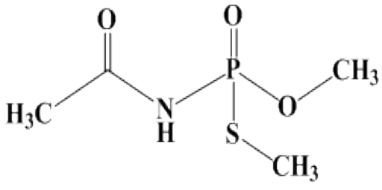
Electronic Supplementary Material (ESI) for New Journal of Chemistry.

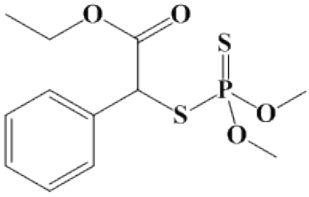
Supporting Information of
Ligand exchange reactions on citrate-gold nanoparticles for parallel colorimetric assay of six pesticides

Kirankumar Rana[a], Jigna R. Bhamore[a], Jigneshkumar V. Rohit[a], Tae-Jung Park[b] and Suresh Kumar Kailasa[a*]

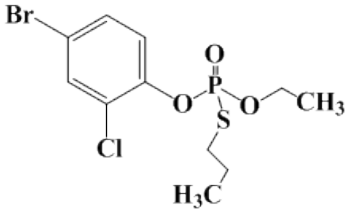
[a]Department of Applied Chemistry, S. V. National Institute of Technology, Surat-395 007, India
[b]Department of Chemistry, Institute of Interdisciplinary Convergence Research, Research Institute of Halal Industrialization Technology, Chung-Ang University, 84 Heukseok-ro, Dongjak-gu, Seoul 06974, Republic of Korea
[*]Corresponding author, Phone: +91-261-2201730; Fax: +91-261-2227334
E-mail: sureshkumarchem@gmail.com; skk@chem.svnit.ac.in



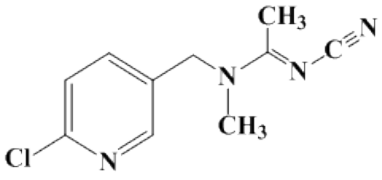
Acephate



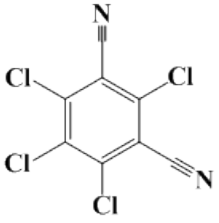
Phenthoate



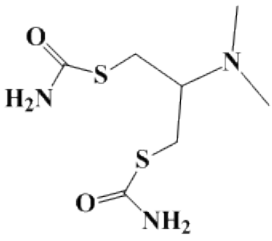
Profenofos



Acetamiprid



Chlorothalonil



Cartap

Figure S1. Structures of six pesticides (acephate, phenthoate, profenofos, acetamiprid, chlorothalonil, and cartap) that were detected using citrate-Au NPs.

