

## Influence of dimensionality on optical properties of doped assembly of gold nanoclusters

### Supporting Information

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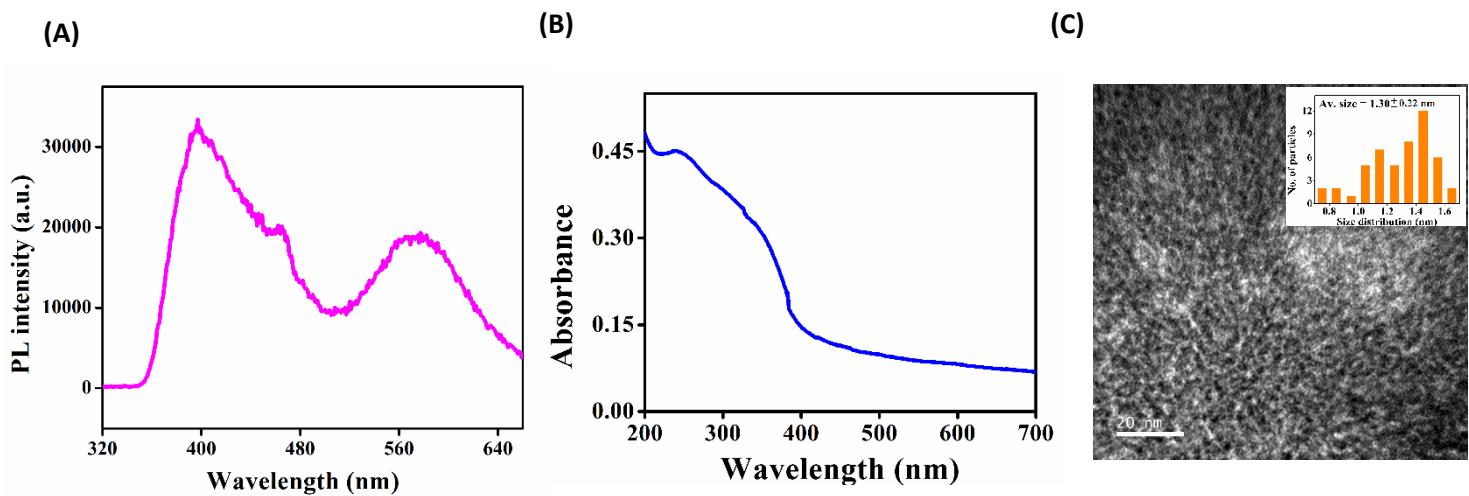
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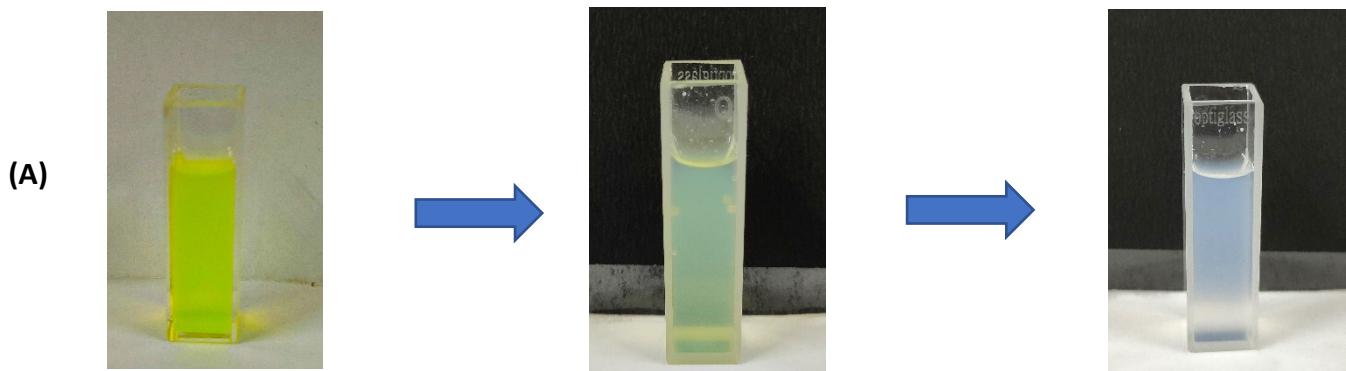
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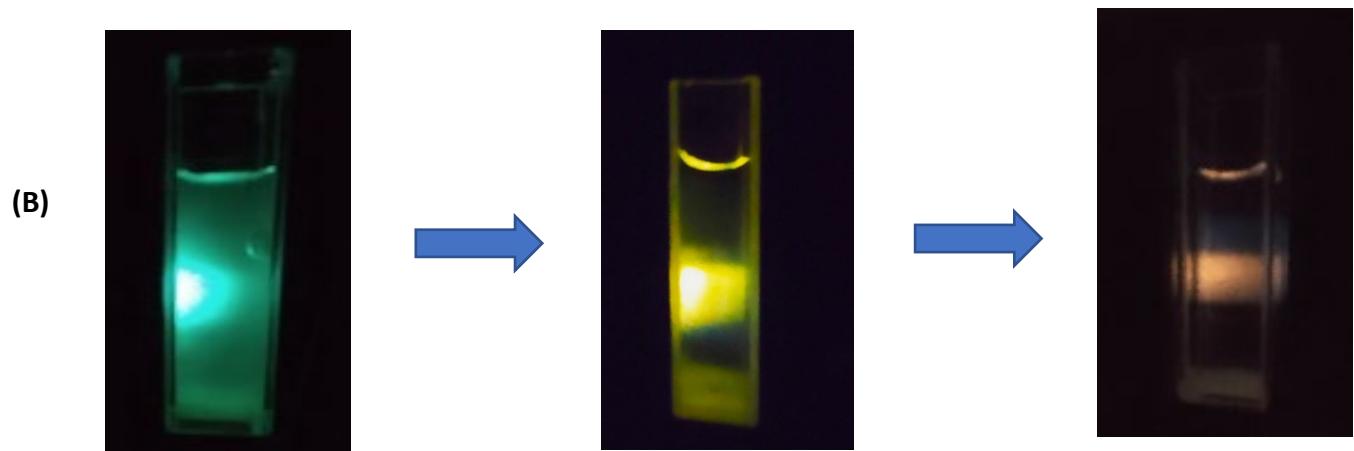


