Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Exploring the photothermal hot spots of graphene in first and second biological window to inactivate cancer cells and pathogens

Madhulika Sinha[a†], Ganesh Gollavelli[a†] and Yong-Chien Ling[a,b*]

[a]Department of Chemistry, National Tsing Hua University, Hsinchu 30013, Taiwan.

[b]Institute of NanoEngineering and MicroSystems, National Tsing Hua University, Hsinchu 30013, Taiwan

[†]These authors contributed equally to this work.

Email: ycling@mx.nthu.edu.tw

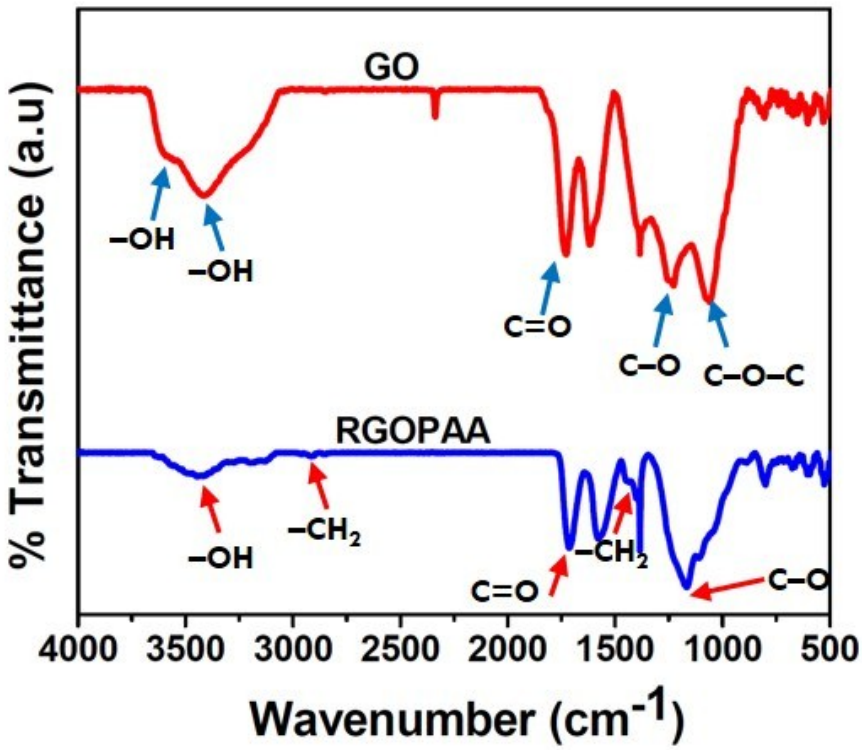

Figure S1. FT-IR spectra of GO and RGOPAA

Comparing the GO and RGOPAA spectra, the intensities of –OH decrease and of $–CH_2$ increase as expected from the reduction of GO and the addition of PAA into GO.

