Bio-functionalized few-layer graphene as a potential substrate for in situ growth of metal nanoparticles

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Recently, functionalized graphene has been used in a variety of biomedical applications such as drug delivery systems, nanocarriers, tissue scaffolds, biodetection, bioimaging, and biosensors. Most of the chemicals used to prepare functionalized graphene are generally costly and harmful, requiring the development of a one-step, eco-friendly production process that does not use toxic chemicals. In this study, a simple environmentally friendly gallnut extract-based exfoliation of graphite to functionalized few-layer graphene (FFG) has been demonstrated. Gallnut was screened from 21 plant materials based on FFG yield, high polyphenol content, radical scavenging activity, and tannin presence. The polyphenols and flavonoids present in gallnut extract are solely responsible for the exfoliation, stabilization, and functionalization of graphene. Raman and atomic force microscopy analysis showed that FFG is within the range of 1-7 layers. The highest yield of FFG from graphite was 15.3%, which was higher than those produced using tannic and gallic acid solutions (0-9.5%).