**Fig. S1** (A) Emission spectrum of Au NCs upon excitation at 300nm. (B) UV-vis spectrum of Au NCs. (C) TEM image of Au NCs. Inset: particle size distribution in TEM image (C)

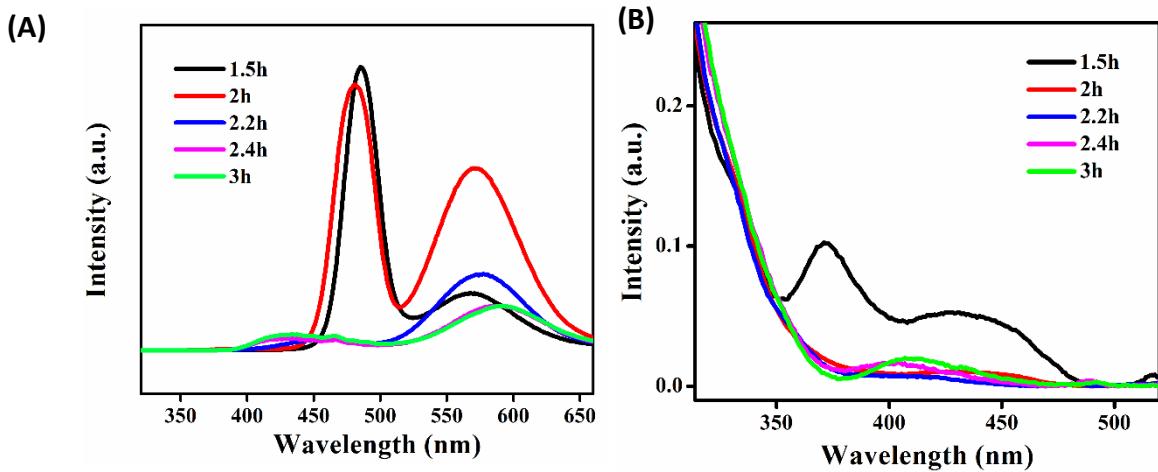
#### Under daylight:



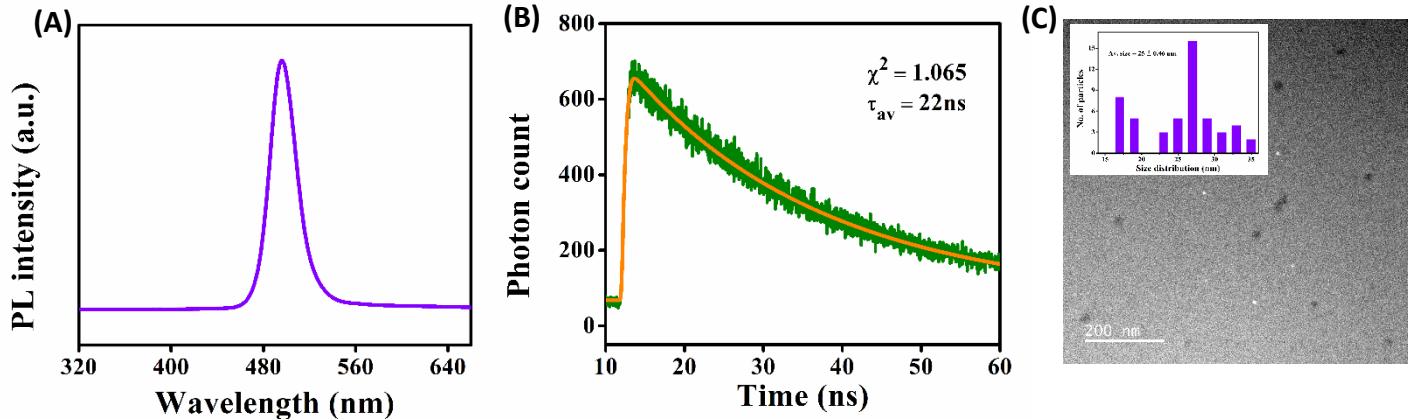
#### Under UV light(365nm):



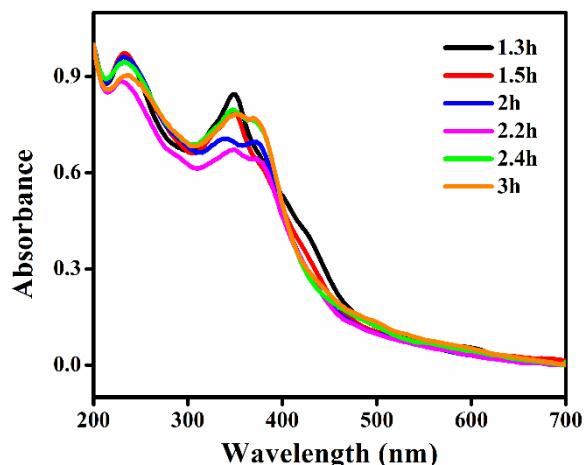
**Fig. S2** Digital images of the reaction mixture at different stages. Reaction initiated after zinc acetate dihydrate & manganese acetate dihydrate were added to a solution of Au NCs - (A) under daylight and (B) under UV lamp.