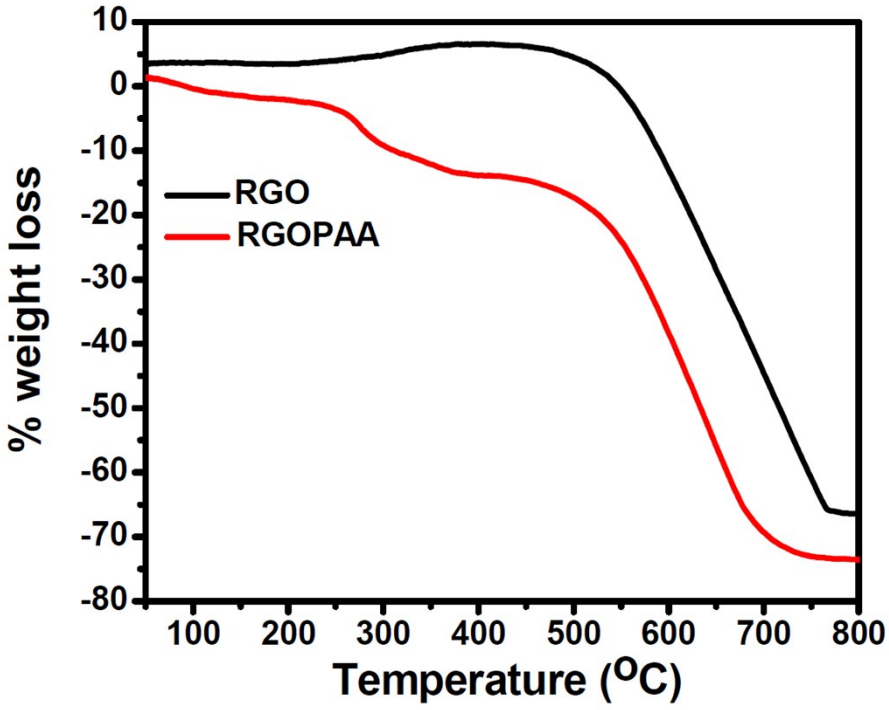

Figure S2. Thermogravimetric profiles of RGO and RGOPAA

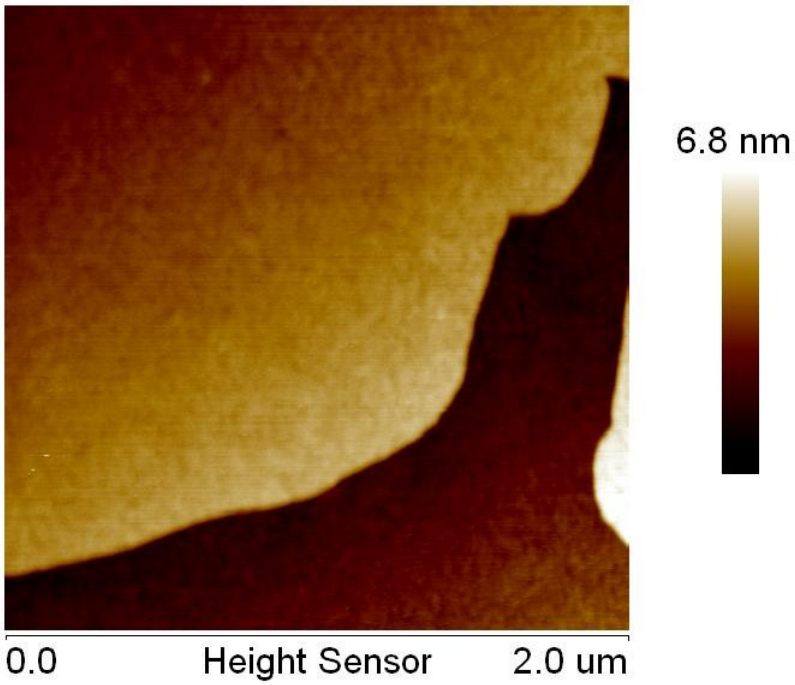

Figure S3. AFM image of RGOPAA

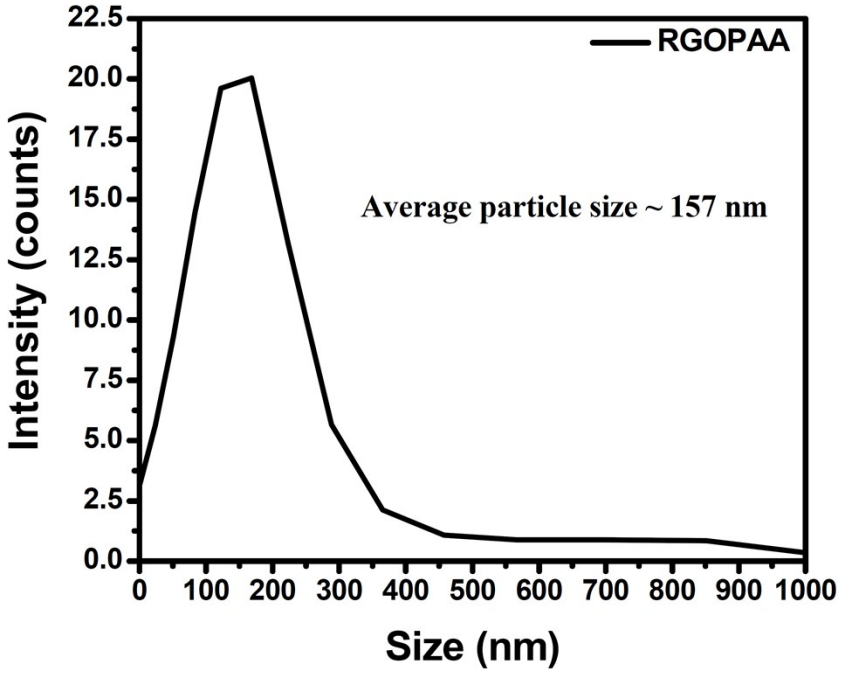

