Electronic Supporting Information (ESI)

Synthesis, characterization and antibacterial activity of Ag incorporated ZnO–graphene nanocomposite

Atanu Naskar[1], Susanta Bera[1], Rahul Bhattacharya[2], Pritam Saha[3], Sib Sankar Roy[2], Tuhinadri Sen[3], and Sunirmal Jana[1]*

[1]Sol-Gel Division, CSIR-Central Glass and Ceramic Research Institute
196 Raja S.C. Mullick Road, P.O. Jadavpur University, West Bengal, Kolkata 700032, India

[2]Cell Biology & Physiology Division, CSIR-Indian Institute of Chemical Biology,
4 Raja S.C. Mullick Road, P.O. Jadavpur University, West Bengal, Kolkata 700032, India

[3]Department of Pharmaceutical Technology, Jadavpur University
188, Raja S.C. Mallick Rd, West Bengal, Kolkata – 700032, India

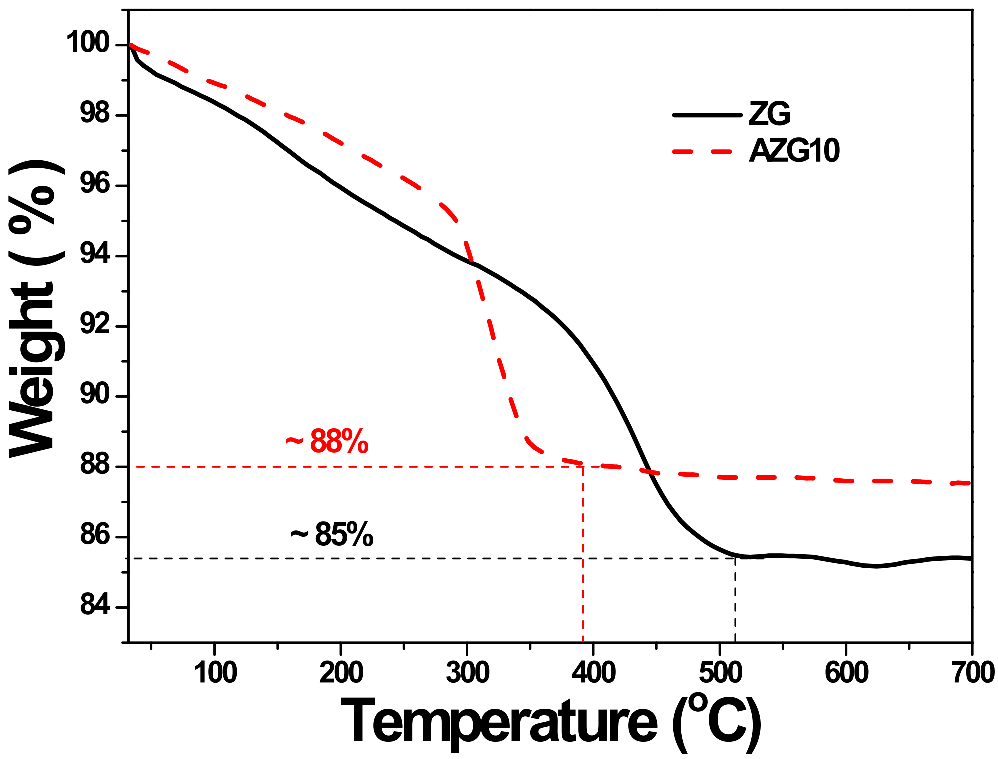

Fig. S1: TG curves of AZG10 and ZG nanocomposites.

Thermogravimetric weight loss behaviour of ZG and AZG10 nanocomposites was analysed by TG analysis (Fig. S1). Two main weight losses were observed in the TGA curve for both samples. The first one was noticed at around 280 °C, could be attributed due to loss of adsorbed water from both the samples.[1] The oxidation of carbon of CCG into carbon oxides could be the reason for the second weight loss at ~400 °C and 500 °C for ZG and AZG10, respectively.[1] The total weight loss could also be calculated from the TG curves. The total weight loss of ZG and AZG nanocomposites were about 15% and 12%, respectively.

Reference

[1] A. Naskar, S. Bera, R. Bhattacharya, S. S. Roy and S. Jana, *Polymer. Adv. Tech*., 2016, **27(4)**, 436–443.

