Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information for

Homogenously Magnetically Concentrated Silver Nanoparticles for Uniform "Hot Spots" in Surface Enhanced Raman Spectroscopy

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Concentration (M)	Log (Concentration) (M)	Counts	Standard Deviation	Log(Counts)	SNR
7.40×10^{-12}	-11.1	17.24	32.8	1.24	0.69
		80.54		1.91	3.21
		64.06		1.81	2.55
7.40×10^{-11}	-10.1	256.07	7.91	2.41	10.2
		244.98		2.39	9.75
		260.30		2.42	10.4
7.40×10^{-10}	-9.13	354.76	120	2.55	14.1
		121.75		2.09	4.85
		287.39		2.46	11.4
7.40×10^{-9}	-8.13	310.90	129	2.49	12.4
		564.42		2.75	22.5
		476.13		2.68	19.0
7.40×10^{-8}	-7.13	630.06	59.3	2.80	25.1
		513.78		2.71	20.5
		591.82		2.77	23.6
7.40×10^{-7}	-6.13	1081.86	147	3.03	43.1
		1312.41		3.12	52.3
		1460.63		3.16	58.2
		1470.68		3.17	58.6
		1438.86		3.16	57.3
		1377.46		3.14	54.8
7.40×10^{-6}	-5.13	1997.30	249	3.30	79.5
		2352.80		3.37	93.7
		2502.04		3.40	99.6
		2591.74		3.41	103
		2295.64		3.36	91.4
		2698.02		3.43	107
7.40×10^{-5}	-4.13	4898.46	491	3.69	195
		4953.71		3.69	197
		5391.35		3.73	215
		5399.80		3.73	215
		4109.72		3.61	164
		5297.38		3.72	211
7.40×10^{-4}	-3.13	7998.84	403	3.90	319
		7280.80		3.86	290
		7255.95		3.86	289
		6935.66		3.84	276
		7758.50		3.89	309
		7127.91		3.85	284

Table S1. Raman signal data illustrating reproducibility and detection limits of AgJ_{13}NP-MH as a substrate and DTBN as an analyte. The signal to noise ratio (SNR) indicates detection of DTNB in concentrations as low as 7.40×10^{-12} M. A SNR >3 was used as a criterion for reliable detection.

