

***In situ* synthesis of gold nanoparticles embedded in magnetic nanocomposite of glucosamine/alginate for enhancing recyclable catalysis performance of nitrophenol reduction**

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Supporting Information

Table S1. Physical parameters of AuNPs calculated from XRD patterns at planes of (3 1 1) for Fe₃O₄ and (1 1 1) for AuNPs

No.	2θ deg	θ Radian	Cos θ (deg)	FWHM degree	β radian	Crystalline size 'D' nm	Interplanar spacing 'd' (Å)	h k l Identified from peak	h ² +k ² +l ²	Lattice const. 'a' from 'd' Å	Cell volume Å ³
Fe₃O₄											
0%	35.4172	0.3091	0.9526	0.2662	0.0046	31.3325	2.5300	3 1 1	11	8.3911	590.8137
9%	35.4493	0.3094	0.9525	0.3101	0.0054	26.8978	2.5260	3 1 1	11	8.3778	588.0159
11%	35.4423	0.3093	0.9525	0.2658	0.0046	31.3806	2.5300	3 1 1	11	8.3911	590.8137
13%	35.4474	0.3093	0.9525	0.2668	0.0047	31.2564	2.5310	3 1 1	11	8.3944	591.5146
15%	35.4423	0.3093	0.9525	0.2835	0.0049	29.4202	2.5230	3 1 1	11	8.3678	585.9233
AuNPs											
9%	38.1727	0.3331	0.9450	0.4792	0.0084	17.5411	2.3550	1 1 1	3	4.0790	67.8664
11%	38.1612	0.3330	0.9451	0.3845	0.0067	21.8636	2.3570	1 1 1	3	4.0824	68.0394
13%	38.1667	0.3331	0.9450	0.3938	0.0069	21.3465	2.3560	1 1 1	3	4.0807	67.9529
15%	38.2318	0.3336	0.9449	0.4768	0.0083	17.6341	2.3530	1 1 1	3	4.0755	67.6936

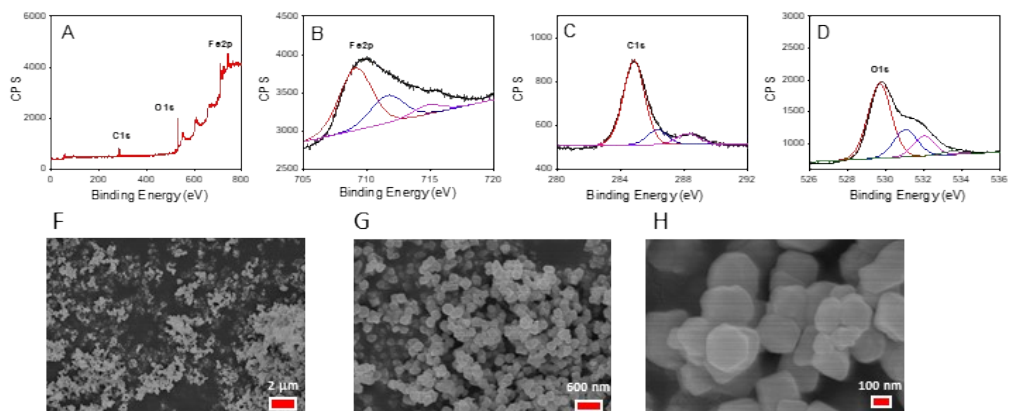


Figure S1. XPS spectrum (A) and High resolution XPS spectra of iron (B), carbon (C) and oxygen (D) in Fe₃O₄ NPs and SEM images at different magnifications (F – H).

