Nanographene Oxide mediated cell hyperthermia

M.Vila[a*] , M.C.Matesanz[b], G.Gonçalves[a], M.J.Feito[b], J.Linares[b], P.A.A.P. Marques[a] M.T.Portolés[b], M.Vallet-Regi[c,d]

[a]TEMA-NRD, Mechanical Engineering Department and Aveiro Institute of Nanotechnology (AIN), University of Aveiro, 3810-193 Aveiro, Portugal
[b]Department of Biochemistry and Molecular Biology I, Faculty of Chemistry, Universidad Complutense, 28040-Madrid, Spain
[c]Department of Inorganic and Bioinorganic Chemistry, Faculty of Pharmacy, Universidad Complutense, 28040-Madrid, Spain.
[d]Networking Research Center on Bioengineering, Biomaterials and Nanomedicine, CIBER-BBN, Spain

mvila@ua.pt

Abstract

Graphene and more specifically, pegylated graphene oxide (GO) has been proposed as a highly efficient in vivo photothermal therapy agent due to its strong Near-Infrared (NIR 700-1100 nm range) optical absorption ability. Its small two dimensional size could be unique performing when compared to any other nanoparticle, therefore, light should be given to the hyperthermia route and the kind of GO-cell interactions induced in the process. The type of cell damage and toxicity produced by Near-infrared (NIR) laser irradiation has been evaluated as a function of exposure time and laser power in order to control the temperature rise and consequent damage in the GOs containing tumoral cell culture medium. The results showed that cell culture temperature (after irradiating cells with internalized GO) increases preferentially with laser power rather than with exposure time. Moreover, when laser power is increased, necrosis is the preferential cell death leading to an increase of cytokine release to the medium. The results suggested that tailoring cell death, the threshold for producing thermal ablation with soft or harmful damage could be specifically controlled and so, the immune response.