

# Photo-Fenton-inspired deoxygenation of tea polyphenol-graphene by household bleach

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## Abstract

A liquid-phase exfoliation of few-layer graphene in tea is considered as one of the alternative approaches for the preparation of environment-friendly graphene. However, the removal of chemically adsorbed tea-polyphenols from graphene is known to be difficult and the application of centrifugation or filtration alone for the purification of graphene against tea-polyphenols is regarded to be almost technically impossible. Notably, a strategy for facile deoxygenation of tea-graphene must be established for a green and economical production of graphene to be realized. In this work, a simple purification method of graphene through the application of merely a household bleach (Clorox®) after the pre-exfoliation in black tea has been proposed. It has been found that the carbon-oxygen (C/O) value for graphene increases from 2.7 to 8.1 while the values of C-OH, C-O-C and C=O region in the C1s spectrum of graphene decrease significantly after being purified in bleach for 5 h. The stretching and shift of C-OH, C=O and C-O-C at 3468 cm<sup>-1</sup>, 1637 cm<sup>-1</sup> and 1008 cm<sup>-1</sup> from IR spectrum of purified graphene seems to be in agreement with the produced data from the XPS and Raman spectroscopy. Despite the enhanced  $I_D/I_G$  of Raman from the hybridization of sp<sup>2</sup> by hydroxylation, the deoxygenation of tea-graphene does not negatively affect the electrical performance since the sheet resistance was impressively reduced to 193 Ω from 2.1 kΩ. It is believed that this photo-Fenton-inspired purification strategy would assist in the washing issue of polyphenol-stabilized graphene for various future electronic applications.

## Keywords

Bleach; Graphene; Liquid-phase exfoliation; Polyphenols; Purification