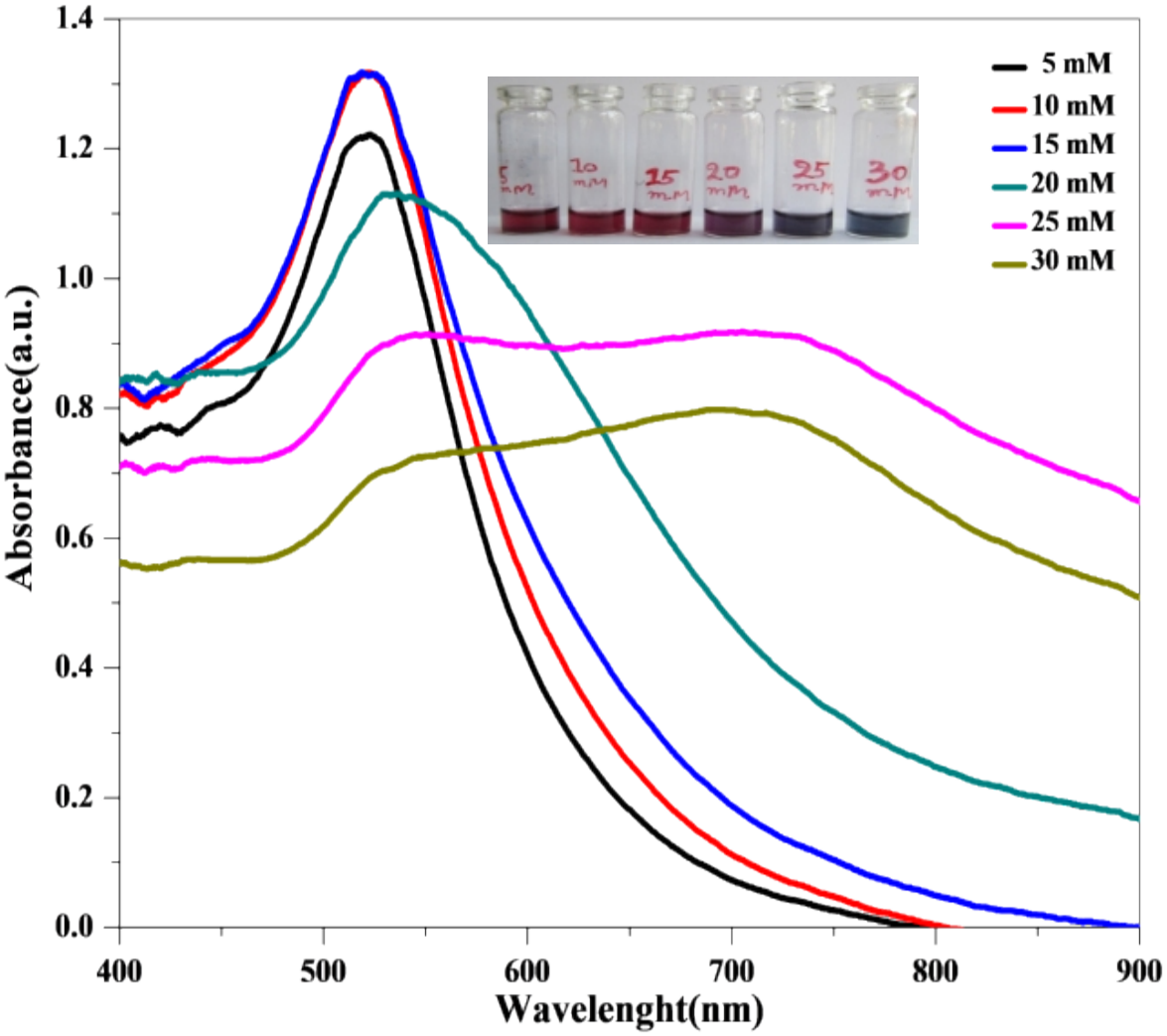


Figure S2. Effect of NaCl concentration (5.0 – 30 mM) on the SPR band of citrate-Au NPs.