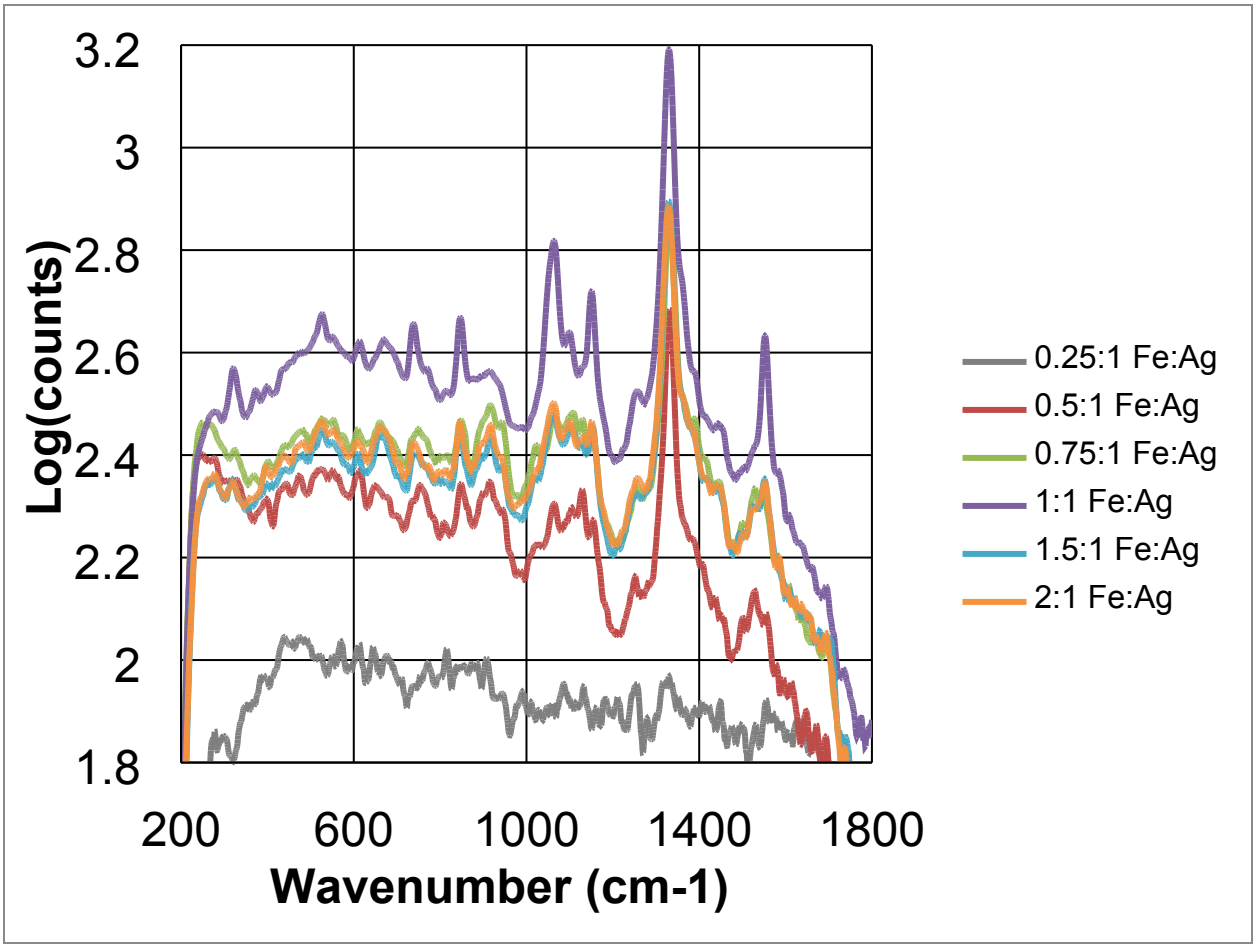

Figure S1. Raman spectra of DTNB for different amounts of maghemite in AgJ_{13}NP-MH expressed by the molar ratio between iron and silver (Fe:Ag). It can be clearly seen that the best ratio for detection of DTNB is 1:1 Fe:Ag. DTNB concentration was 7.41×10^{-7} M for all samples.

Fe:Ag	Counts	Log (Counts)
0.25:1	21	1.32
0.50:1	364	2.56
0.75:1	553	2.74
1:1	1412	3.15
1.5:1	902	2.96
2:1	663	2.82

Table S2. Data on Raman signal intensity at 1330 cm^{-1} expressed as Counts and Log(Counts), from Figure S1 showing that the best ratio of Fe:Ag in AgJ_{13}NP-MH for detection of DTNB is 1:1.

