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Synthesis, characterization and cytotoxicity of graphene oxide

Graphene oxide (GO) is a derivate of graphene whose structure have a high oxygen content. This structure confers many important properties to be used in improved packaging materials[1]. But before the application of this material, it is required to know its potential toxic effects.
Graphene oxide was synthetized from graphite by using the Modified Hummers Method[2]. The product obtained was characterized by Fourier-Transform Infrared Spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS), Zeta Potential (ζ potential), X-ray diffraction (XRD), scanning electron microscopy (SEM), and transmission electron microscopy (TEM).
FTIR was used to confirm the introduction of the oxygen-containing functional groups onto the surface of graphite. The elemental composition of GO, investigated by XPS, revealed carbon content (66.3 At%), oxygen content (33.2 At%) and traces of nitrogen (0.6 At%). The C/O atomic ratio was 1.99. The ζ potential in cell culture medium was -10.9 ± 0.3 and -30.3 ± 0.6 in Milli-Q water. GO showed two diffraction peaks at 2Θ = 12.6 and 2Θ = 42.5. SEM micrographs showed that large number of layers have been stacked to each other and formed into thick and bulk sheet clusters which are opaque in nature.
The toxicological effects were evaluated on a human colorectal adenocarcinoma cell line (CaCo-2) by the MTS reduction assay and protein content assay. Caco-2 cells showed no significant changes in the endpoints considered after 24 and 48h of exposure at any concentration assayed (0-250 µg/mL). Further toxicological tests are required before the potential application of GO as food contact material.
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