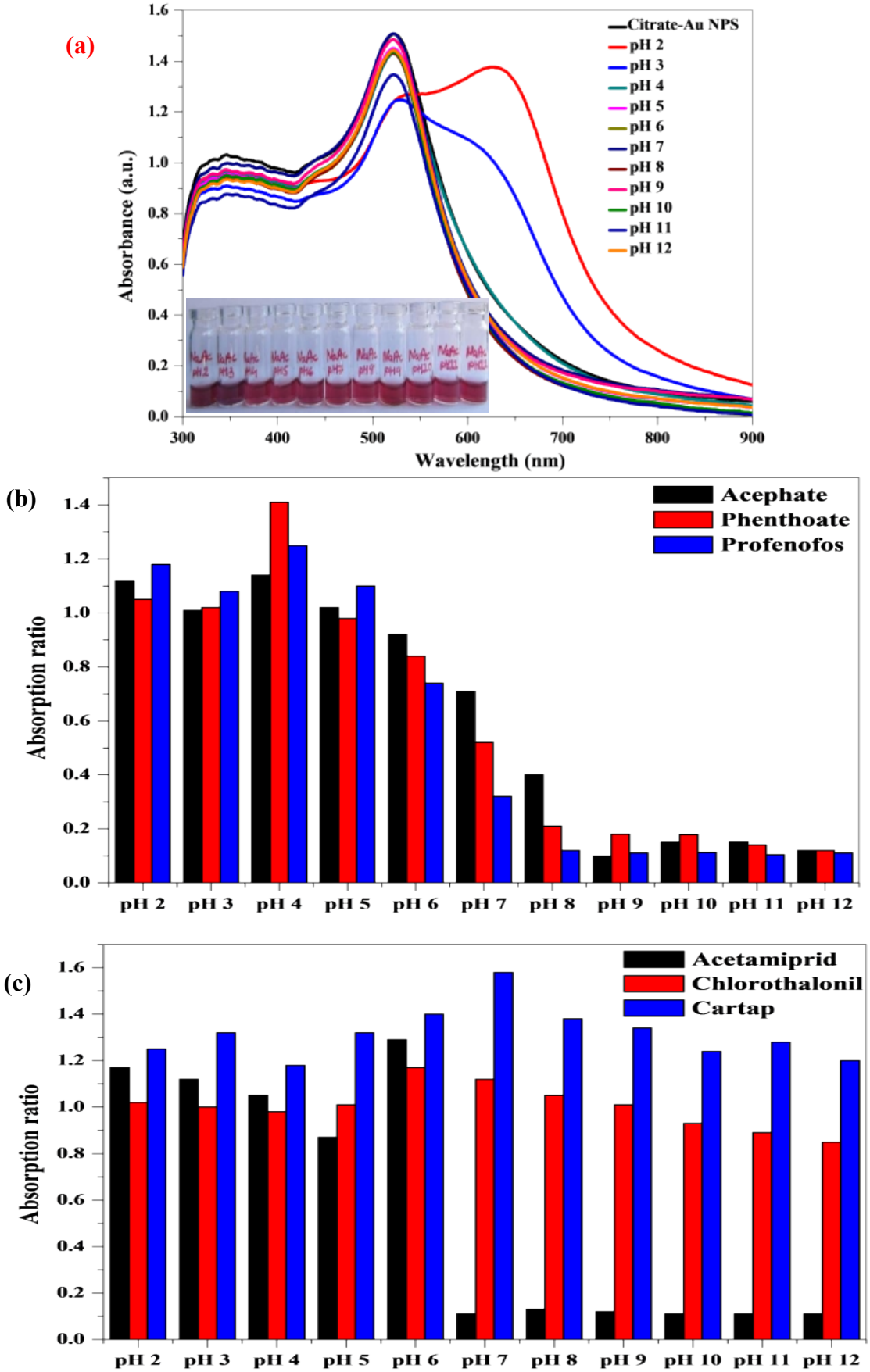


Figure S3. Effect of sodium acetate buffer from pH 2.0 to 12.0 on (a) only citarte-Au NPs, (b) and (c) aggregation of citrate-Au NPs induced by pesticides (acephate, phenthoate, profenofos, acetamiprid, chlorothalonil and cartap).

