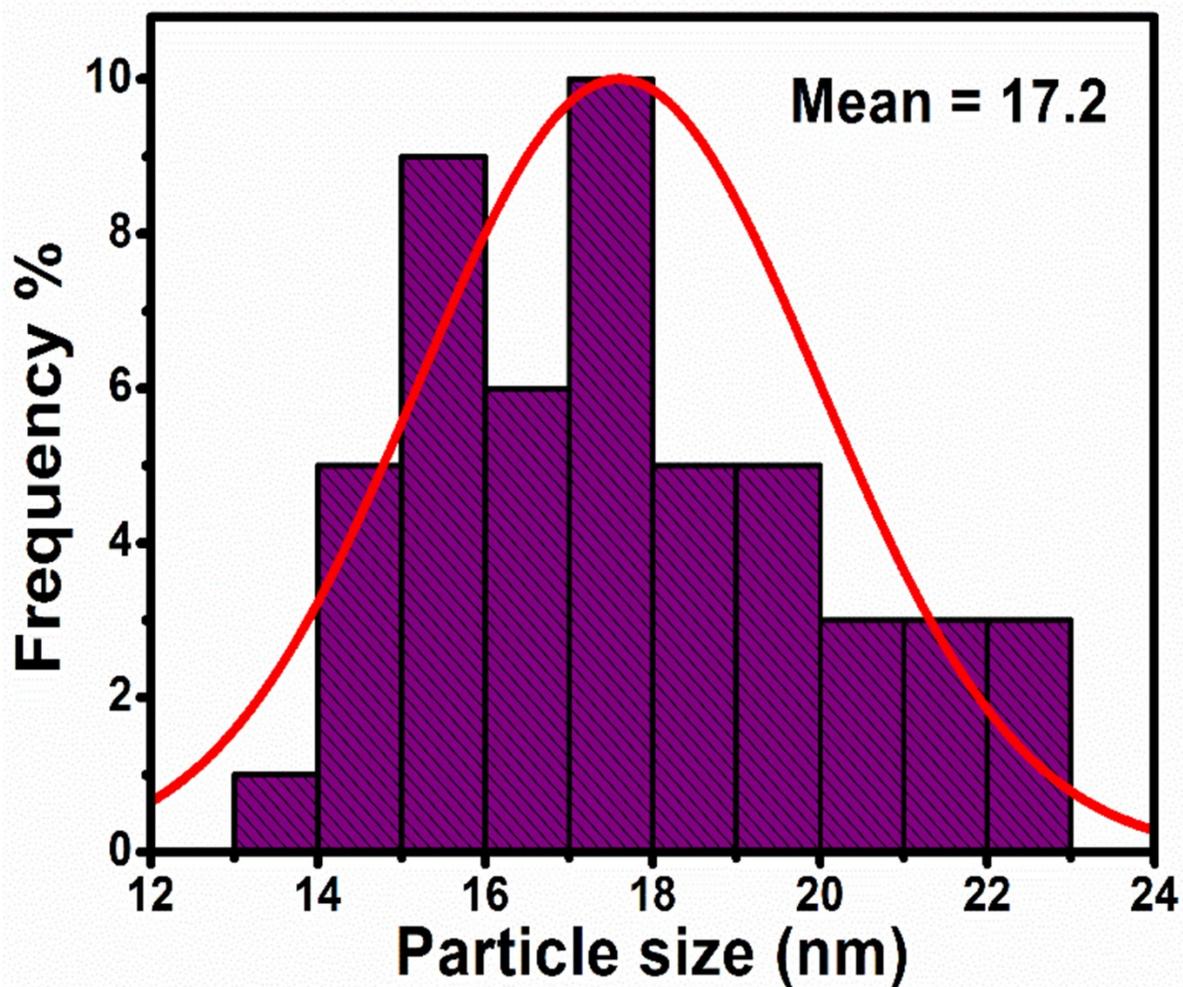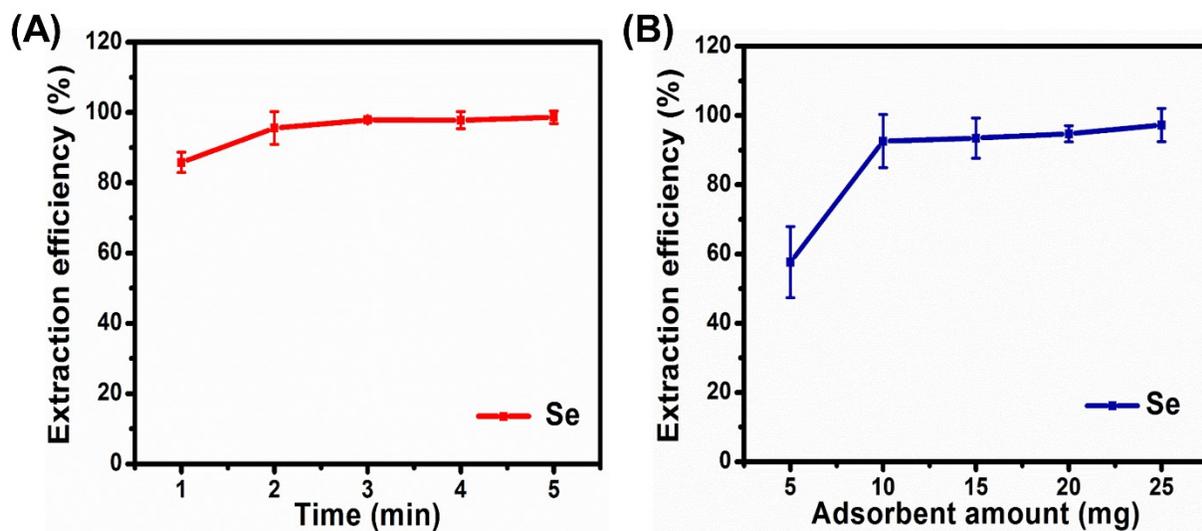
Fig. S5 Deconvoluted XRD spectra related to the P–IL@GCN NSs@Fe$_3$O$_4$ (MNC-SPE) nanocomposite.