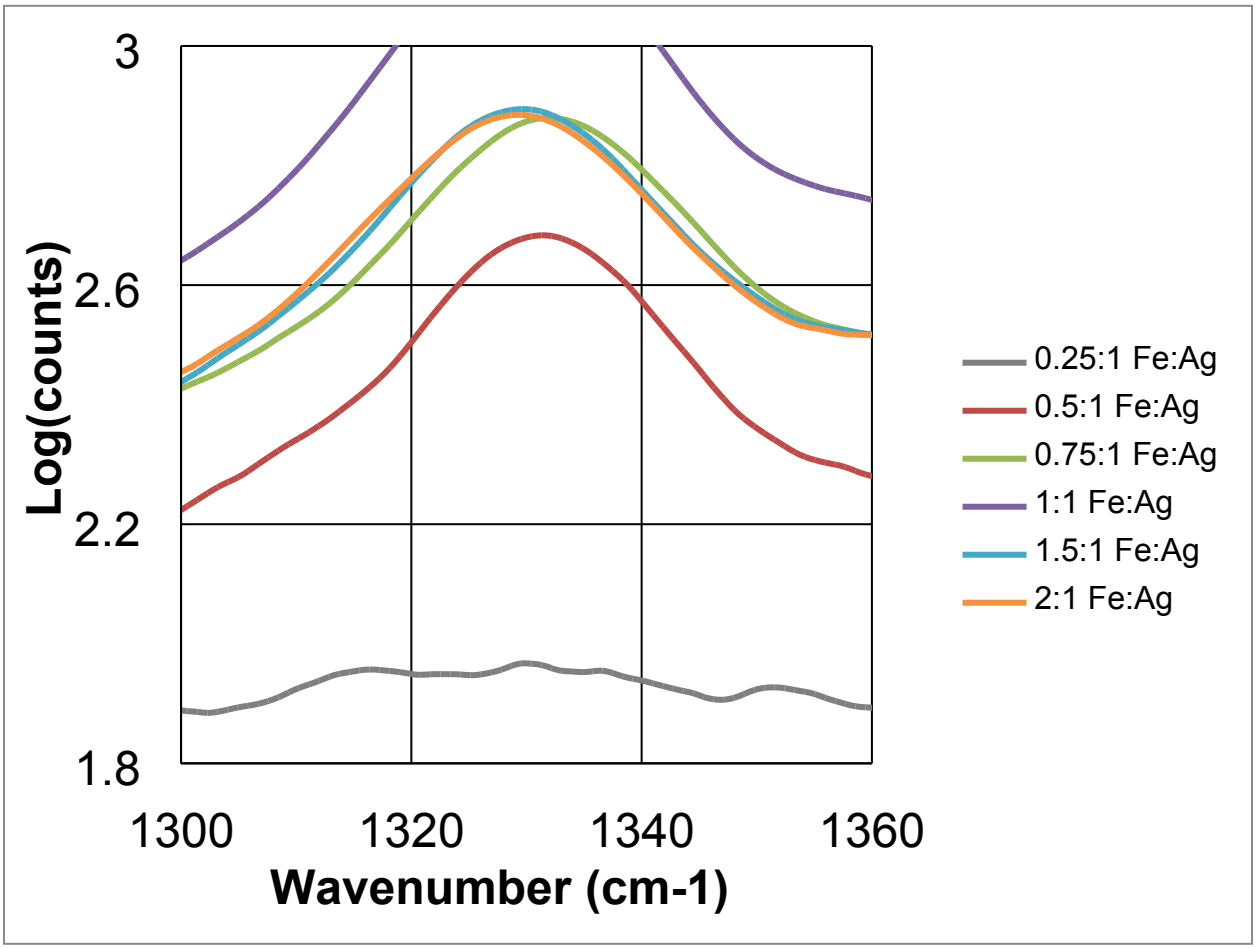

Figure S2. Figure S1 plot expanded from 1300 cm^{-1} to 1360 cm^{-1}. Raman spectra of DTNB with variation of the amount of maghemite in AgJ_{13}NP-MH as judged by the ratio between iron and silver (Fe:Ag). It can be clearly seen that the best ratio for detection of DTNB is 1:1 Fe:Ag. The [DTNB] = 7.41×10^{-7} M for all samples.

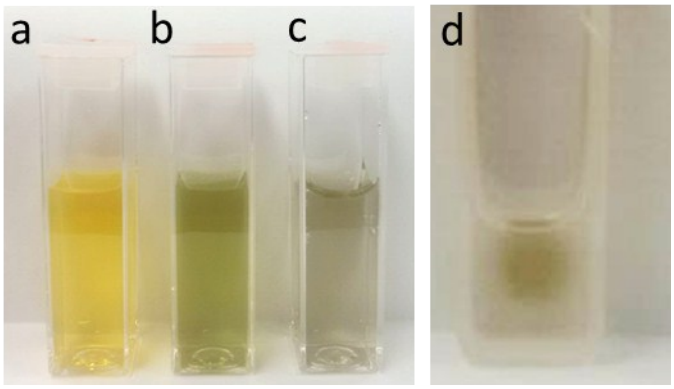

Figure S3. Optical images of AgJ_{13}NP&MH samples: **a)** initially after mixing, **b)** 2 hours after mixing, and **c)** 4 hours after mixing; **d)** the pellet formed upon magnetic concentration of AgJ_{13}NP&MHs in a quartz cell – the pellet remains intact after the removal of the magnet.

