

*Supplementary information

Size controlled green synthesis of gold nanoparticles using Coffee Arabica Seed extract and their catalytic performance in 4-Nitrophenol reduction

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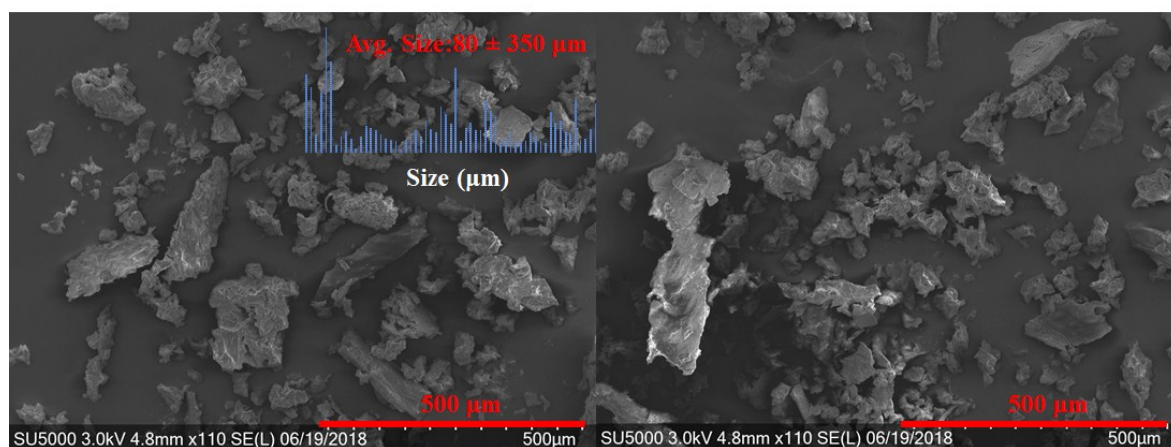


Fig.S1 FE-SEM images of CAS before its use for the preparation of gold nanoparticles (inset shows the average particle size)

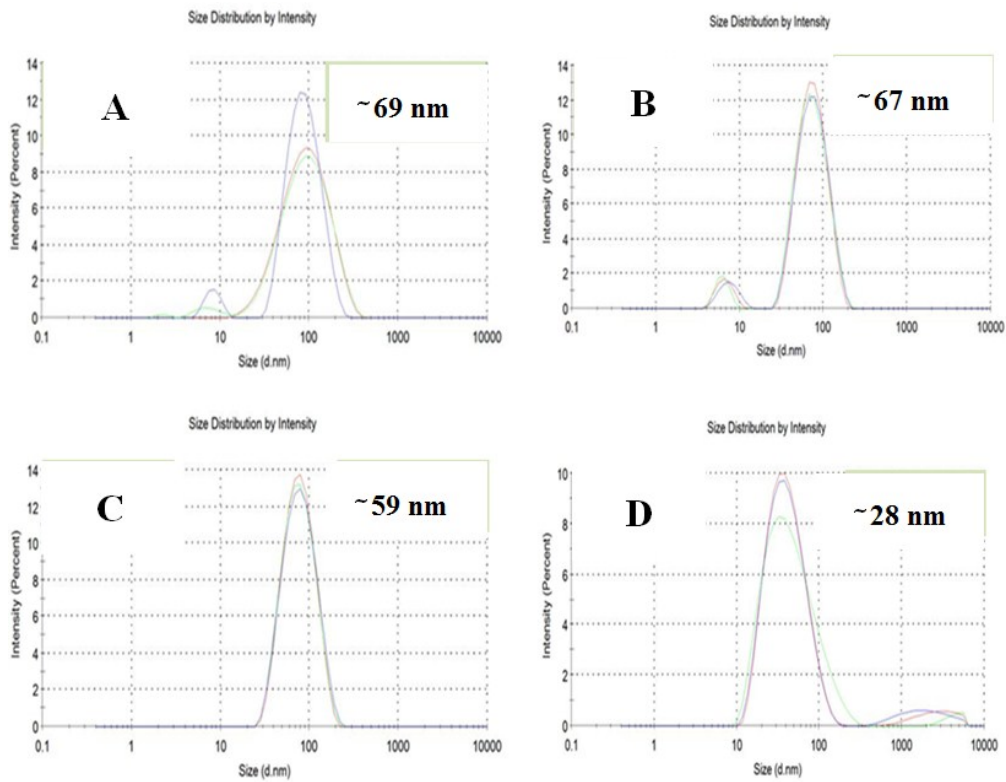


Figure S2. DLS results of GAuNPs as a function of extract pH 5, 7, 9 and 10.5 (A-D)