Figure S4. Dynamic light scattering (DLS) plot for RGOPAA.

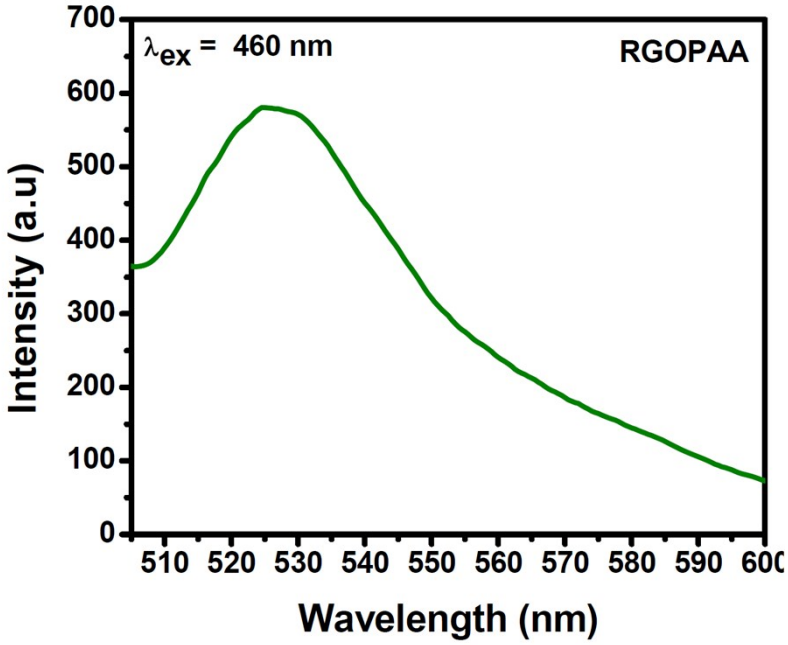

Figure S5. Photoluminescence spectrum of fluorescein o-methacrylate (FMA) functionalized RGOPAA. The excitation wavelength used is 460 nm.