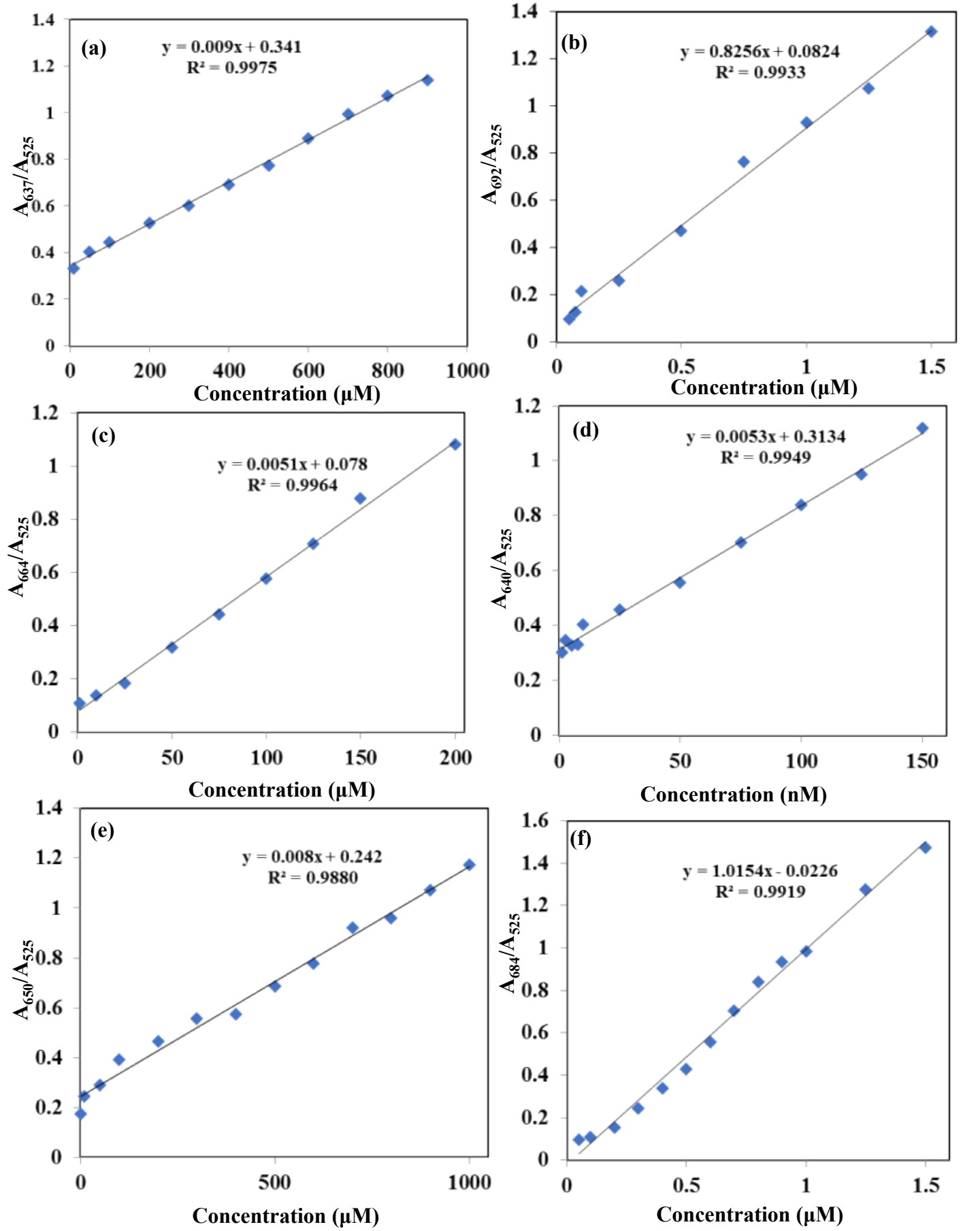


Figure S4. Calibration graphs plotted between absorption ratios and different concentration of (a) acephate (10 – 900 µM), (b) phenthoate (0.01 – 1.50 µM), (c) profenofos (1.0 – 200 µM), (d) acetamiprid (1.0 – 150 nM), (e) chlorothalonil (1.0 – 1000 µM), and (f) cartap (0.05 – 1.50 µM), respectively.

