Supporting Information: Stimulating Antibacterial Activities of Graphitic Carbon Nitride Nanosheets with Plasma Treatment

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Optimal Conditions of Nitrogen Plasma Treatment

In order to study the effects of power output and illumination time of plasma on the antibacterial activity of g-C_3N_4, and search for the best treatment conditions simultaneously, an optimization experiment was performed. The antibacterial activity of N-g-C_3N_4 was enhanced with the increased power of nitrogen plasma as expected (Figure S1a). The antibacterial efficiency of g-C_3N_4 treated with 1000 W nitrogen plasma was more than 100 times that of g-C_3N_4 treated with 200 W nitrogen plasma. However, the g-C_3N_4 treated with 500, 750, and 1000 W nitrogen plasma had very similar antibacterial efficiency. The biggest difference was only 1.82 time between 1000 W and 500 W. Thus, 500 W was set as the optimal power of nitrogen plasma to save energy. With the treatment of 500 W nitrogen plasma for 1, 3, and 5min respectively, the antibacterial activities of N-g-C_3N_4 were shown as Figure S1b, Supporting Information. The influence of illumination time was much less than output power. Thence, 1 min was set as the optimal illumination time. All of the N-g-C_3N_4 samples used below were obtained by treating with nitrogen plasma at 500 W for 1min.

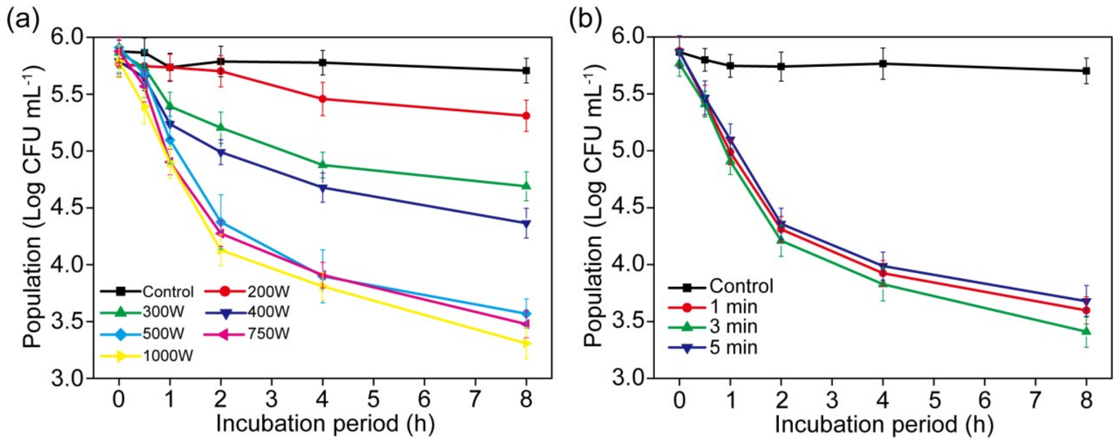

Figure S1. Optimization of plasma treatment conditions. a) Effects of different output powers of nitrogen plasma on antibacterial properties of N-g-C_3N_4; b) Effects of illumination time of 500W nitrogen plasma on antibacterial properties of N-g-C_3N_4.