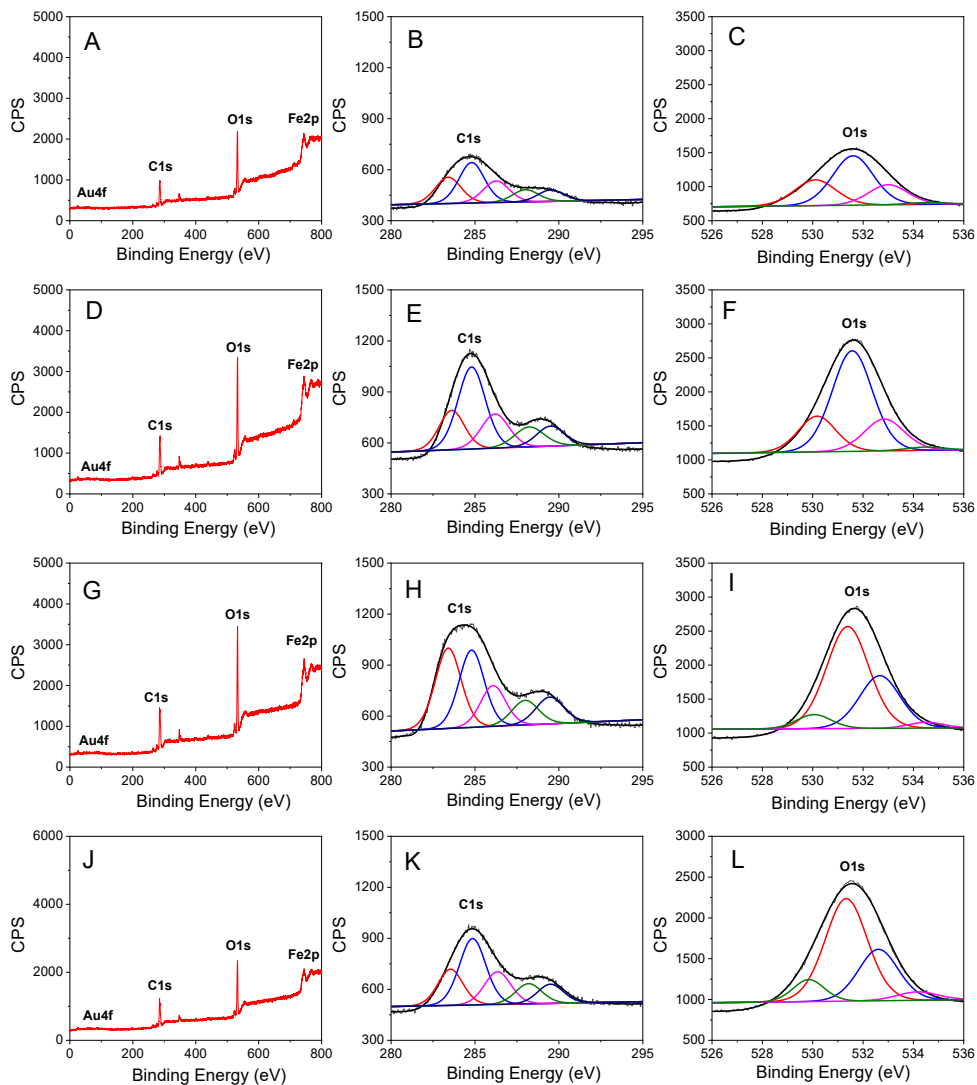


Figure S2. XPS spectra and High resolution XPS spectra of carbon and oxygen in nanocomposite AuNPs/Fe₃O₄@GluN/Alg with various content of gold ion: 9% (A-C); 11% (D-F); 13% (G-I) and 15% (J-L).