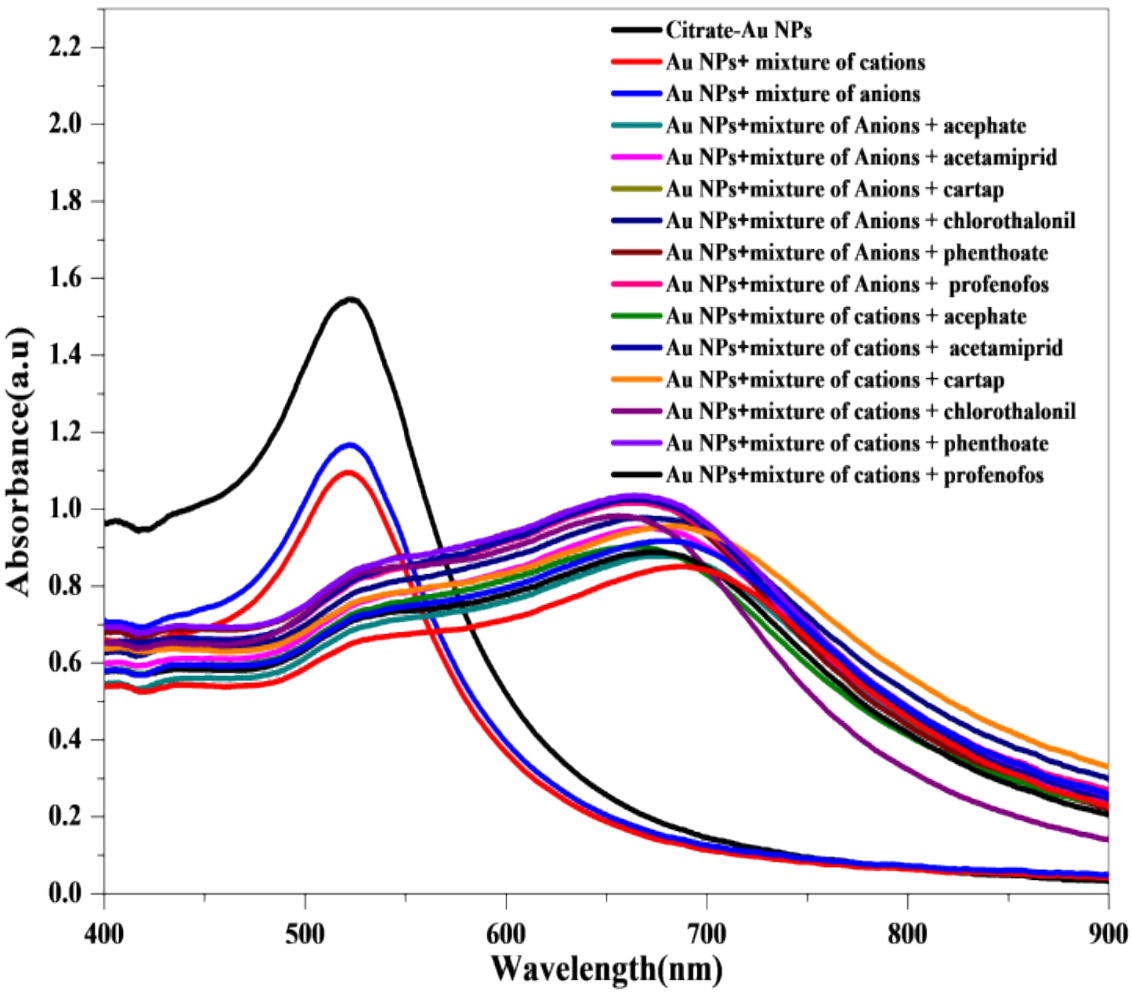


Figure S5. UV-visible absorption spectra of citrate-Au NPs with and without addition of mixture of inorganic species (metal ions - Na^{+}, K^{+}, Cu^{2+}, Zn^{2+}, Cd^{2+}, Fe^{2+}, Mn^{2+}, Mg^{2+}, Ba^{2+}, $Cr^{3+,}$ Fe^{3+} and Al^{3+} 1.0 mM) and anions - Cl^{-}, I^{-}, Br^{-}, NO_3^{-}, SO_4^{-2} and $Cr_2O_7^{2-}$,1.0 mM) in the presence of six pesticides separately.

