Reducing Graphene Oxide cytotoxic effects via lipid coating

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Abstract

Toxicity evaluation is a crucial step for the proper use of applications that involve graphene oxide (GO) intravenous administration but the GO circulation time and blood interactions are largely unknown. It is thought that GO causes haemolysis when it interacts with red blood cells but very few studies have been performed to date. We have found that GO can interact with both neutral and negatively charged lipid vesicles. After this binding occurs, neutral membrane vesicles tend to break down and extend over the GO, while vesicles with negatively charges membranes are mainly bound to the GO without disruption. GO also disrupts different cell types when interacts with them, but it has been shown that coatings of chitosan or specific biopolymers can be useful to reduce the GO cytotoxicity [1]. In our study RBC haemolysis and CHO cell lysis have been decreased when GO is previously coated with lipid membranes, particularly with pure phosphatidylcholine vesicles [2].

References

[1] Liao, K. H.; Lin, Y. S.; Macosko, C. W.; Haynes, C. L., ACS Appl. Mater. Interfaces 2011, 3, 2607−2615.

[2] Monasterio, B.G.; Alonso, B.; Sot, J.; García-Arribas, A.B.; Gil-Cartón, D.; Valle, M.; Zurutuza, A., Goñi, F.M., Langmuir, 2017, 22;33(33), 8181-8191

Figures
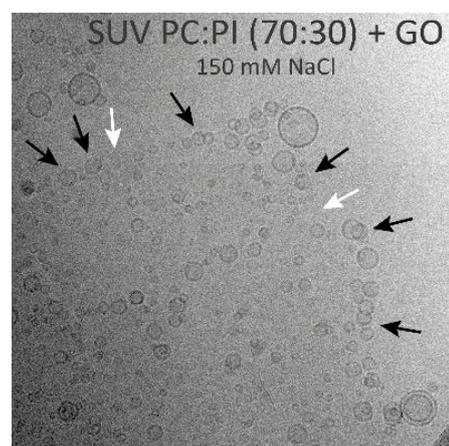
Figure 1: Cryo-TEM imaging of GO and SUV. GO-PC:PI SUV mixture in 150 mM NaCl. GO sheet edges are marked with white arrows; interactions between SUV and planar GO surfaces are labelled with black arrows.
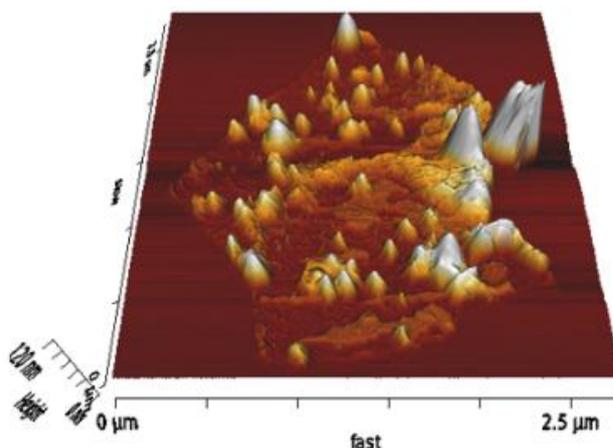
Figure 2: AFM image. 3D reconstruction of the PC:PI (70:30) LUV-GO mixture where extended and semiextended vesicles are seen