Fig. S6 Image software assisted particle size distribution analysis of fabricated MNC-SPE nanocomposite.

Fig. S7 Key reaction parameters optimization for the effective Se extraction and desorption (A and B). Contact time was optimized by varying the contact time (1, 2, 3, 4, and 5 min) while maintaining other parameters constant (adsorbent dosage = 10 mg, Se concentration = (100 pg μL^{-1} and se volume = 1.0 mL) (A). Then, using above utilized same reaction conditions, the adsorbent dosage was optimized by altering the adsorbent dosage between 5 and 25 mg (B). (n=3)

* Resultant solutions from all the experiments were subjected to ICP-MS for Se determination.
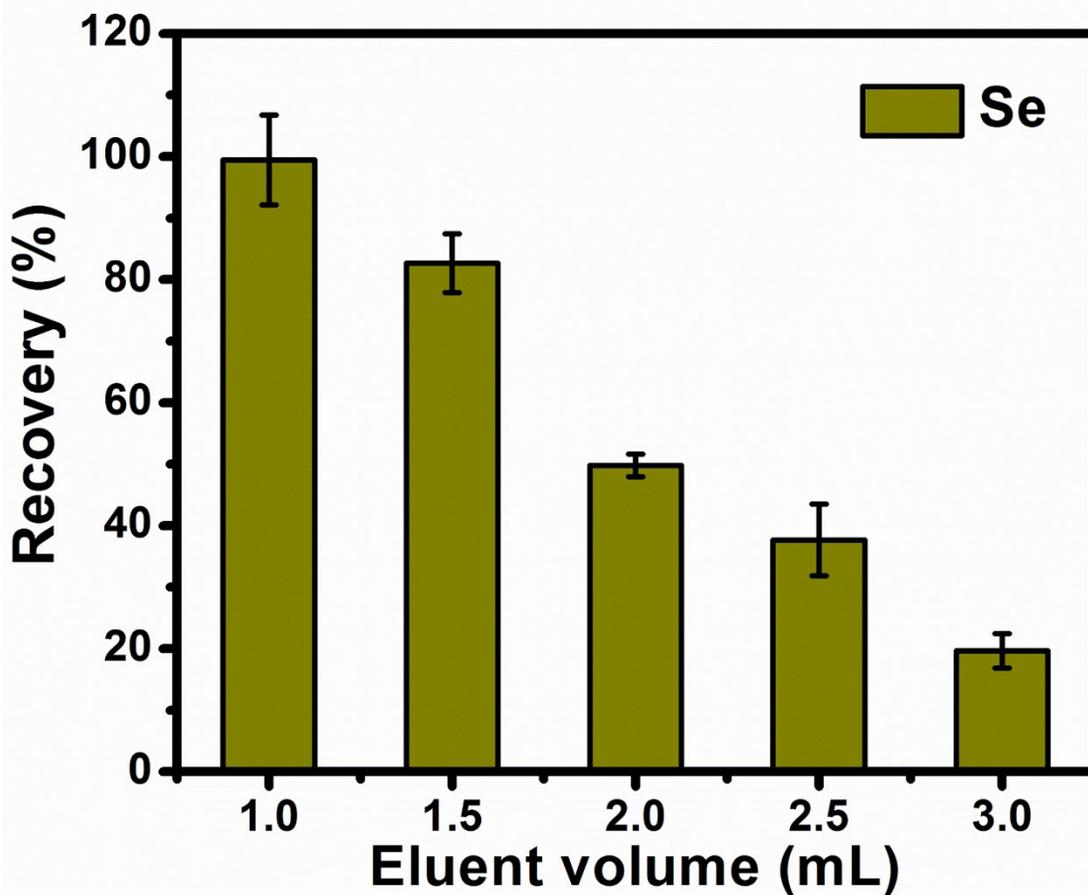
Fig. S8 Effect of eluent volume on the Se extraction by MNC-SPE. MNC-SPE adsorbent containing Se was treated with various eluent (0.5 M NaOH) volume condition between 1.0 and 3.0 mL for 10 min to optimize the ideal eluent volume required for the effective se desorption (n=3).