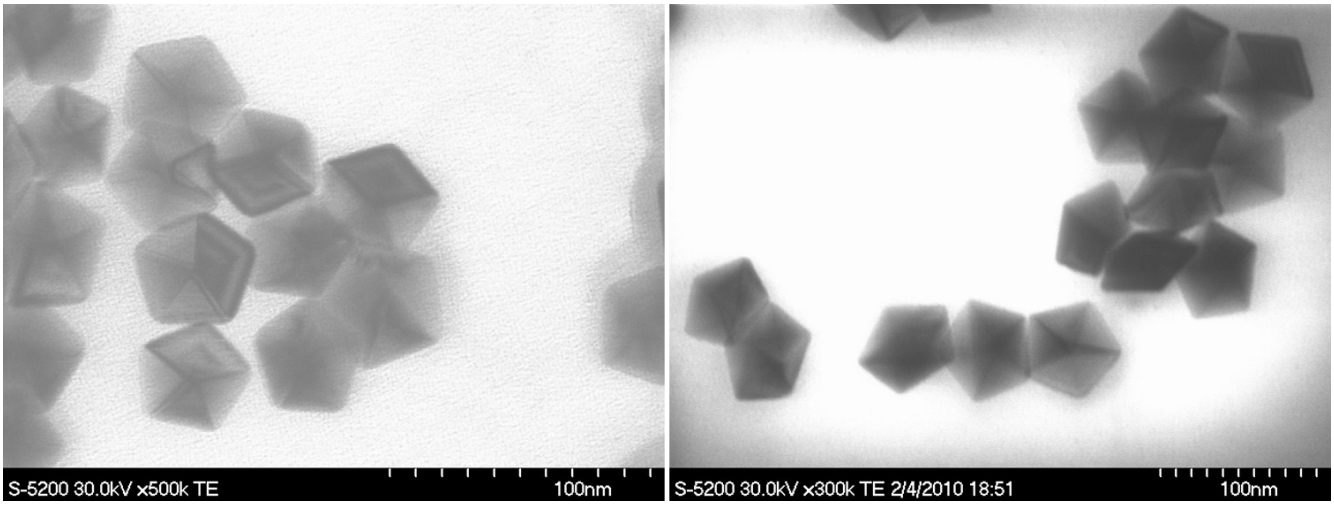

Figure S4. Representative transmission electron microscopy (TEM) images of AgJ_{13}NPs.

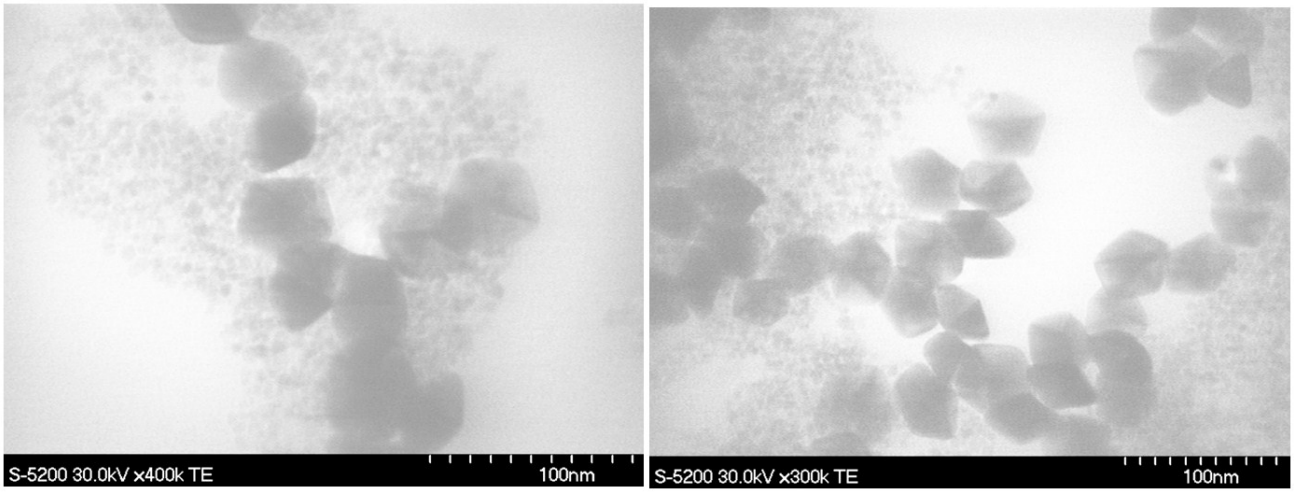

Figure S5. TEM images of the AgJ_{13}NP&MH pellet components prepared by magnetic concentration and subsequent transfer to TEM grids.

