Nanomedicines-based phototherapy with bioengineered hydrogels for skin cancer treatment

Inês Pedro[1,2,3], MSc, ipedro@i3s.up.pt, *arturp@fe.up.pt

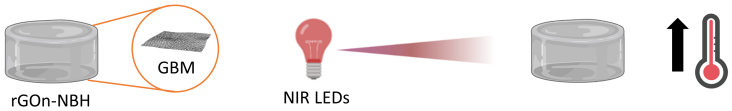
Filipa Silva[1,2,3,4], Bruno Freitas[1,2,3,4], José Ramiro Fernandes[5,6], Fernão D. Magalhães[1,2], Rúben Pereira[3,4], Artur M. Pinto[1,2,3,4,*]

[1]LEPABE - Laboratory for Process Engineering, Environment, Biotechnology and Energy, Faculdade de Engenharia, Universidade do Porto, Portugal; [2]ALiCE - Associate Laboratory in Chemical Engineering, Faculdade de Engenharia, Universidade do Porto, Portugal; [3]i3S - Instituto de Investigação e Inovação em Saúde, Universidade do Porto, Portugal; [4]INEB - Instituto de Engenharia Biomédica, Universidade do Porto, Portugal; [5]CQVR – Centro de Química Vila Real, Universidade de Trás-os-Montes e Alto Douro, Portugal; [6]Physical Department, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal

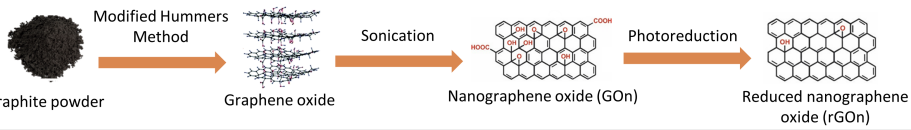
Nanotechnologies

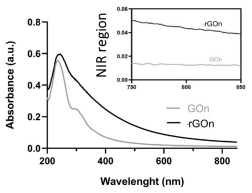
BACKGROUND

- Non-melanoma skin cancer (NMSC) has been reported as the most common cancer type worldwide, resulting in about 3 million new cases each year [1]. The main available treatments are of surgical nature, radiation therapy, and topical chemotherapy. These treatments have several poor side effects.
- Graphene-based materials (GBM) have remarkable thermal and electrical conductivity, high surface area, small particle size [2], and high absorption in the near-infrared (NIR) region, being therefore, ideal agents for photothermal therapy (PTT) of skin cancer.
- Hydrogels of natural polymeric origin are very promising for tissue regeneration (TR) since they share resemblances to extracellular matrix (ECM) components, presenting very good biocompatibility [3].
- For these reasons, we propose a combination of natural polymer-based hydrogels (NBH) with reduced nanographene oxide (rGOn) as fillers, for PTT, as a new treatment for skin cancer, which simultaneously promotes TR.

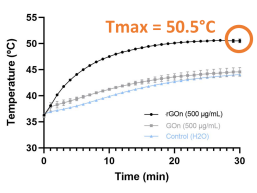


GBM PRODUCTION & CHARACTERIZATION



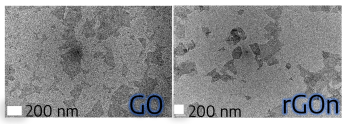


UV/Visible Spectra



NIR Irradiation Heating

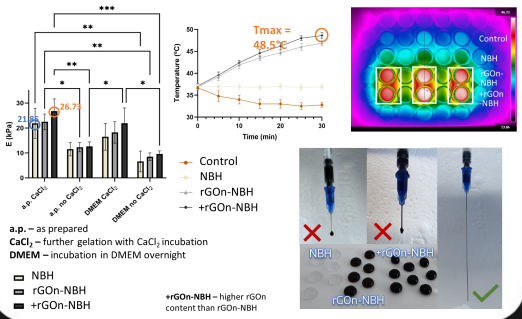
Transmission Electron Microscopy



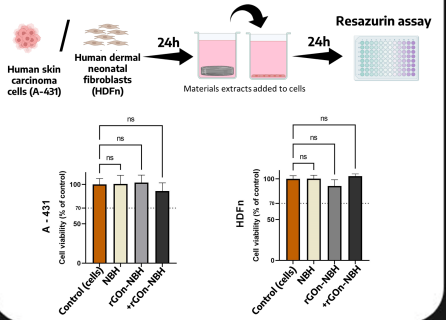
Zetasizer

Sample	Size (nm)	Surface charge (mV)
GOn	206.0 ± 5.0	−31.9 ± 0.8
rGOn	247.0 ± 8.0	−42.1 ± 0.9

HYDROGEL CHARACTERIZATION



BIOLOGICAL ASSAYS



CONCLUSIONS

- rGOn-NBH have tunable viscoelastic and mechanical properties, are bioprintable, and can reach temperatures in the mild hyperthermia range (42-52 °C), having high potential for skin cancer PTT and TR.
- All hydrogel extracts were non-toxic (ISO 10993-5:2009(E)) for both A-431 and HDFn cells.

REFERENCES

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[3] Catoira, MC *et al.*, 2019, Journal of Materials Science: Materials in Medicine 30, 10

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