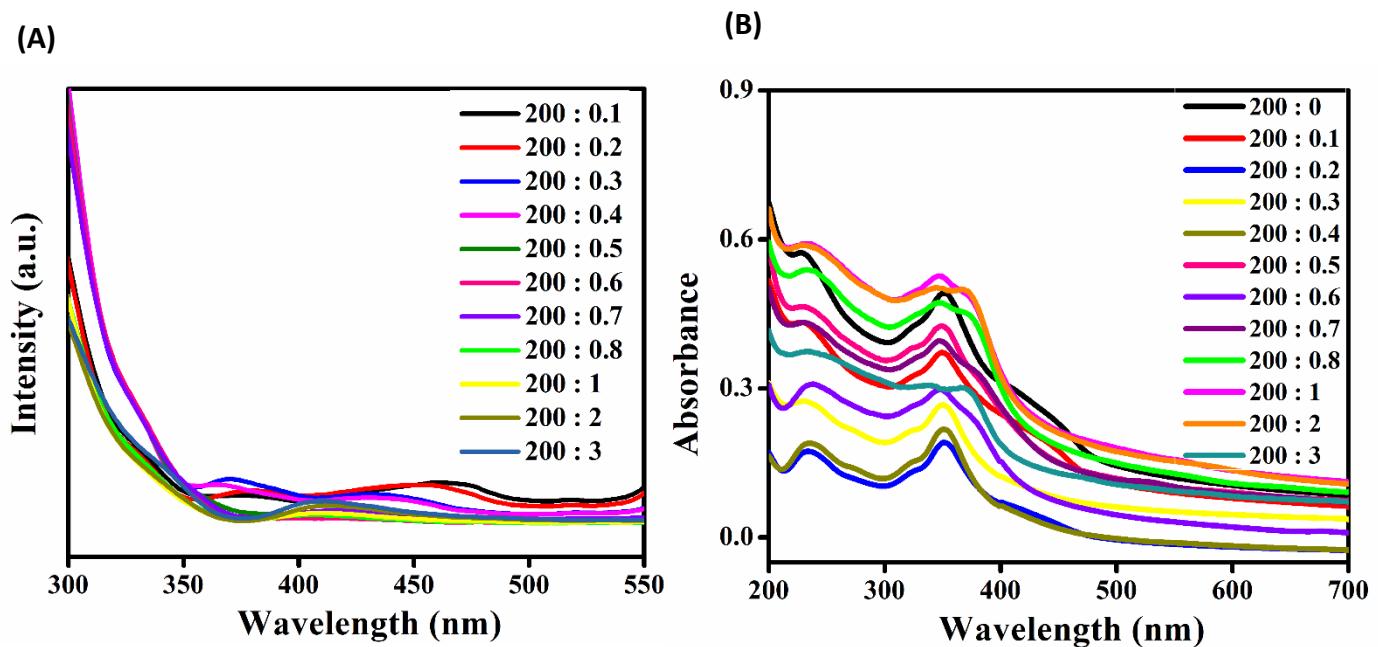
**Fig. S3** **(A)** Emission ( $\lambda_{\text{excitation}} = 300 \text{ nm}$ ) & **(B)** excitation spectra ( $\lambda_{\text{emission}} = 565 \text{ to } 595 \text{ nm}$ ) of Mn doped Zn Au NCs (Zn : Mn = 200 : 0.5(W/W in mg) at different reaction time.



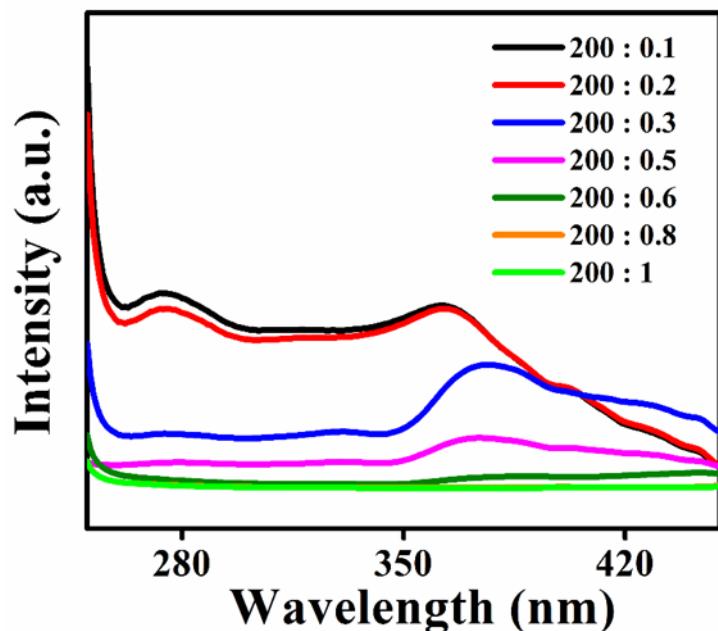
**Fig. S4** **(A)** Emission spectrum of Zn Au NCs upon excitation at 300 nm. **(B)** Time resolved photoluminescence decay curve of Zn Au NCs. **(C)** TEM image of Zn Au NCs. Inset: particle size distribution in TEM image (C)



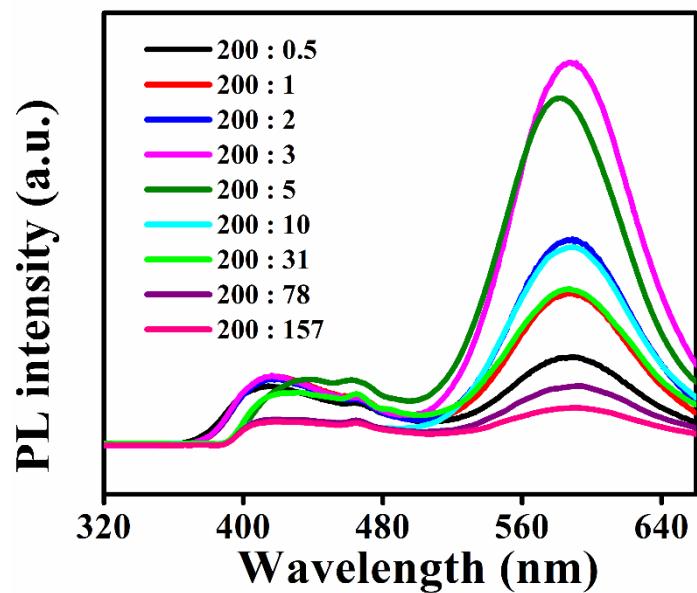
**Fig. S5** UV-vis spectra of  $\text{Mn}^{2+}$  doped Zn Au NCs weight ratio of Zn:Mn = 200:0.5 at different reaction times.