Table S1: Antibacterial activity shown by different Ag-ZnO-graphene nanocomposites

Sl no	Nanocomposite System	Antibacterial activity	References
1	Zinc Oxide/Graphene Oxide nanocomposite by Yan-Wen Wang et al	*E. coli* (10 μg/ml)	ACS Appl. Mater. Interfaces 2014, 6, 2791−2798
2	Ag–ZnO nanocomposite by Ishita Matai et al	Green fluorescent protein (GFP) expressing antibiotic resistant *E. coli* (550 μg/ml), *S. aureus* (60 μg/ml)	Colloids Surf., B: Biointerfaces 2014, 115, 359–367
3	Ag–graphene oxide nanocomposites by Wei-Ping Xu et al	*E. coli* (12.5 μg/ml)	J. Mater. Chem., 2011, 21, 4593
4	PEGylated Ag – graphene quantum dots nanocomposites by Khaled Habiba et al	*S. aureus* (25 μg/ml), *P. aeruginosa* (50 μg/ml)	Appl. Mat. Today 2015, 1, 80–87
5	Ag - reduced graphene oxide - multiwalled carbon nanotube by Leila Shahriary et al	*E. coli* (25 μg/ml)	New J. Chem., 2015, 39, 4583
6	Ag doped ZnO by Mahesh Kumar Talari et al	*E. coli* (40 μg/ml), *S. aureus* (100 μg/ml)	Chem. Pharm. Bull. 2012, 60 (7), 818-824

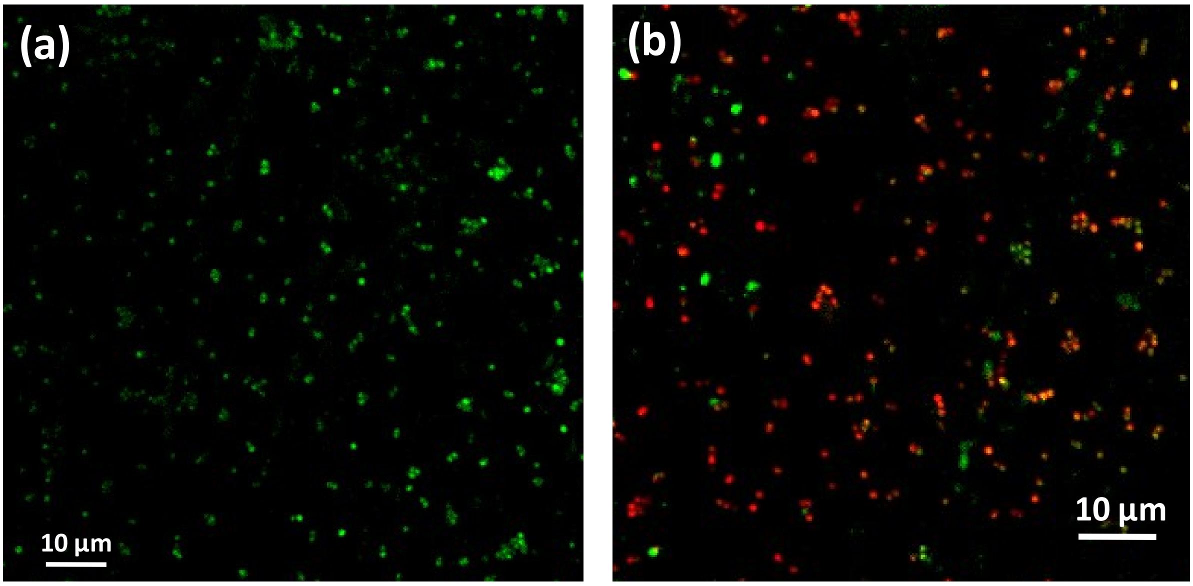

Fig. S2: Confocal laser-scanning microscopy (CLSM) images of Staphylococcus aureus: (a) blank (without treatment of sample) and (b) treatment with AZG10 (6.25μg/ml) after 10 h.

We have studied the effect of AZG10 nanocomposite on *S. aureus* by confocal laser scanning microscopy (CLSM) with the help of SYTO9 and propidium iodide (PI) staining. The CLSM images (Fig. S2) show that SYTO9 stains both live and dead cells while PI stains only the cells that have lost membrane integrity. It is also noted that live cells are in green colour and dead cells are in red colour. Figure S2a is the untreated *S. aureus* bacterial cells which show that the majority of the untreated cells are green in colour due to the viable or live cells. Figure S2b is the image of *S. aureus* bacterial cells treated with AZG10 nanocomposite which show that the major bacterial cells are in red colour, indicating the presence of dead cells.