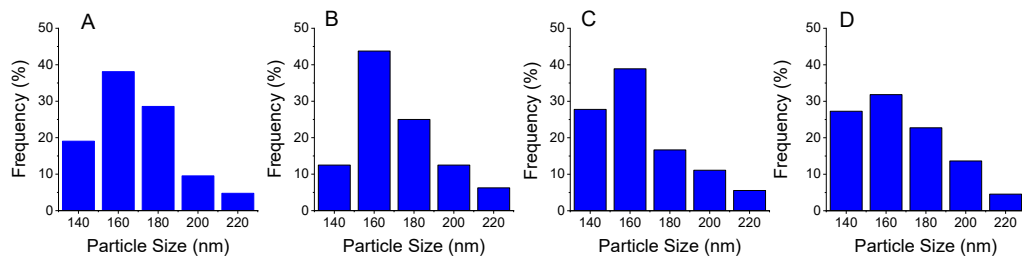


Figure S3. Particle size distribution of Fe₃O₄ in nanocomposite AuNPs/Fe₃O₄@GluN/Alg with various content of gold ion from TEM images: 9% (A), 11% (B), 13% (C) and 15% (D).

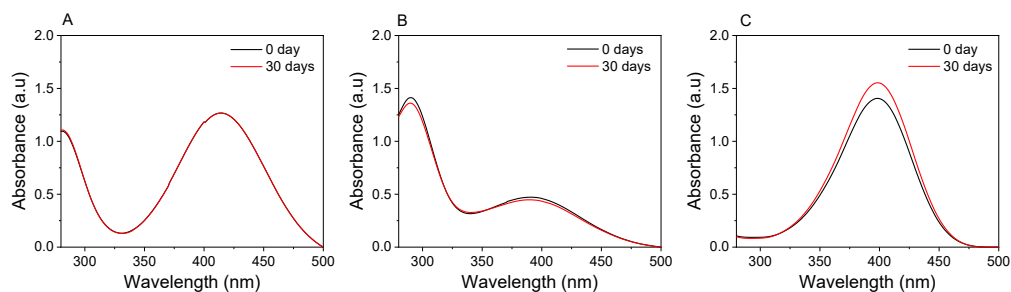


Figure S4. UV-Vis spectra for reduction of 2-nitrophenol (A), 3-nitrophenol (B) and 4-nitrophenol (C) using NaBH₄ without catalyst after 30 days.

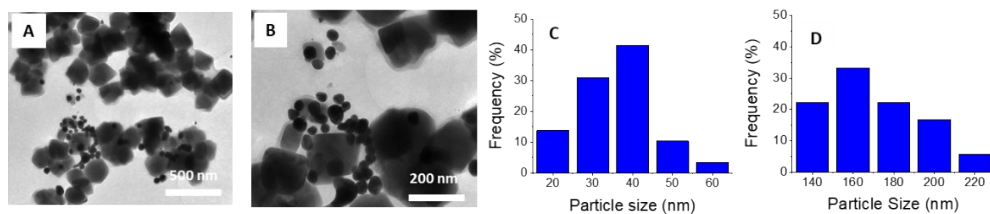


Figure S5. TEM images at different magnification (A and B) and size distribution of AuNPs (C) and Fe₃O₄ (D) of AuNPs/Fe₃O₄@GA/Alg – 15% reused after 5 recycle runs.

Table S2. Apparent rate constants derived from the pseudo-first-order kinetic experiments conducted for reduction of nitrophenols in the presence of various nanocomposite AuNPs/Fe₃O₄@GluN/Alg

Sub.	Nanocomposites									
	0%		9 %		11 %		13%		15%	
	$k_{app} \times 10^{-3}$ (s ⁻¹)	R ²	$k_{app} \times 10^{-3}$ (s ⁻¹)	R ²	$k_{app} \times 10^{-3}$ (s ⁻¹)	R ²	$k_{app} \times 10^{-3}$ (s ⁻¹)	R ²	$k_{app} \times 10^{-3}$ (s ⁻¹)	R ²
2-NiP	0.13	0.95	1.16	0.94	1.22	0.91	1.67	0.92	2.05	0.92
3-NiP	0.11	0.97	1.35	0.93	1.57	0.95	2.02	0.97	2.01	0.93
4-NiP	0.05	0.90	1.78	0.95	1.77	0.98	2.02	0.98	2.29	0.99