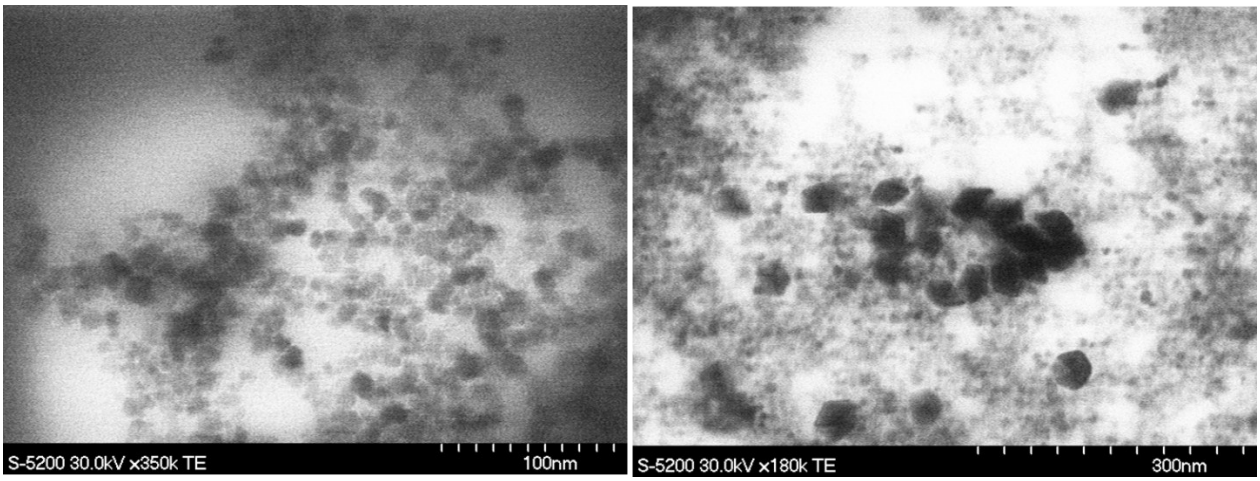

Figure S6. Representative TEM images of magnetite (MN) nanoparticles (left panel) and AgJ_{13}NP&MNs (right panel).

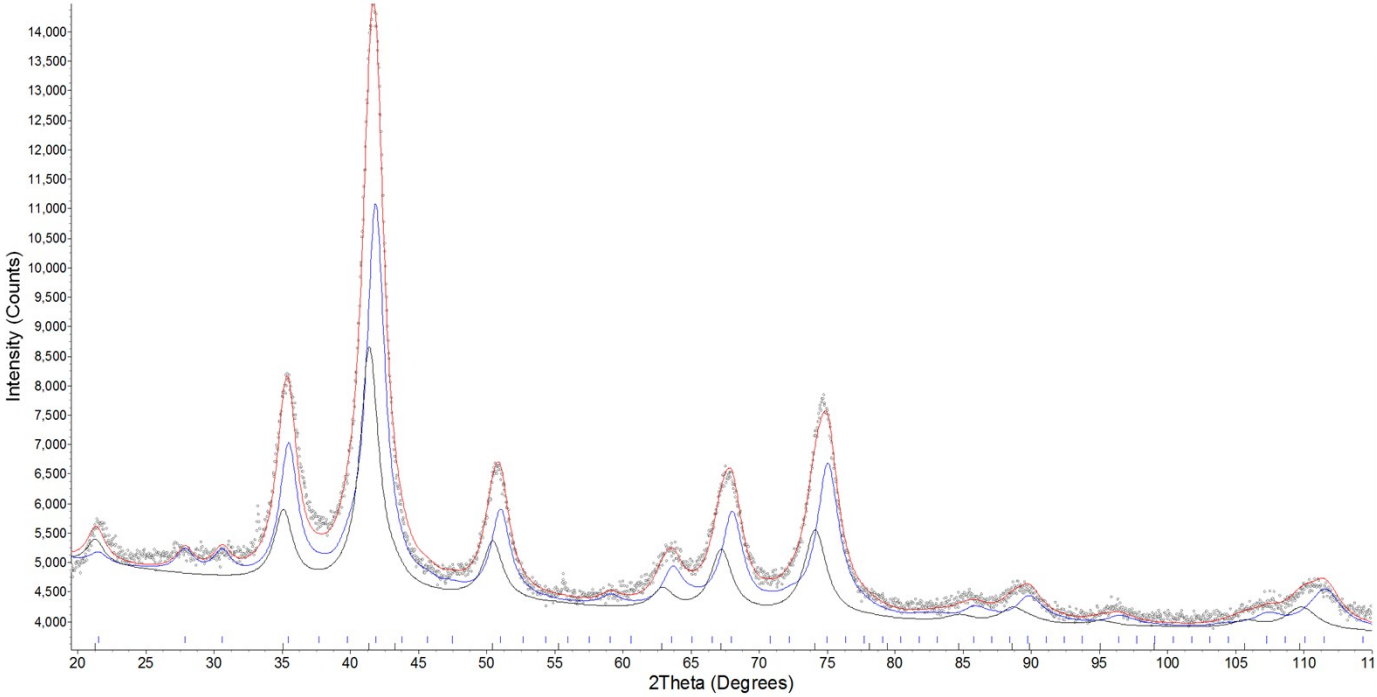

Figure S7. Powder X-ray diffraction data of the maghemite (MH) sample. Red line is an original spectra. Blue line and black lines corresponds to the deconvolution of maghemite and magnetite components, respectively.