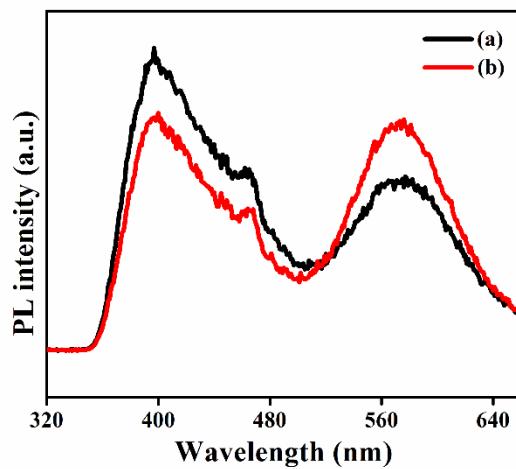
**Fig. S6 (A)** Excitation spectra ( $\lambda_{\text{emission}} = 565$  to  $595$  nm) of  $\text{Mn}^{2+}$  doped Zn Au NCs after two hours of reaction with different Zn : Mn (W/W in mg) ratio. **(B)** UV-vis spectra of  $\text{Mn}^{2+}$  doped Zn Au NCs after two hours of reaction with different Zn : Mn (W/W in mg) ratio.



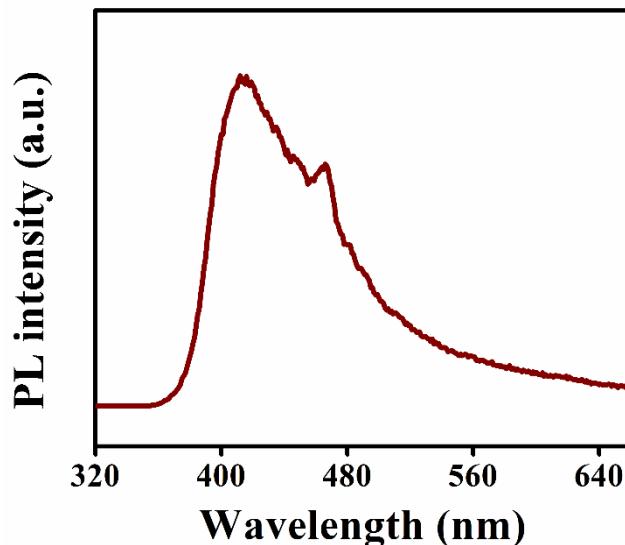
**Fig. S7** Excitation spectra ( $\lambda_{\text{emission}} = 492$  to  $465$  nm) of  $\text{Mn}^{2+}$  doped Zn Au NCs at different Zn:Mn (W/W in mg) ratios after 2hrs.



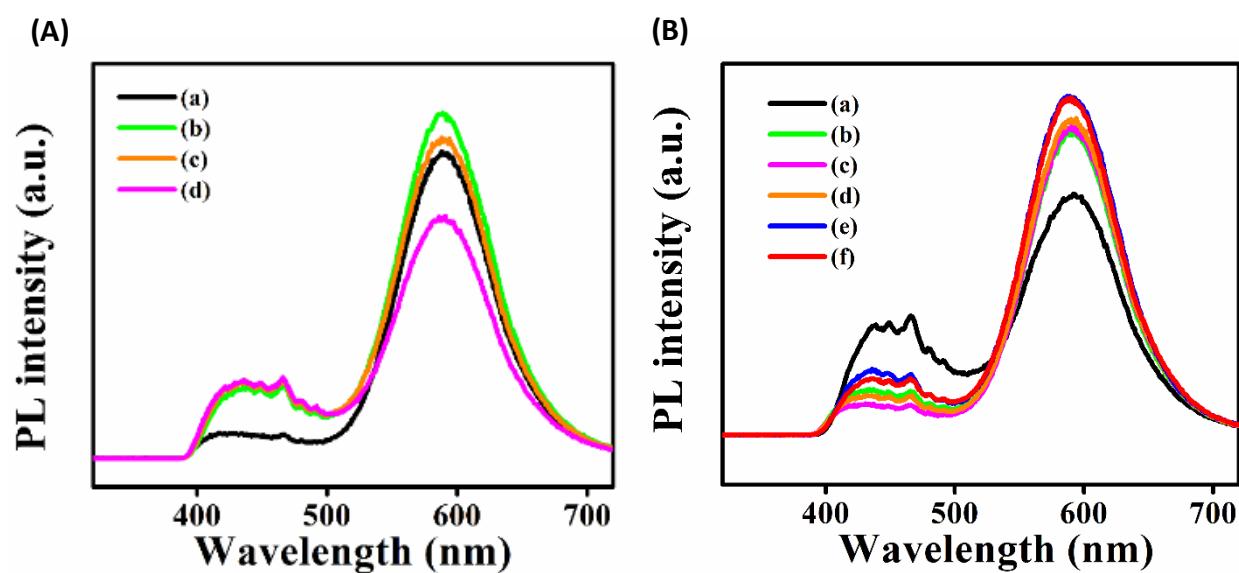
**Fig. S8** Emission spectra of Mn<sup>2+</sup> doped Zn Au NCs at completion of reaction with varying Zn : Mn (W/W in mg) ratio. Excitation at 300nm.