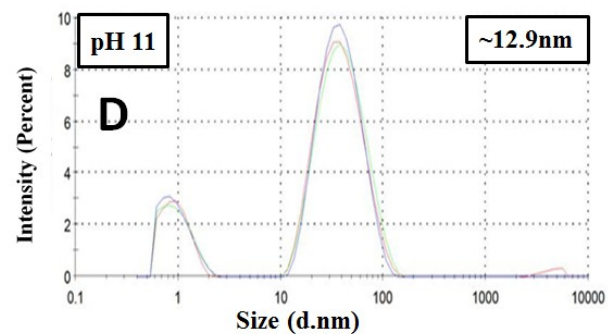
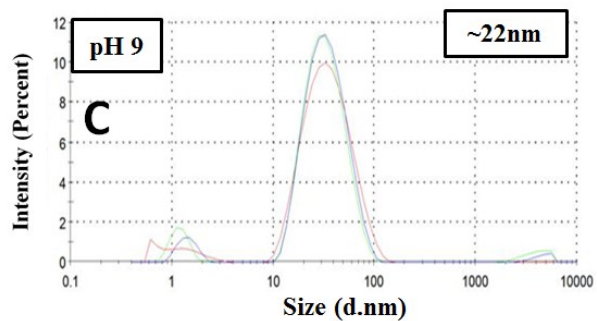
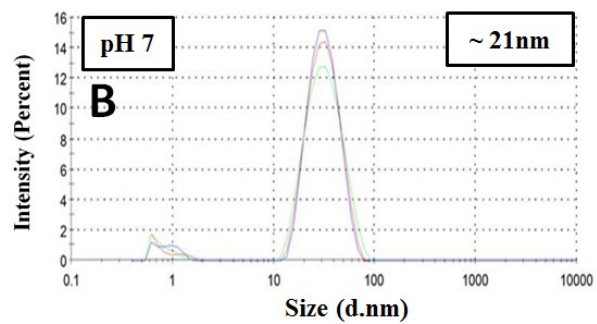
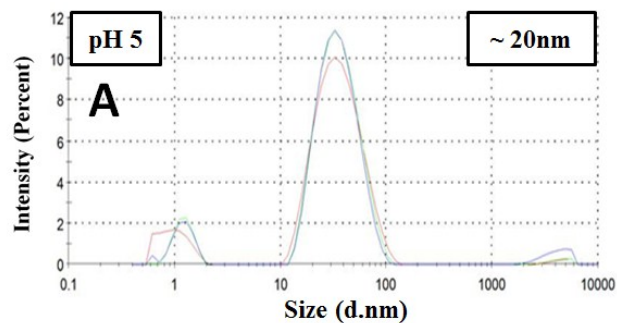


Figure S3. DLS results of CAuNPs as a function of pH 5, 7, 9 and 11 (A-D)

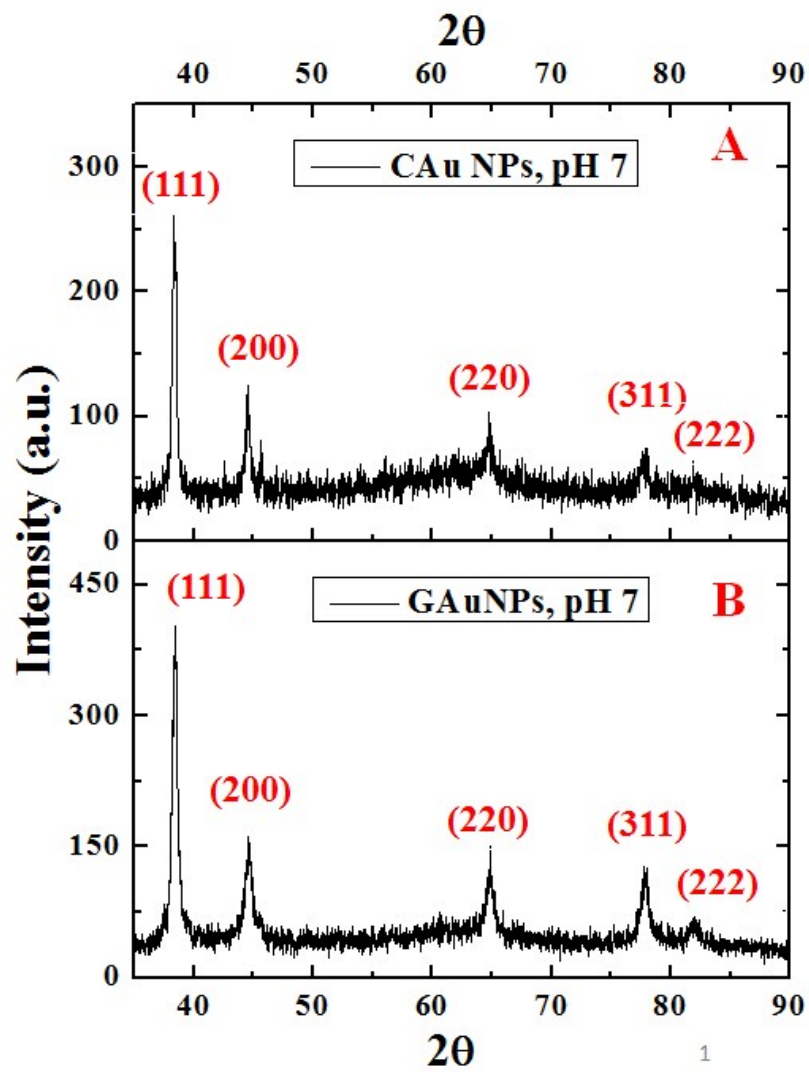


Figure S4. XRD pattern of (A) CAuNPs and (B) GAuNPs synthesized at pH 7 of the reaction mixtures.

