Electronic Supplementary Material (ESI) for RSC Advances.

Solar mediated reduction of graphene oxide

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Supporting Information 1

S1.1 Synthesis of Graphene oxide (GO)

Step1: Pre-oxidation of graphite

Take 25 ml of concentrated sulphuric acid (H_2SO_4) in a 250 ml beaker. Add 5 gms of potassium persulfate and 5 gms of phosphorous pentoxide. Heat the mixture to 90 °C under constant stirring. After complete dissolution of the reactant the temperature is reduced to 80 °C. Then add 6 gms of graphite powder. Effervescence was observed for 30 mins. Maintain the temperature to 80 °C for next 5 h. Stop heating and dilute the mixture by adding 1 litre of distilled water. Keep it overnight and allow the solution to settle then filter and wash several times with water to remove acids. Dry the filtered solid pat overnight.

Step 2: Oxidation graphite oxide

Pre-oxidised graphite (dry weight ~6 gms) obtained from step 1 was added to 230 ml of concentrated sulphuric acid (H_2SO_4) under stirring in an ice-bath. Then 15 gms of potassium permanganate ($KMnO_4$) was added slowly. An exothermic reaction with the evolution of thick fumes was noted; hence the temperature was maintained below 10 °C till complete addition of $KMnO_4$. Now, the temperature was raised to 35 °C and maintained for 2 h. Add 1 litre of deionized water (DIW). Keeping temperature below 50 °C stir the mixture for 2 h and add 1.5 litre of DIW and 25 ml of 30 % H_2O_2, mix well and allow it to settle for 24 h at room temperature and then the supernatant was carefully poured without disturbing the sediment.

Settled dispersion was centrifuged and washed several times with 10 % HCl followed by distilled water. The resultant solid is dried. The working solution of desired concentration was prepared by diluting the GO appropriately and used after dialysis.

S1.2. Hydrothermal method of reducing GO to Reduced Graphene Oxide (RGO)

The working solution of GO was sonicated for 45 mins to exfoliate suspension. About 25 ml of the sample is transferred to the Teflon lined hydrothermal reaction vessel and heat it to 160 °C for 6 h.

After cooling at room temperature, black precipitate of RGO settles. It is then re-dispersed in distilled water by mild sonication.

S1.3. Reduction of GO by hydrazine hydrate

100 mg of GO was loaded in a 250 ml round bottom flask and 100 ml of water was then added to it. The yellow brown dispersion of GO was then sonicated. Hydrazine hydrate (1.00 ml, 32.1 mM) was then added and the solution was heated in an oil bath at 90 °C under water cooled condenser for 24 h over which RGO gradually precipitates out as black solid and then filtered after washing with 500 ml of water and 500 ml of methanol.

Supporting Information 2

Calculation of Electrical conductivity

The electrical conductivity was calculated using the expressions give below (1 and 2).

$$\text{Resistivity } (\rho) = \frac{\rho_o}{correction\ factor\ (CF)}$$

$$\rho o = \frac{V}{I} x \frac{2\pi S}{CF} \quad \text{…….(1)}$$

$$CF = \frac{2S\ ln2}{W} \quad \text{…… (2)}$$

Conductivity (σ) = 1/ρ (S/m)

Where V = potential difference between inner electrodes (in volts)

I = current through the outer pair of electrodes (in amps)

S= probe spacing (in meters); S=2.5 mm

W= Sample thickness (in meters); W=8 μm

Correction Factor = 433

ρ = resistivity in ohm-meter

Supporting Information 3

Table 1. The zeta potential values of RGO samples

Sample designation	Zeta Potential (mV)
sRGO	-29.1
hRGO	-28.9
hyRGO	-23.5

Supporting Information 4

Calculation of bandgap of GO

Band Gap Energy (E) = (h*c)/λ

h = Planks constant = 6.626 x 10^{-34} Joules sec

c = Speed of light = 3.0 x 10^{8} meter/sec

λ = Cut off wavelength = 401 x 10^{-9} meters

E = 3.09 eV

Supporting Information 5

Table 2: Variation in TOC concentration as function of duration of light irradiation

	Total Organic Carbon TOC (ppm)	**Inorganic Carbon IC (ppm)**	**Total Carbon TC (ppm)**
initial GO	4.79	0.189	4.99
After 2 h	1.31	0.131	1.45
After 5 h	1.91	0.249	2.16
After 8 h	2.11	0.353	2.47
After 11 h	3.30	0.275	3.57