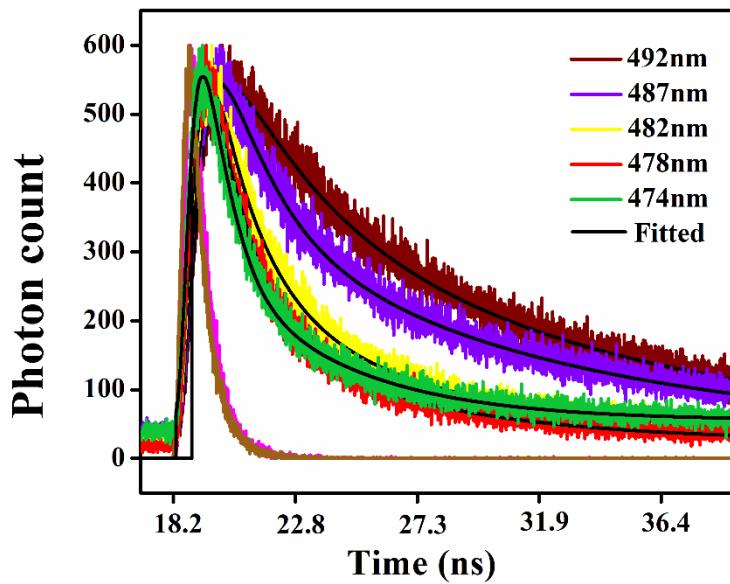
**Fig. S9** Emission spectra of (a) Au NCs & (b) after addition of Mn- acetate, exciting at 300nm.



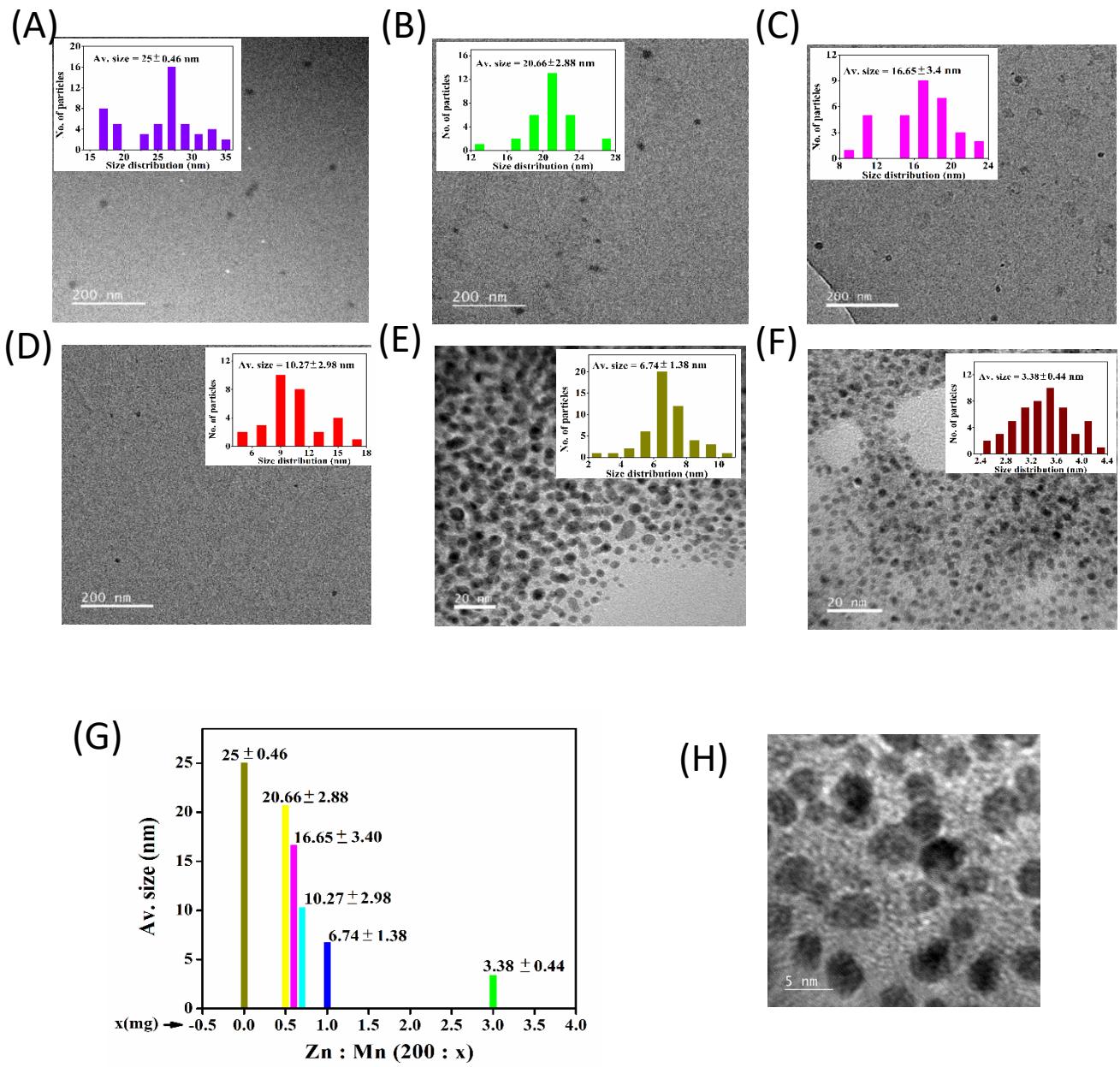
**Fig. S10** Emission spectra of Zn Au NCs after addition of Mn- acetate exciting at 300nm.



