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Synthesis of Ag/rGO Nanocomposite using *Bos Taurus Indicus* Urine for Nitroarenes Reduction and Biological Activity

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Supplementary Information

1. Synthesis of Graphene Oxide (GO) from Improved Method

An improved graphene oxide (GO) production process is reported. Hummers' technique (KMnO₄, NaNO₃, H₂SO₄) is now the most widely used method for producing graphene oxide. We discovered that removing the NaNO₃, increasing the quantity of KMnO₄, and executing the reaction in a 9:1 H₂SO₄/H₃PO₄ combination improved the oxidation efficiency. 3 g of graphite flakes are then added to the solution. Then, pinch by pinch i.e., slowly 18 g of KMnO₄ is added, and the mixture is maintained at 60°C for roughly 14 hours under the constant stirring. Moreover, 400 ml ice cold D.W. was slowly added to the solution and H_2O_2 , is also added to the solution to remove excess amount of KMnO₄. However, during this the solution was held in an ice-cold bath until the mixture becomes yellow. Next, the mixture is filtered and centrifuged at 5000 rpm to remove any undesired materials. After washing with 200 ml of 30% HCl, 200 ml of D.W. and one cycle of ethanol, finally one wash with petroleum ether, the material is transferred to a petri plate and left at 60oC temperature for drying. The dried product was then weighed to determine the yield¹.

2. Synthesis of Reduced graphene oxide (rGO)

In this procedure, 100 mg of graphene oxide was placed in a roundbottom flask with an equivalent quantity of water to produce a yellow–brown dispersion. The solution was thoroughly sonicated with a bath sonicator until it was clean and no particle matter was visible, then solution was heated in an oil bath at 100 °C with addition of 1 mL of hydrazine hydrate under continuous stirring. The solution was kept for 24 hours, in addition to that, the entire setup was maintained cold by a water-cooled condenser. The rGO slowly turned into a black precipitate. After that, it was rinsed in water and ethanol and then dried to form a powder. It has been discovered that washing with deionized water plays an important role in decreasing contamination from various constituents throughout the reduction process².

Characterization study

XRD of GO and rGO

The XRD pattern of GO and rGO is observed shown in Figure S1 where (hkl) values are (001), (002) and (001), (002) and (100) respectively. The XRD pattern confirms the successful synthesis of GO and rGO.

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Electron Supplementary Information (ESI) available: [details of any supplementary information available should be included here].

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Raman spectroscopy

The Raman spectra of GO and rGO revealed that the intensity ratio for GO and rGO ID/IG is 0.8106 and 1.077, respectively (shown in Figure S2). Where ratio is greater than 1 of rGO than nanocomposite represents the high purity.





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Fig.S3: FE-SEM image of (a-d) Ag NPs and (e-h) Ag/rGO nanocomposite.



Fig.S4: Elemental mapping of Ag NPs (5a) and Ag/rGO (5c) nanocomposite. Elemental Mapping of (5b) Ag Map, (5d) Ag Map, (5e) carbon

Map.



(b) $\Delta q/r C O$	Sum Spectrum					
	Element	Wt%				
©	С	66 .30				
10	Ag	33.70				
	Total:	100.00				
4 9						
0 1 2 3 4 5	6 7 8	3 9 10				
Full Scale 565 cts Cursor: 0.000		keV				

Fig.S5: EDX graph of (a) Ag NPs and (b) Ag/rGO nanocomposite.

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Sr. No.	20	θ	cos θ	sin θ	FWHM (°)	FWHM [radian]	β cos θ	Crystalline size	d-spacing	surface area	M.I.
1.	38.0649	19.03246	0.9452	0.3261	0.0945	0.001649	0.001559	88.94639	2.36409	6.418303	0.879749
2.	44.3883	22.19415	0.926	0.37775	0.3779	0.006595	0.006106	22.70643	2.04088	25.14199	0.646551
3.	64.4939	32.24695	0.8458	0.53356	0.3779	0.006595	0.005578	24.85854	1.44487	22.96534	0.646551
4.	77.4587	38.72935	0.7801	0.62564	0.6912	0.012064	0.009411	14.7328	1.23121	38.74925	0.5

Table no. S1: XRD Analysis and Calculation of Various Parameters for Ag NP's.

Table no. S2: XRD Analysis and Calculation of Various Parameters for Ag/rGO nanocomposite.

Sr.	20	θ	cos θ	sin O	FWHM (°)	FWHM	β cos θ	Crystalline	d-spacing	surface	M.I.
No.						[radian]	size			area	
1.	38.0868	19.04	0.9452	0.32622	0.1574	0.002747	0.002596	53.3898	2.36278	10.69	0.777804
2.	44.3652	22.18	0.926	0.37751	0.551	0.009616	0.0089	15.573	2.0419	36.65	0.5
3.	64.4959	32.24	0.8458	0.53346	0.4723	0.008243	0.006971	19.8823	1.44483	28.71	0.53844
4.	77.4638	38.73	0.7801	0.62565	0.4723	0.008243	0.006971	19.8823	1.23216	28.71	0.53844