Graphene/nickel oxide nanocomposites against isolated ESBL producing bacteria and A549 cancer cells

Rajivgandhi, Govindan

Maruthupandy, Muthuchamy

Quero, Franck

Li, Wen Jun

The synthesis of nickel oxide nanoparticles (NiO NPs)and graphene/nickel oxide nanocomposites (Gr/NiO NCs)was performed using a simple chemical reduction method. Powder X-ray diffraction (XRD)and thermogravimetric analysis (TGA)were used to examine the crystalline nature and thermal stability of the synthesized NiO NPs and Gr/NiO NCs, respectively. Scanning electron microscopy (SEM)and transmission electron microscopy (TEM)were utilized to observe the morphology of NiO NPs and Gr/NiO NCs and estimate their size range. TEM suggested that the NiO NPs were speared onto the surface of Gr nanosheet. The efficiency of NiO NPs and Gr/NiO NCs against extended spectrum ?-lacamase (ESBL)producing bacteria, which was confirmed by specific HEXA disc Hexa G-minus 24 (HX-096)and MIC strip methods (CLSI); namely Escherichia coli (E. coli)and Pseudomonas aeruginosa (P. aeruginosa)was investigated using the minimal inhibitory concentration (MIC)and minimal bactericidal concentration (MBC)methods. MIC results suggested that the NiO NPs and Gr/NiO NCs possess maximum growth inhibition of 86%, 82% and 94%, 92% at 50 and 30 ?g/mL concentrations, respectively. Similarly, both nanomaterials were found to inhibit the ?-lacamase enzyme at concentrations of 60 ?g/mL and 40 ?g/mL, respectively. The cytotoxicity of NiO NPs and Gr/NiO NCs was quantified against A549 human lung cancer cells. Cell death percentage values of 52% at 50 ?g/mL against NiO NPs and 54% at 20 ?g/mL against Gr/NiO NCs were obtained, respectively. The NCs were found to reduce cell viability, increase the level of reactive oxygen species (ROS)and modify both the mitochondrial membrane permeability and cell cycle arrest.