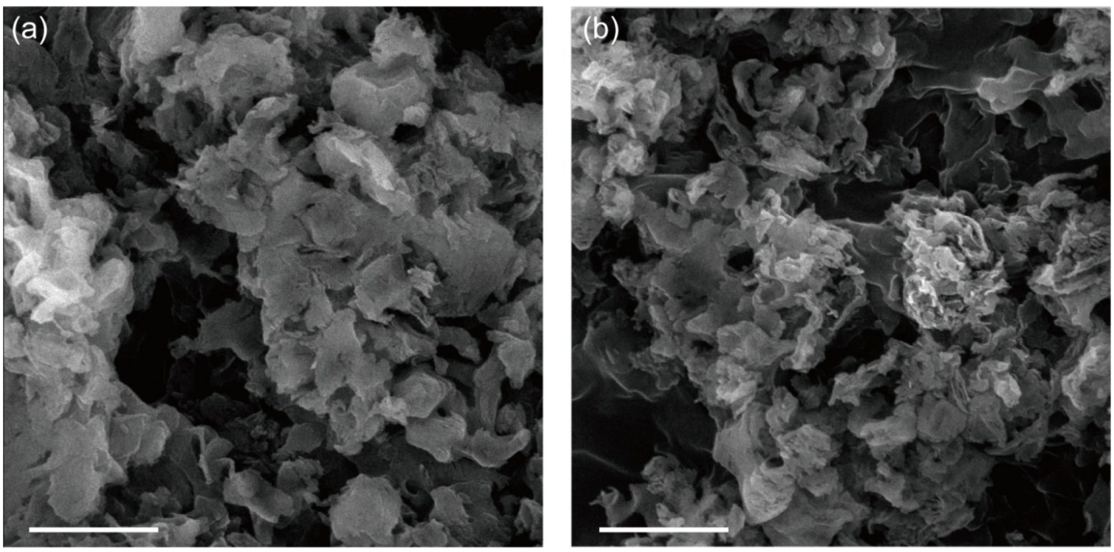

Figure S2. SEM image of the a) as prepared g-C_3N_4 and b) N-g-C_3N_4. Most of the particles showed flake-like morphology. The scale bar is 1μm.

