Delamination of graphite in methanol solution containing quercetin.

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Introduction

Graphene, one of the allotropic forms of carbon, is a bidimensional material that has exceptional properties. It was initially isolated by mechanical exfoliation of pyrolytic graphite, but this method is not suitable large-scale production[1]. Chemical vapor deposition (CVD), reduction of Graphene Oxide or solvent exfoliation are the main procedures described in the literature. Polyphenols, from green tea, have been used to reduce GO and stabilize the dispersion of reduced graphene oxide (rGO)[2]. In this work, we presented the results obtained from delamination of graphite in the presence of quercetin, a polyphenol with antioxidant properties. The goal of this study was verify if quercetin can stabilize graphene obtained by solvent delamination.

Results and Discussion

Initially, 1mg of graphite flakes (45µm) were added in two vials, one containing 10mL of methanol and other with 10mL of methanol solution containing 1.75mmol/L of quercetin. The mixtures were sonicated for 1h and maintained in a thermostatic bath at 80ºC for 8h. Afterwards, both suspensions were centrifuged for 15 min at 4000rpm. The electronic spectra of quercetin in methanol shows two bands at 371nm and 256nm referring to cinnamoyl (B ring) and benzoyl (ring A) systems, respectively (Figure 1a).

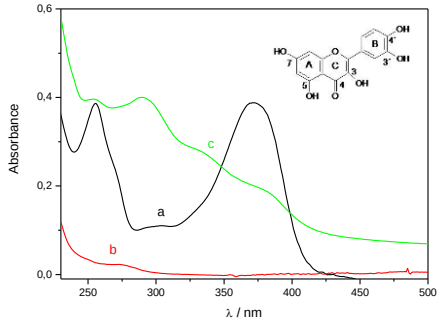

Figure 1. Electronic spectra of methanol solutions of quercetin (a), graphene in the ausence (b) and presence of quercetin(c).

In the ausence of quercetin, the electronic spectra of graphene (fig. 1b) presents a small band around 272nm. The graphene interacts with quercetin and change completely its electronic spectra (fig. 1c), suggesting that an oxidation of polyphenol occurred.
In order to confirm that graphene was obtained by delamination in the presence of quercetin, sample droplets were placed on a silicon substrate and Raman images, using 532nm laser lines, were performed on a Witec Alpha 300R confocal spectrometer. Figure 2a shows one of these images where lighter colors represents more intense G band signal. Figure 2(b) shows the spectrum taken on the larger yellow dot (right-up corner). From this spectrum no conclusion about the number of layers can be taken since the 2D/G Raman intensity ratio is below one[3]. On the other hand, figure 2(c) shows the spectrum taken on the small yellow dot (left-down corner). The 2D/G intensity signal is exactly one clearly indicating a bilayer graphene[3]

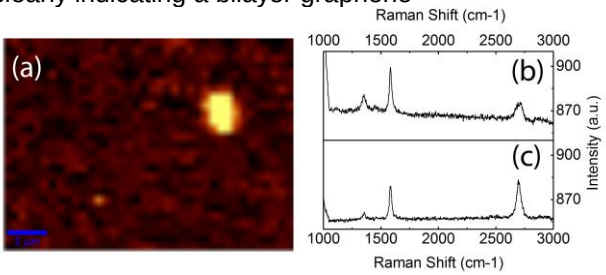

Figure 2. (a) G Band Raman image using 532nm laser line. (b) Spectra taken on the larger yellow dot. (c) Spectra taken on the smaller yellow dot indicating the presence of bi-layer graphene.

Conclusion

The results indicate that it is possible to obtain few-layer graphene using methanol solutions containing quercetin. In addition, the data suggest that oxidation of quercetin occurs in the presence of graphene.

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