* Resultant solutions from all the experiments were subjected to ICP-MS for Se determination.
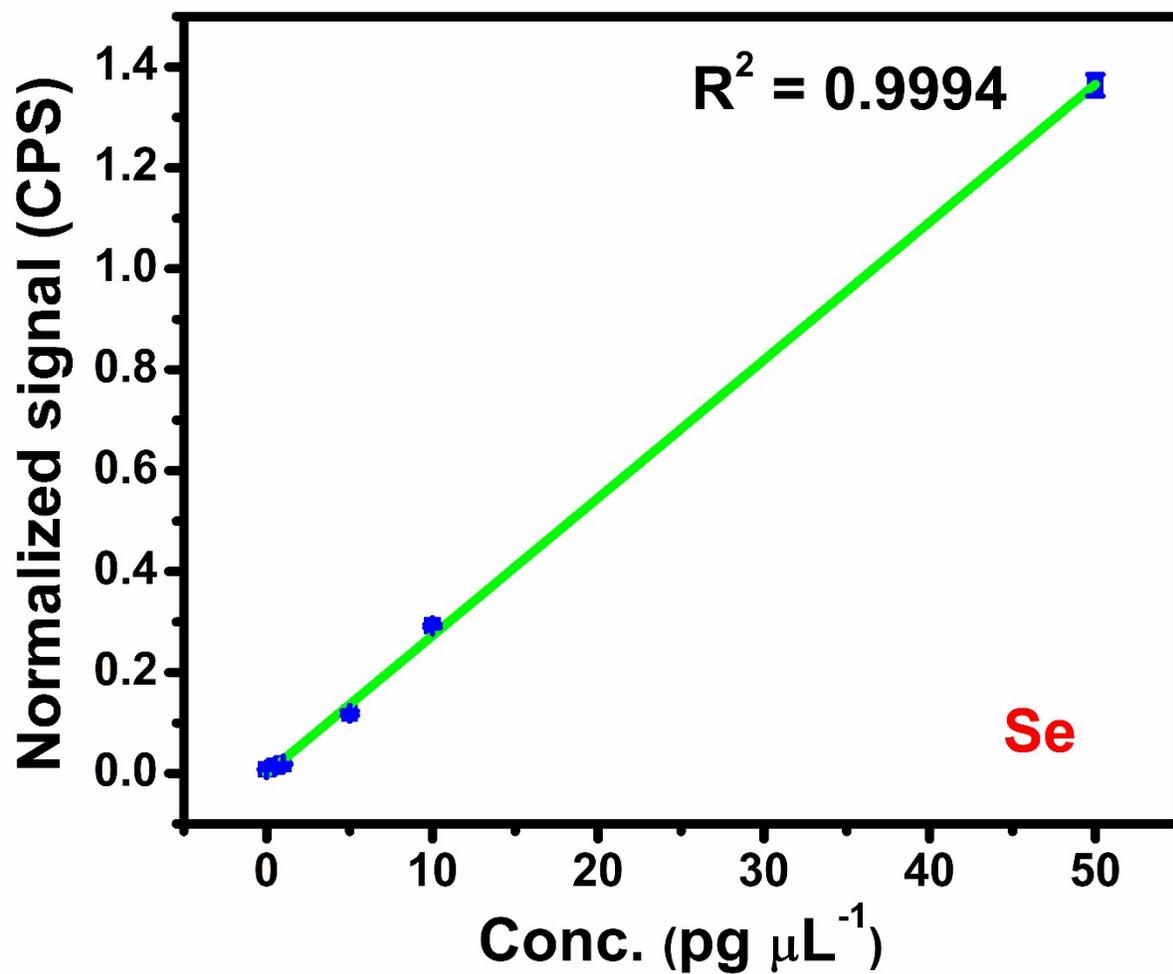
Fig. S9 Sensitivity characteristics of the fabricated MNC-SPE toward Se metal under the optimal reaction condition (n=3). *CPS = Counts per second, *Conc. = Concentration and *R^2 = Correlation coefficient.

Table S1. The MNC-SPE assisted ICP-MS approach practicality to determining Se in actual water samples (n=6).

Analyte	Sample Name	Spiked concentration (pg μL^{-1})	Found concentration (pg μL^{-1})	Recovery (%)
Se	Tap water	0	0.5	-
		10	12.05	115.5
		50	53.03	105.1
		100	105.88	105.4
	River water	0	1.13	-
		10	9.88	87.6
		50	53.56	104.9
		100	93.15	92.0

Table S2. Applicability of the MNC-SPE assisted ICP-MS approach to determining Se in Certified reference material (CRM) (n=6).

Analyte	Sample Name	Available concentration (pg μL^{-1})	Found concentration (pg μL^{-1})		Recovery (%)	
			ICP-MS approach	MNC-SPE / ICP-MS approach	ICP-MS approach	MNC-SPE / ICP-MS approach
Se	CRM-TMDW	10.0 ± 0.1	10.3	9.16	103.14	91.63