UV-C driven reduction of nanographene oxide opens path for new applications in phototherapy

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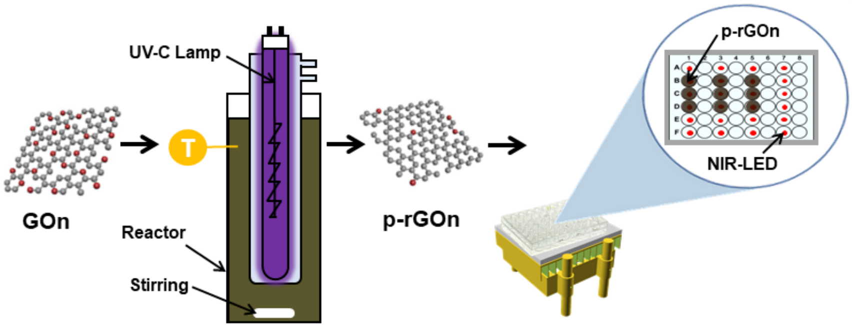

- **New nanosized, water stable and biocompatible PTT agent**
- **New NIR-LED system to evaluate PTT agents efficacy *in vitro***

The main challenges associated to the application of graphene-based materials (GBM) in phototherapy are obtaining particles with lateral nanoscale dimensions and water stability that present high near-infrared (NIR) absorption. Nanosized graphene oxide (GOn) is stable in aqueous dispersion, due to the oxygen functionalities on its surface, but possesses low photothermal efficiency in NIR region. GOn total reduction originates reduced nanographene oxide (rGOn) that presents high NIR absorption, but poor water stability. [1] In this work, partially reduced nanographene oxide (p-rGOn) has been produced by GOn UV-C photoreduction. Different irradiation times (2–12 h) were tested to determine the optimal point for obtaining a partially reduced material that is still water-stable, but displays the ability to convert NIR light into heat. 8 h of UV-C irradiation was identified as the optimal value, yielding a p-rGOn that remains well dispersed in water for at least 6 months and possesses strong photothermal efficiency. After 30 min of NIR irradiation, an aqueous p-rGOn 8 h dispersion (250 µg mL^{-1}) attains 57.2 °C, corresponding to a temperature increase of 26.4 °C. Its mean lateral nanoparticle size was 188 ± 99 nm, measured by TEM. Finally, after 24h incubation with p-rGOn 8 h (150–250 µg mL^{-1}) no significant effects have been observed in human skin fibroblasts (HFF-1) cell viability, demonstrating its high potential for use in the biomedical field, namely in photothermal therapy. Furthermore, an innovative custom-built NIR LED-system has been successfully developed for *in vitro* tests.

References

[1] Artur M. Pinto, Andreia M. Pereira, Inês C. Gonçalves (2020). Carbon Biomaterials. In Wagner WR, Sakiyama-Elbert SE, Zhang G, Yaszemski MJ (Ed.), Biomaterials Science. An Introduction to Materials in Medicine, 4th ed. San Diego, California: Elsevier. ISBN: 9780128161371.