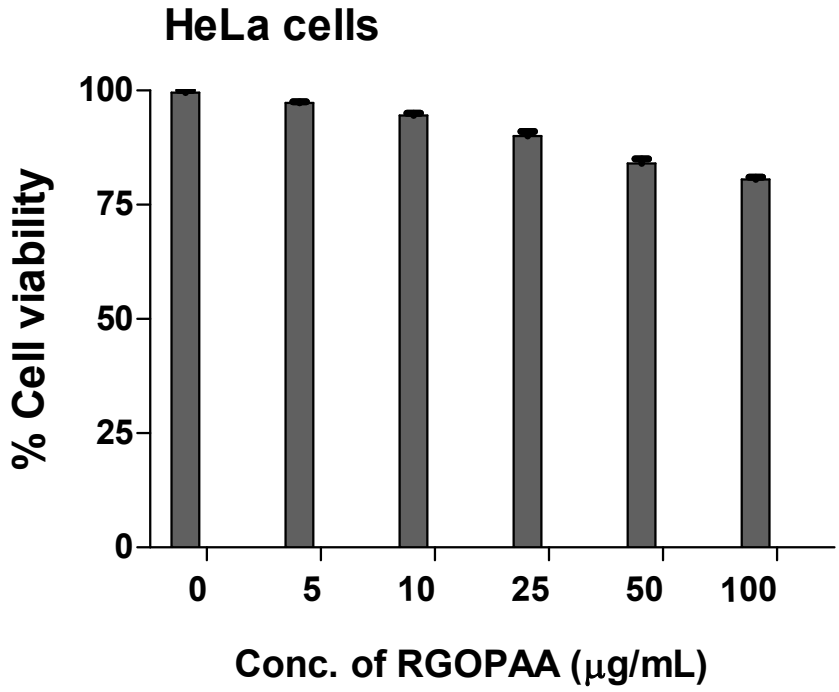

Figure S6. MTT assay for RGOPAA internalized HeLa cells under dark conditions for 24 h of incubation.

In the control experiments of RGOPAA without laser excitation, RGOPAA shows significantly lower killing of bacteria as well as cancer cells. Since the mechanism of killing in this study is heat generation, in the absence of laser irradiation, no heat generation is noted, therefore, making RGOPAA a biocompatible material. The focus of this work is selective ablation based on the heat generation capabilities of RGOPAA. The same can be proved by the heat shock protein experiments with and without laser excitation. It is a common fact that protein denaturation occurs under higher temperature (above 40 degrees). The photothermal heating curves showed that RGOPAA lead to a temperature rise of up to 53°C, which is enough to cause protein denaturation and further folding of proteins. In the experiments with HSP70, we see similar characteristic protein folding under laser excitation, while the same is significantly lower without laser excitation. For pathogenic bacterial experiments, laser irradiation caused heat generation which led to the bacterial cell death. But, without laser excitation, the bacterial survival rate was almost 95% at a concentration of 3 μg/mL and up to 85% at 15 μg/mL.

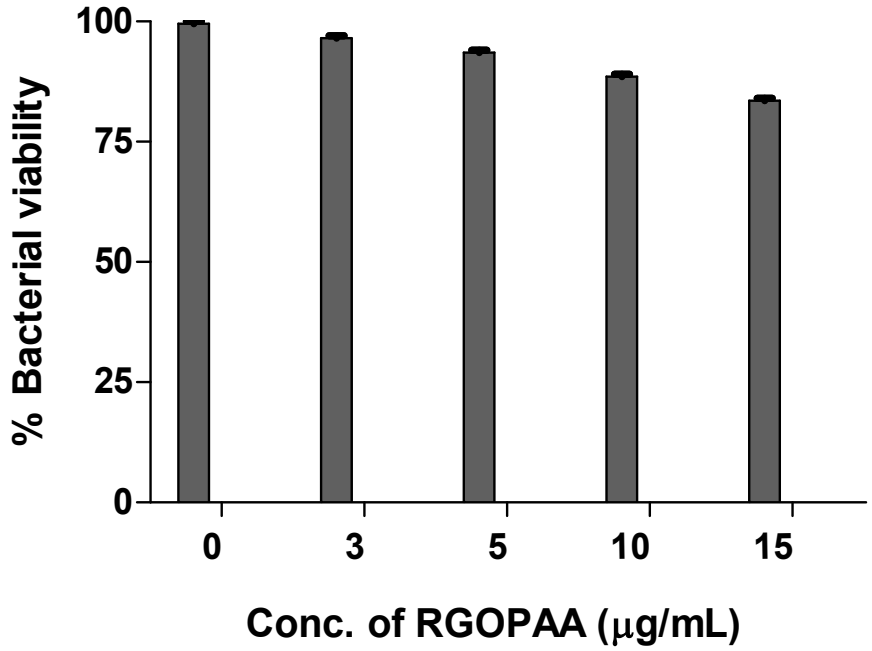

Figure S7. Percentage of viable bacterial cells for RGOPAA internalized *S.aureus* under dark conditions.