**Fig. S11** Emission spectra of (A) Mn doped Zn Au NCs (exciting at 300 nm) after addition of 13 mM Zn acetate at (a) 0 min, (b) 20min, (c) 4h, (d) 20h. (B) Mn doped Zn Au NCs (exciting at 300 nm) after addition of (a) 0 mM, (b) 1.23 mM (c) 2.38 mM (d) 3.44 mM (e) 5.55 mM (f) 7.44 mM zinc acetate.



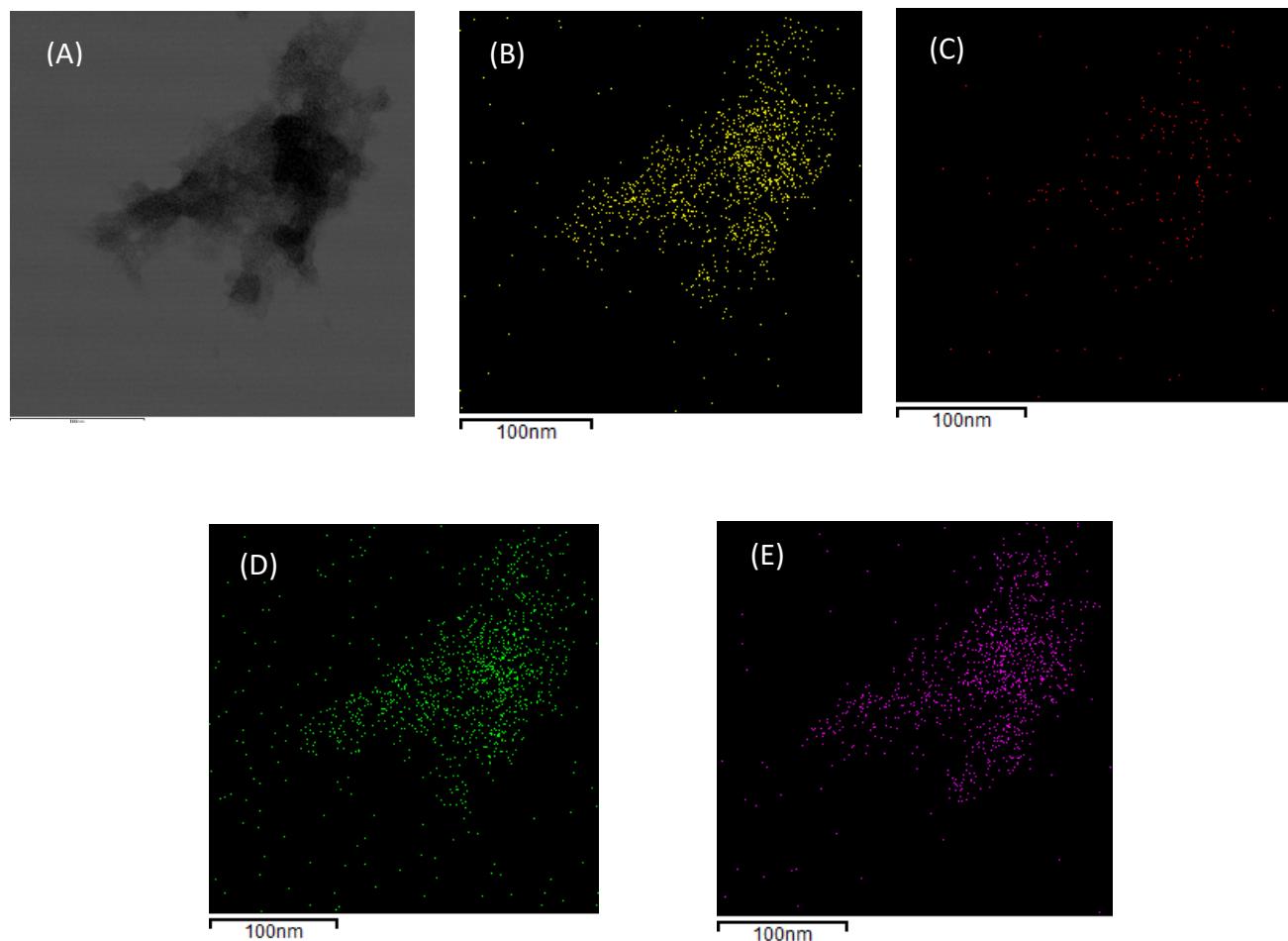
**Fig. S12** Time resolve photoluminescence spectrum of Mn doped Zn Au NCs with Zn : Mn(W/W in mg)= 200 : 0.5 emitting at different wavelength with time respectively.