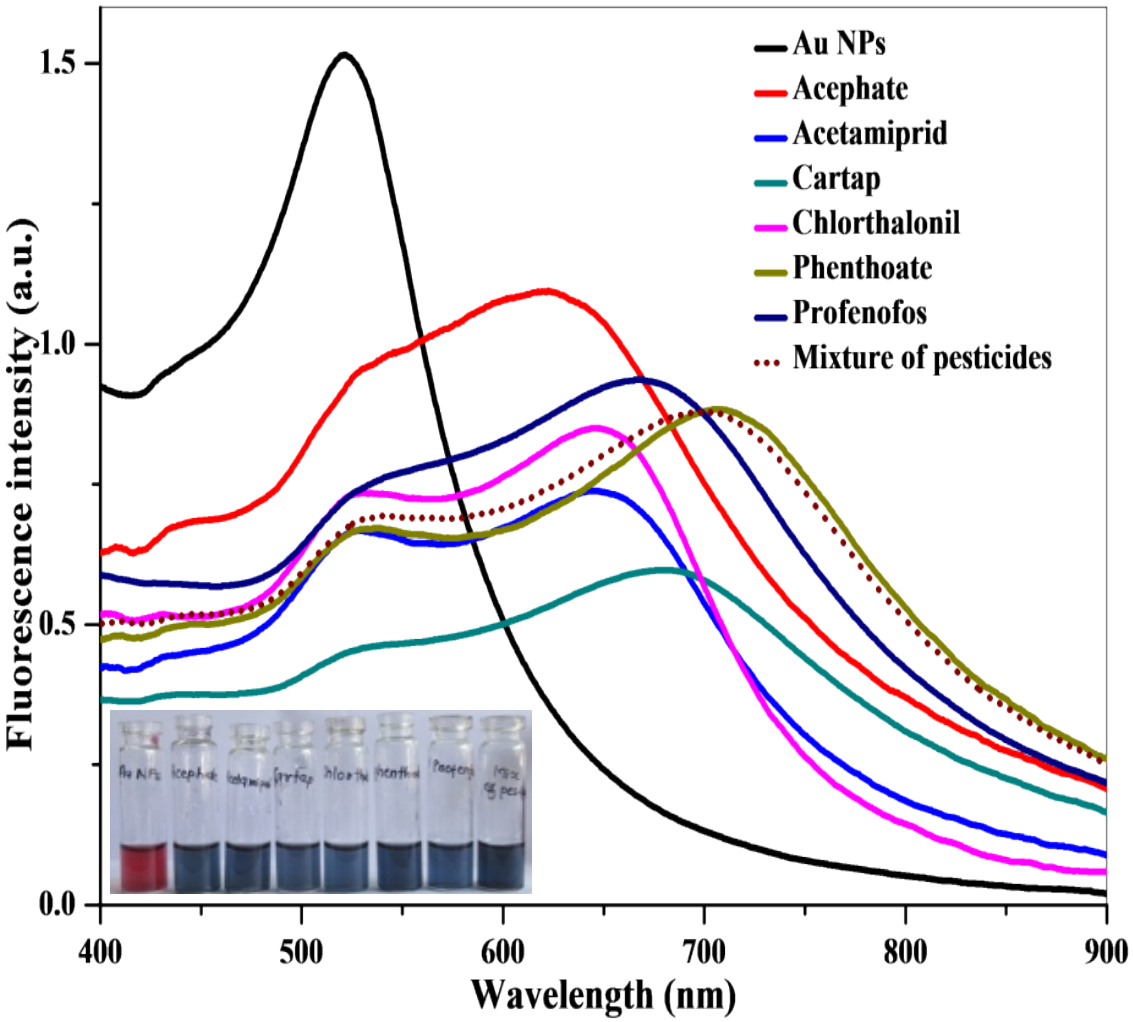


Figure S6. Absorption spectra of citrate-Au NPs with the addition of six pesticides separately and with mixture of pesticides (six pesticides). Inset: photograph of corresponding solutions.

Table S1. Analysis of acephate, phenthoate and cartap in water samples (n=3).

	Tap water				Canal water			River water		
	Add (μM)	Found (μM)	Recovery (%)	RSD (%)	Found (μM)	Recovery (%)	RSD (%)	Found (μM)	Recovery (%)	RSD (%)
Acephate	300	305.19	101.73	0.6	304.62	101.54	0.1	304.48	101.49	0.3
	500	500.13	100.92	0.8	500.31	100.96	0.2	499.81	99.96	0.6
Phenthoate	0.25	0.24	98.88	1.0	0.24	98.44	1.7	0.24	99.79	1.1
	0.50	0.49	98.87	0.5	0.49	99.07	1.3	0.48	97.90	0.9
	0.75	0.69	99.27	0.4	0.68	98.49	1.0	0.69	98.63	1.9
Cartap	0.3	0.30	101.60	0.3	0.30	101.86	0.2	0.30	101.81	0.1
	0.5	0.50	100.03	0.1	0.50	100.21	0.1	0.50	100.44	0.3
	0.7	0.72	102.98	1.5	0.70	101.32	0.4	0.71	101.69	0.8

Table S2. Analysis of profenofos, acetamiprid and chlorothalonil in vegetables (n=3).

	Cabbage				Tomato			Potato		
	Add (μM)	Found (μM)	Recovery (%)	RSD (%)	Found (μM)	Recovery (%)	RSD (%)	Found (μM)	Recovery (%)	RSD (%)
Profenofos	50	49.03	98.07	0.4	48.96	97.63	1.3	48.71	97.43	0.8
	100	98.34	98.34	1.6	98.47	98.47	1.0	97.97	97.97	1.2
	150	146.47	97.64	0.9	145.30	96.48	1.1	146.97	97.98	0.7
Acetamiprid	0.01	0.009	98.69	0.9	0.009	97.96	1.6	0.09	96.98	0.9
	0.05	0.048	97.57	1.8	0.049	98.67	1.1	0.048	97.74	0.3
	0.1	0.097	97.86	0.5	0.098	98.19	1.1	0.098	98.34	1.1
Chlorothalonil	10	9.78	97.88	0.6	9.82	98.23	1.3	9.70	97.07	0.5
	100	98.18	98.18	1.5	98.90	99.90	0.5	98.29	98.29	1.6