Synthesis of a biocompatible nanoporous carbon and its conjugation with florescent dye for cellular imaging and targeted drug delivery to cancer cells

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ABSTRACT

A nanoporous carbon (NPC) was synthesized from Oil palm leaves (OPL) by pyrolysis at 600 °C in a N_2 atmosphere, oxidized by a mixture of sulfuric and nitric acids (3:1 vol/vol) and conjugated with coumarin-6 as a fluorescence dye for cellular imaging and drug delivery to cancer cells. The structure, morphology and dispersion stability of NPC in aqueous media before and after the conjugation were investigated by XRD, FT-IR, Raman spectroscopy, SEM, TEM and zeta potential measurement. Cell uptake for the conjugated NPC was investigated by fluorescence microscopy. Results indicate that the cellulose, hemicelluloses and lignin in OPL convert to a graphitic structure by pyrolysis. NPC consists of spherical nanoparticles with diameters of 30–50 nm and has a high graphitic content with an I_D/I_G ratio of 0.7. The coumarin-6 is successfully conjugated to NPC by forming a complex. Both NPC and the conjugated NPC have a high dispersion stability in aqueous media. NPC is biocompatible with a negligible cytotoxicity. The conjugated NPC exhibits a high cell uptake, is highly biocompatible for normal cells and toxic for tested human cancer cells. NPC is a good candidate for cellular imaging and targeted drug delivery.

KEYWORDS:

Nanoporous carbons; Coumarin-6; Cellular imaging; Targeted drug delivery