Enhanced Antimicrobial Performance of Graphene Materials via Surface Modification

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Graphene has been one of the most important templates in materials science due to its unique structure and superior properties. Some studies have reported that graphene and its derivatives have an antimicrobial effect. The mechanism of the antimicrobial effect of graphene materials has not been fully clarified yet; however, it is speculated that the sharp edges of graphene physically damage phospholipids and intracellular structures of bacteria. Also, highly reactive functional groups in graphene materials cause oxidative stress in cells, resulting in chemically incorporated antimicrobial activities. In this study, we exploited graphene derivatives doped with various elements-oxygen, nitrogen, sulfur and chlorine-to determine the chemical antimicrobial effect by different reactive species. The chemical antimicrobial action of graphene materials was explored by analyzing the interaction with P. Aeruginosa. It is expected that this study enables us to develop a sustainable antimicrobial surface without the release of toxic substances. In addition, it will help to understand the mechanism of chemical antimicrobial characteristics of graphene materials.