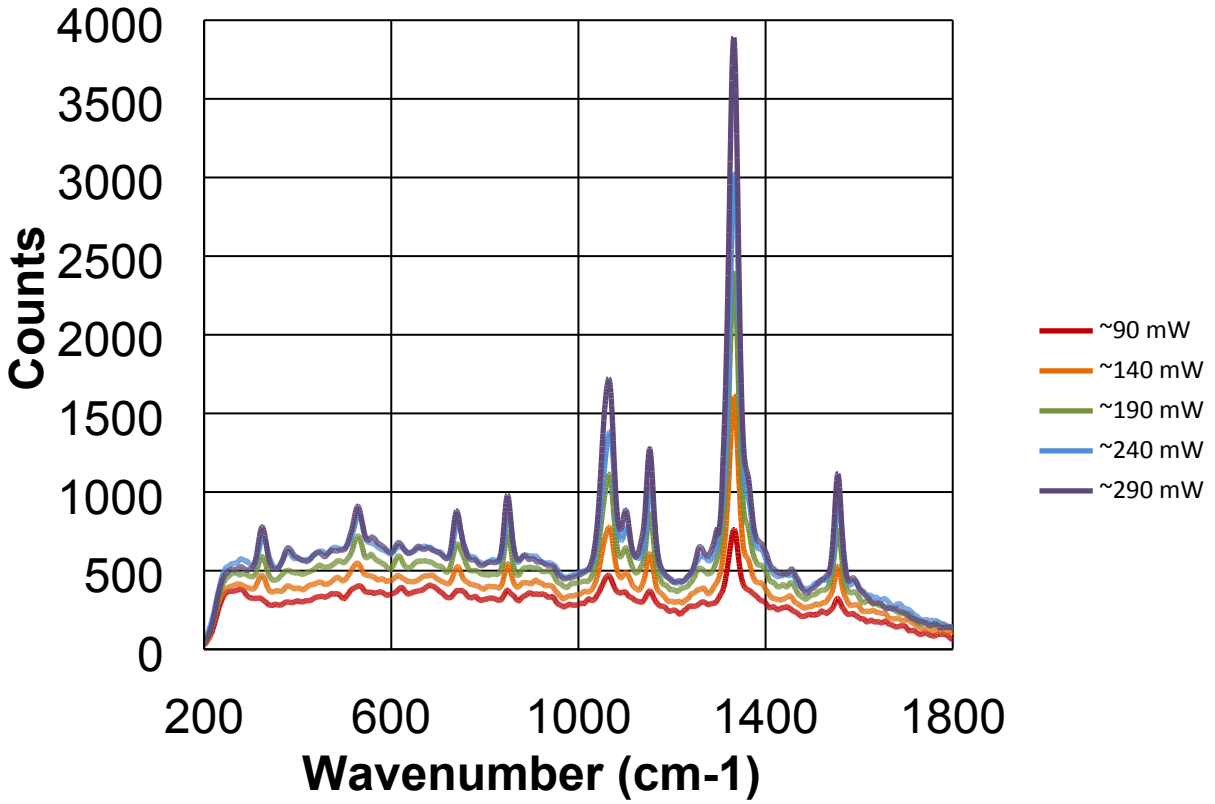

Figure S8. DTNB Raman spectra at different laser power ranging from 90 mW to 290 mW for 1:1 Fe:Ag using DTNB concentration of 1.0×10^{-4} M. 190 mW was selected as the laser power for all other measurements.

Laser Power (mW)	Counts	Counts/LP
90	536.30	5.96
115	874.93	7.61
140	1325.01	9.46
165	1886.57	11.43
190	2034.00	10.71
215	2381.64	11.08
240	2598.05	10.83
265	2788.30	10.52
290	3159.07	10.89

Table S3. Data on Raman signal intensity at 1330 cm^{-1}expressed as Counts and Counts/Laser Power (LP) for 1:1 Fe:Ag using DTNB concentration of 1.0×10^{-4} M. 190 mW was selected as the laser power for all other measurements.