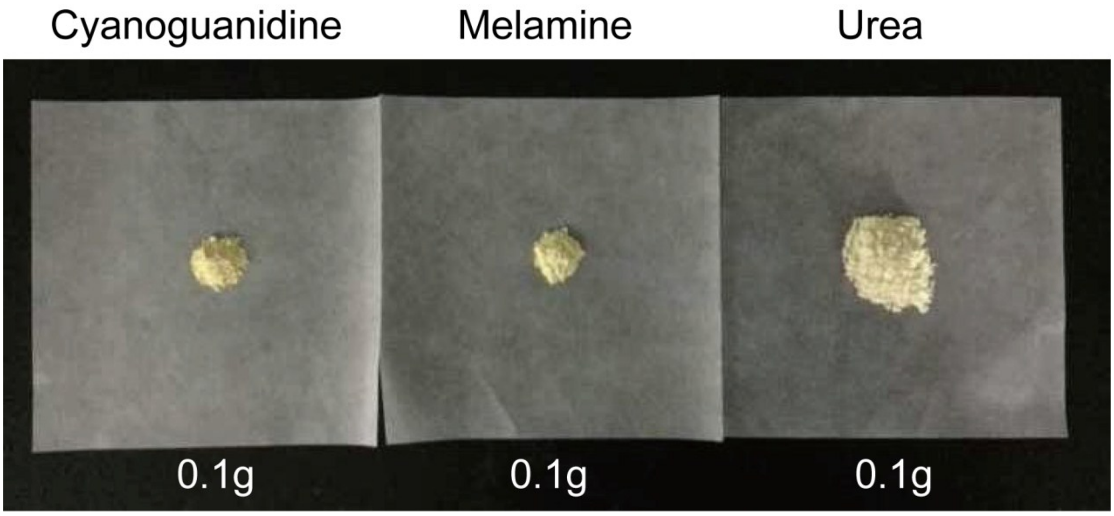

Figure S3. Influence of raw materials to apparent density of g-C_3N_4 powders

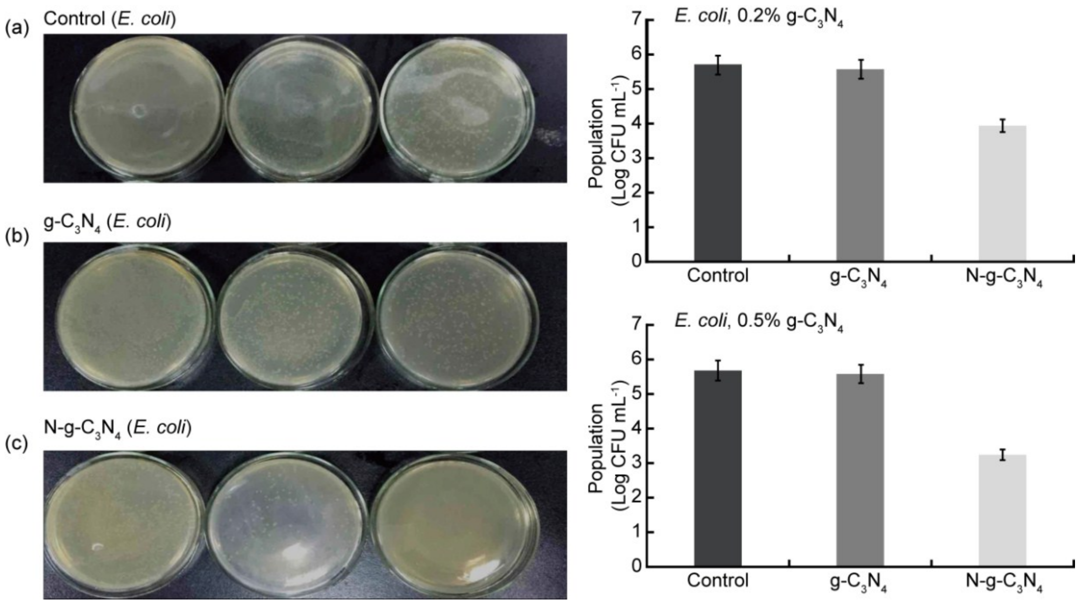

Figure S4. Left side: a-c) Influences of the bacterial concentrations to antibacterial efficiency for *E.coli*. Right side: influences of concentrations of g-C_3N_4 to the antibacterial efficiency for *E.coli*.

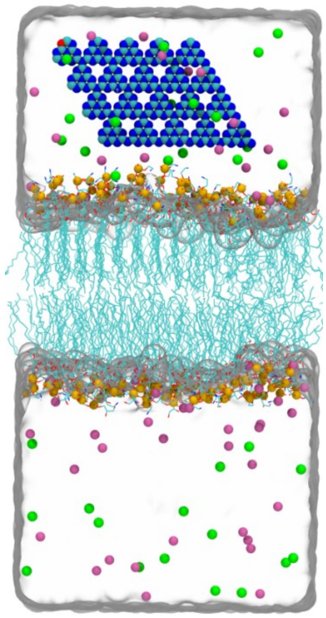

Figure S5. The simulation system of g-C_3N_4nanosheet interaction with bacterial membrane. The g-C_3N_4 nanosheet was shown with cyan (carbon) and blue (nitrogen) spheres. One fixed atom on g-C_3N_4 was displayed with red sphere. The phosphorus atoms of lipids were depicted by orange balls while other atoms of lipids were exhibited with lines. The Na^+ and Cl^- ions were shown with purples and lime balls. The boundaries of the simulated periodic cell were shown with silver surfaces.

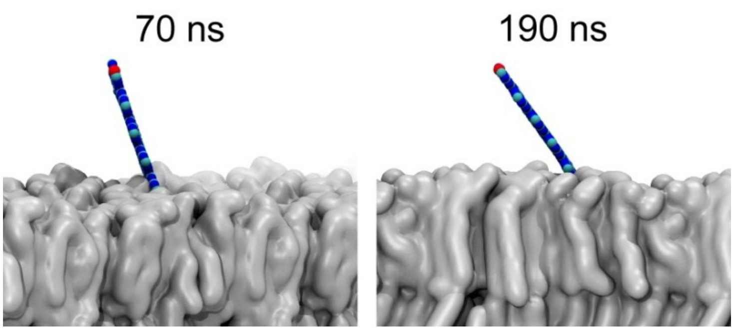

Figure S6. The g-C_3N_4 orientation change when binding to membrane. The g-C_3N_4 was shown with spheres while the lipids were displayed by gray surfaces.

Table S1. Influence of raw materials to apparent density of g-C_3N_4 powders

Raw materials	Apparent density of powders
Cyanoguanidine	0.404 g/cm^3
Melamine	0.359 g/cm^3
Urea	0.057 g/cm^3

Table S2. Lennard-Jones parameters of g-C_3N_4.

Element	nm	kJ/mol
Carbon	0.340	0.360
Nitrogen	0.325	0.711