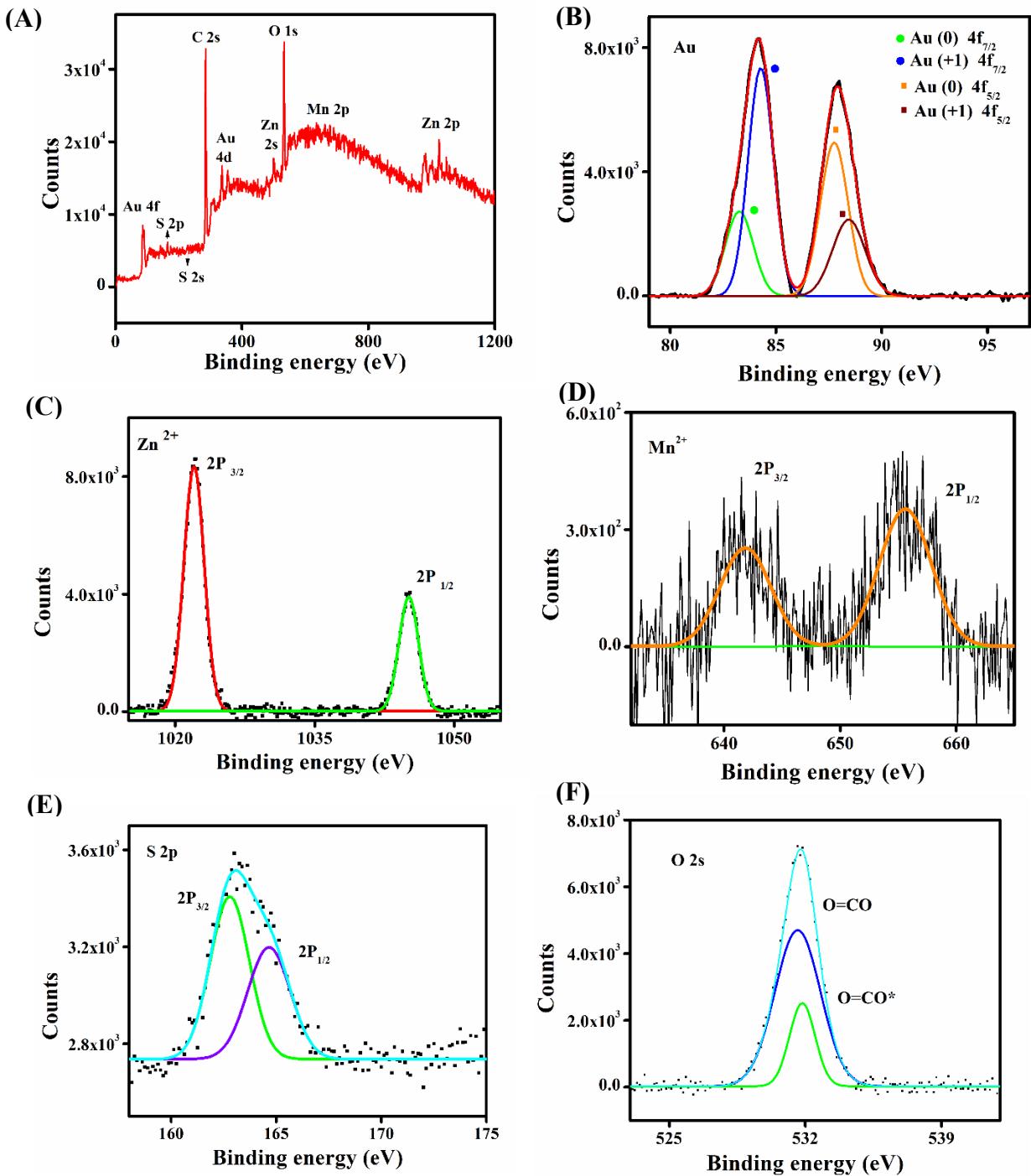
**Fig. S13** TEM image with size distribution (inset) of  $Mn^{2+}$  doped Zn Au NCs after two hours of reaction with Zn:Mn (w/w in mg) ratio (A) 200:0, (B) 200:0.5, (C) 200:0.6, (D) 200:0.7, (E) 200 : 1, (F) 200:3. (G) Corresponding plot of average size of  $Mn^{2+}$  doped Zn Au NCs assembly as function of Zn:Mn ratio is reaction mixture. (H) HRTEM image of  $Mn^{2+}$  doped Zn Au NCs after two hours of reaction with Zn:Mn (w/w in mg) ratio 200:2.

**Table S1** Elemental analysis from XPS at 2hrs & 4hrs of reaction with different Zn : Mn (W/W) ratio.

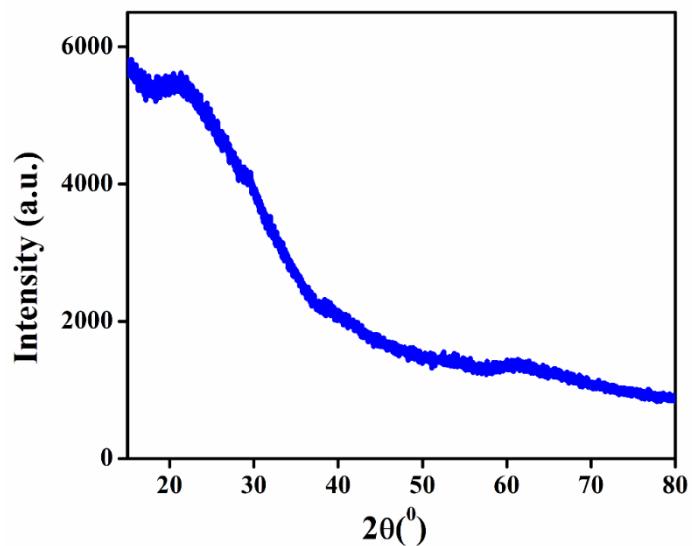
Compound (Zn : Mn)	% of Mn	% of Zn	% of Au	Atomic ratio Mn : Zn : Au	Reaction time (hrs)
200 : 0.5	1.42	59.24	39.33	1 : 42 : 28	2
200 : 0.5	6.51	43.44	50.03	1 : 7 : 8	4
200 : 1	6.78	40.82	52.39	1: 6 : 8	4
200 : 3	11.64	55.76	32.60	1 : 5 : 3	4