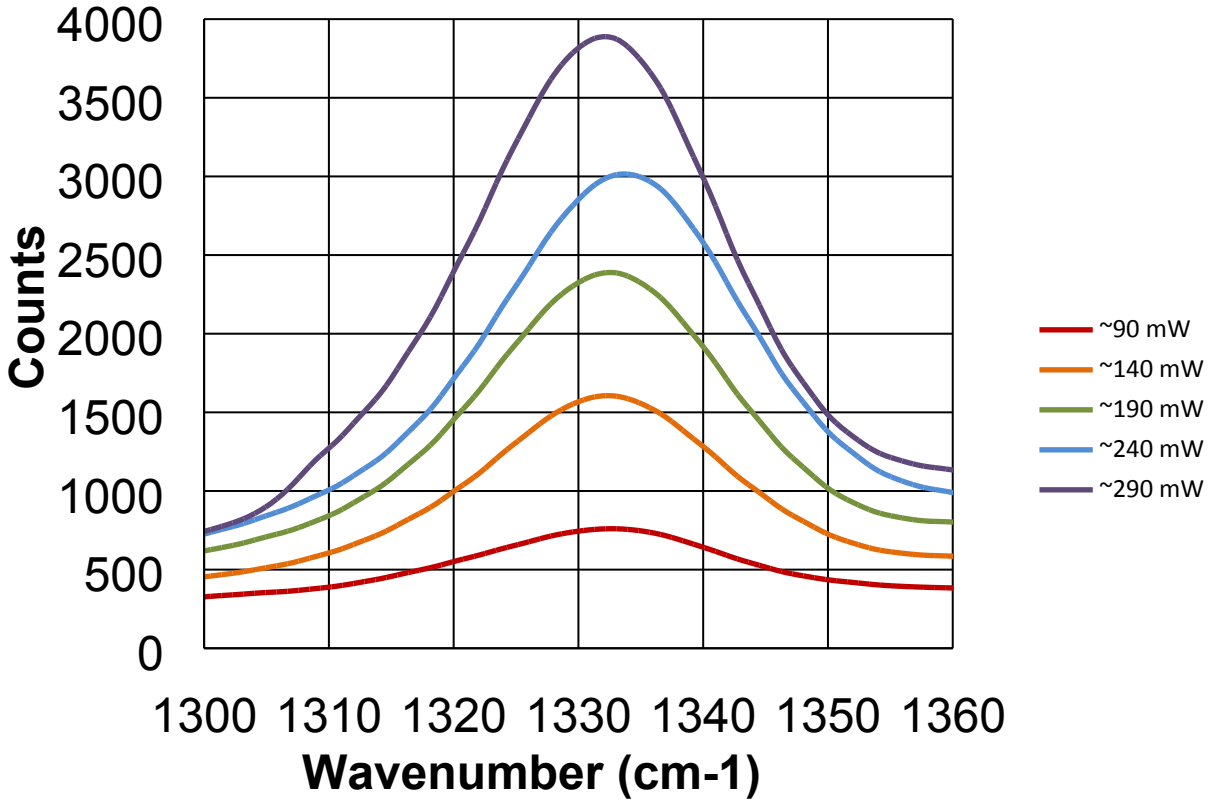

Figure S9. Figure S8 expanded from 1300 cm^{-1} to 1360 cm^{-1}. Raman laser power ranging from 90 mW to 290 mW for 1:1 Fe:Ag using DTNB concentration of 1.0×10^{-4} M. 190 mW was selected as the laser power for all other measurements.