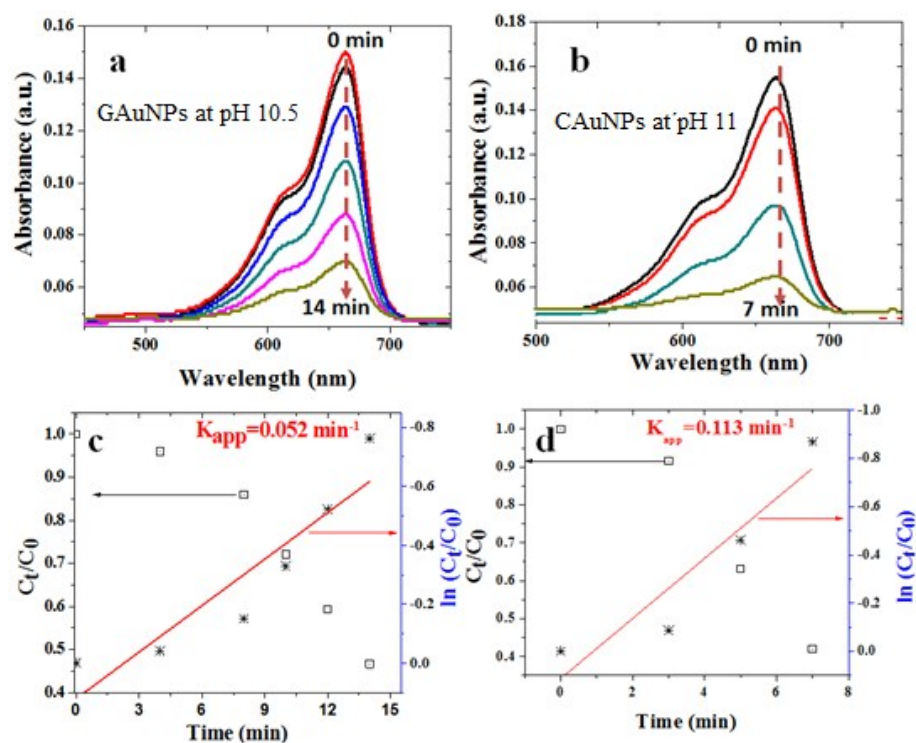


Fig. S5 UV-vis absorbance spectra of methylene blue catalyzed by GAuNPs (pH 10.5) (a) CAuNPs (pH 11) (b), and their kinetic studies GAuNPs (c) and CAuNPs (d)

At the start of the degradation process, the absorbance peak of $\text{NaBH}_4 + \text{MB}$ is around 662 nm. No change in absorbance peak is observed up to 20 min. After the addition of gold nanoparticles (NPs), the absorbance intensity rapidly decreases and finally disappears within 14 min (Fig S1 a) and 7 min (Fig S1 b) for GAuNPs (at pH 10.5) and CAuNPs (at pH 11), respectively. Pseudo-first-order kinetic equation was

applied to evaluate the catalytic rate. The absorbance of MB was proportional to its concentration in the medium. The calculated rate constant k was 0.052 min^{-1} and 0.113 min^{-1} for GAuNPs and CAuNPs, respectively (Fig S2 (c) and (d)).

Table SI I. Comparison of the rate constants and time to reduce 4-NP using sodium borohydride catalyzed by various size and shape of gold nanoparticles.

Size of Au NPs (nm)	Shape	k_{app}	Time (min)	Ref.
~69	Poly disperse	0.0387 min^{-1}	53	Present study
~67	Poly disperse	0.0663 min^{-1}	53	Present study
~59	Poly disperse	0.0538 min^{-1}	45	Present study
~28	Poly disperse	0.0522 min^{-1}	38	Present study
~ 26.5	Poly disperse	0.1060 min^{-1}	36	1
~22	Mono disperse	0.0882 min^{-1}	32	Present study
~21	Mono disperse	0.0826 min^{-1}	30	Present

				study
~20	Mono disperse	0.1009 m ⁻¹	28	Present study
21.8	Mono disperse	0.0044 sec ⁻¹	12	2
20	Mono disperse	0.0075 sec ⁻¹	6	2
14.1	Mono disperse	0.0264 sec ⁻¹	4	2
~13	Mono disperse	0.1401 min ⁻¹	22	Present study
12.9	Mono disperse	0.0061 sec ⁻¹	--	3
6.2	Mono disperse	0.0475 sec ⁻¹	2	2
3	Mono disperse	0.0012 sec ⁻¹	--	3

References

1. N K R Bogireddy, K K H Anand, B K Mandal, J. of Mol. Liq., 2015, 211, 868-875.
2. P. Suchomel, L. Kvitek, R. Prucek, A. Panacek, A. Halder, S. Vajda, R. Zboril, Sci. Rep., 2018, 8, 4589.
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