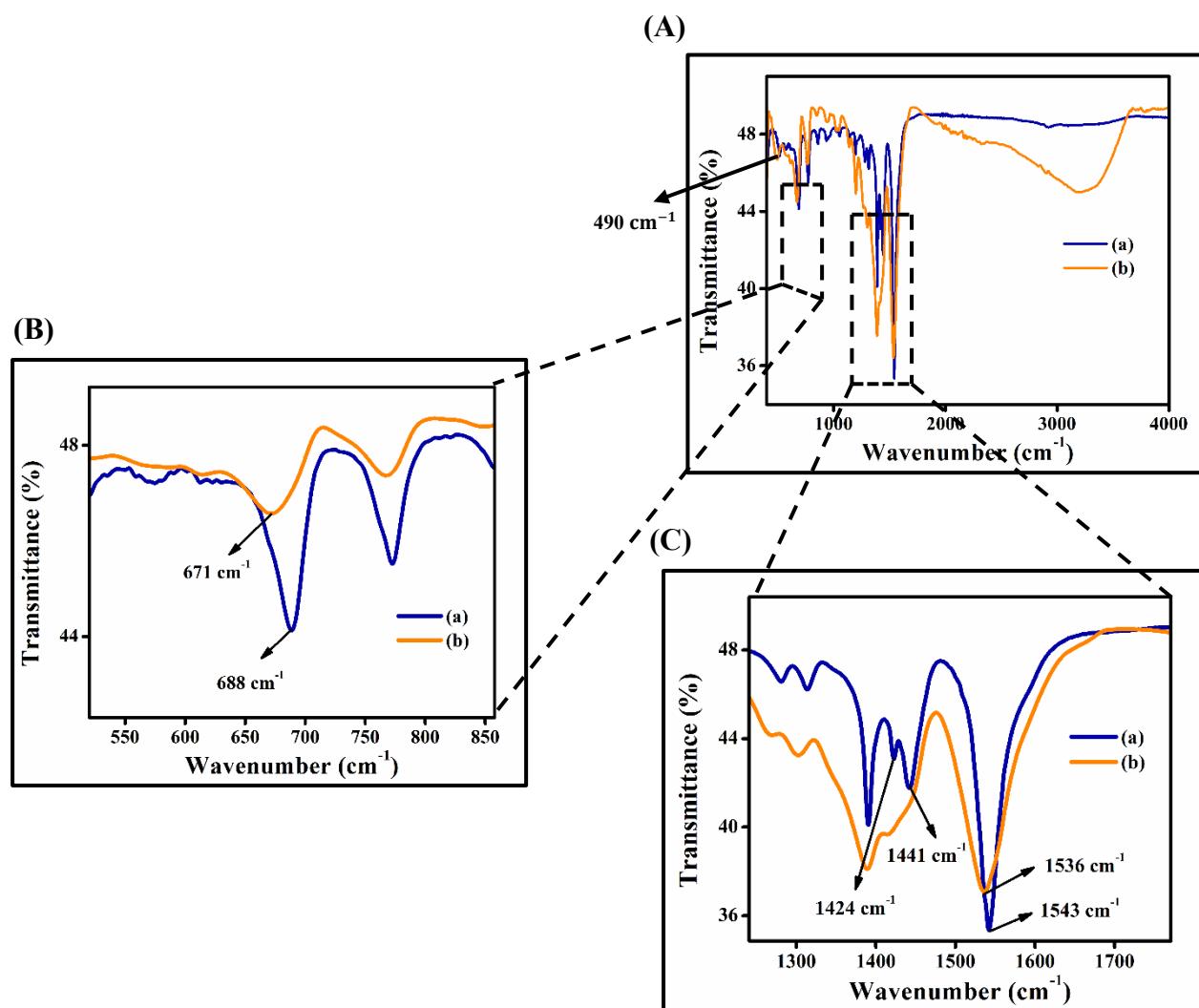
**Fig. S14** (A) TEM image of Mn doped Zn Au NCs. Elemental mapping of (B) Au, (C) Mn and (D) Zn, (E) S in Mn doped Zn Au NCs. The scale bars in all the images are 100 nm.



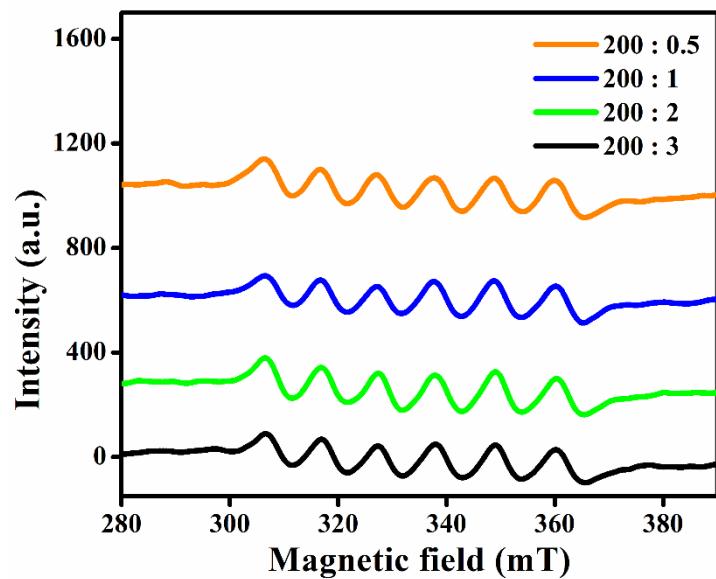
**Fig. S15** (A): Survey XPS spectrum of Mn<sup>2+</sup> doped Zn Au NCs. (B) XPS spectrum of Au element in Mn<sup>2+</sup> doped Zn Au NCs. (C) XPS spectrum of Zn element in Mn<sup>2+</sup> doped Zn Au NCs. (D) XPS spectrum of Mn element in Mn<sup>2+</sup> doped Zn Au NCs. (E) XPS spectrum of S element in Mn<sup>2+</sup> doped Zn Au NCs. (F) XPS spectrum of O element in Mn<sup>2+</sup> doped Zn Au NCs.



**Fig. S16** XRD spectra of  $\text{Mn}^{2+}$  doped Zn Au NCs.



**Fig. S17** (A) FTIR spectra of (a) Zn Au NCs and (b)  $\text{Mn}^{2+}$  doped Zn Au NCs. (B) Zoomed FTIR spectra corresponding to (A) showing peaks between 600 to 800  $\text{cm}^{-1}$  (C) Zoomed FTIR spectra corresponding to (A) showing peaks between 1200 to 1560  $\text{cm}^{-1}$ .



**Fig. S18** EPR spectrum of  $\text{Mn}^{2+}$  doped Zn Au NCs with different Zn : Mn (W/W in mg) at 4hrs.