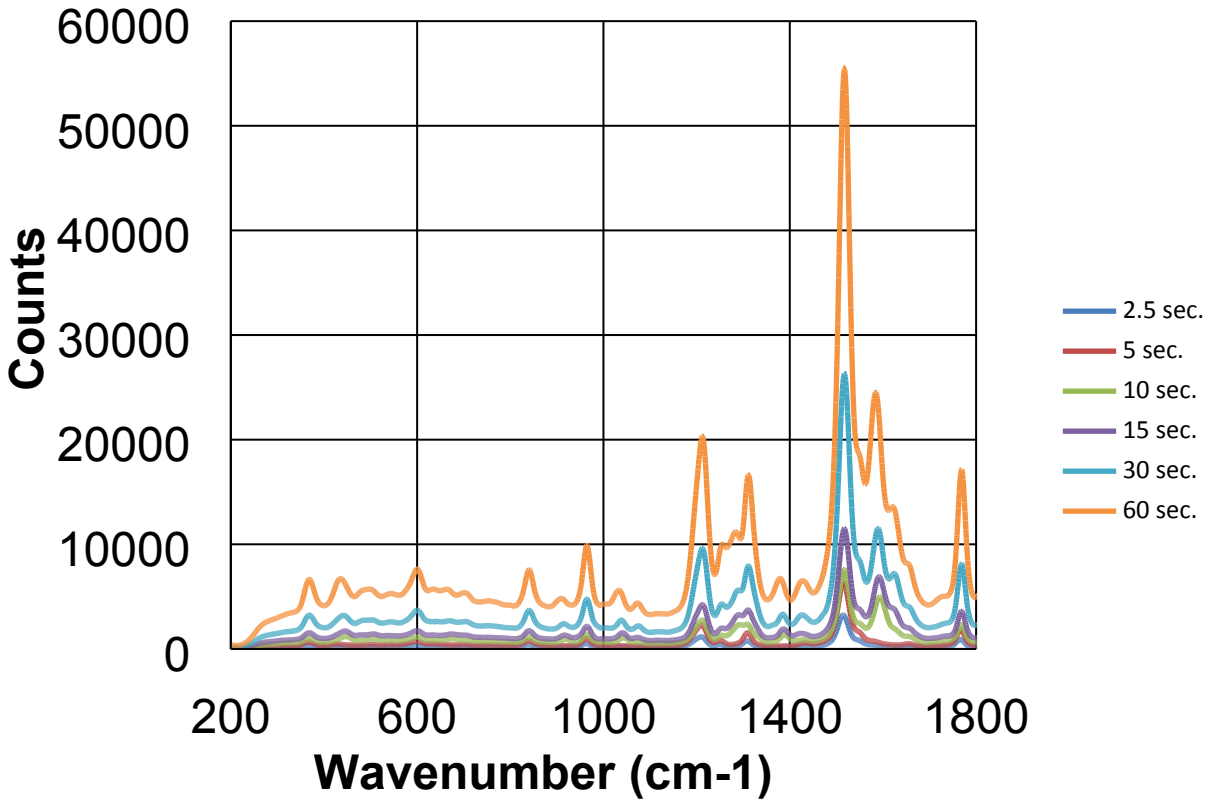

Figure S10. DTNB Raman spectra at different integration times ranging from 2.5 seconds to 60 seconds for 1:1 Fe:Ag for 1.0×10^{-4} M DTNB. An integration time of 5 seconds was selected for all measurements.

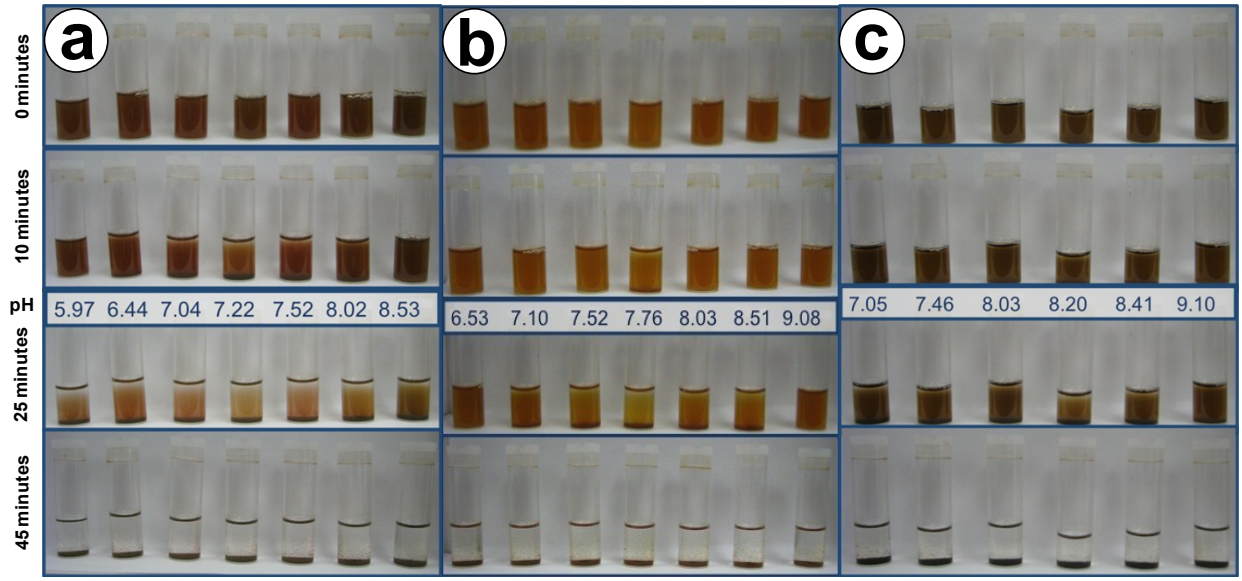

Figure S11. Optical photographs demonstrating colloidal stability of nanoparticle dispersions with time at various pH values. (a) AgJ_{13}NP-MH. (b) Maghemite. (c) Magnetite