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IR780 loaded and Sulfobetaine methacrylate-albumin-coated Graphene Oxide for improved breast cancer photothermal therapy

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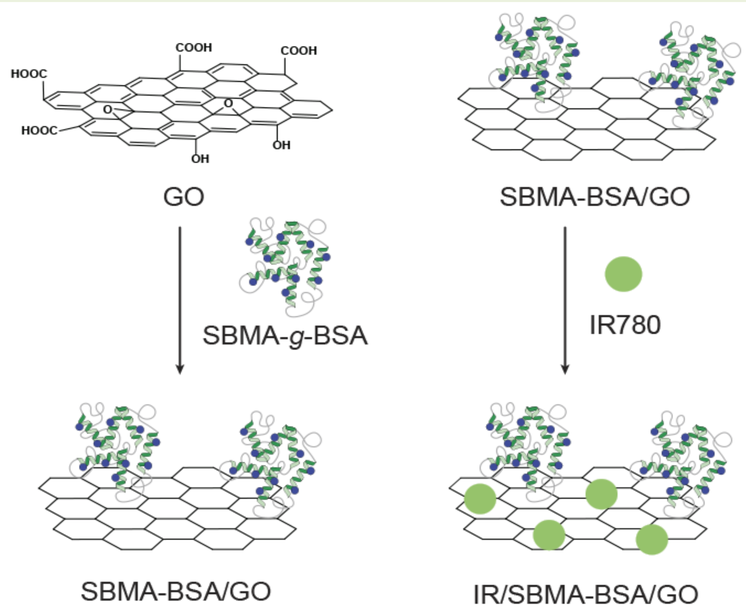
Introduction

- Graphene oxide (GO) nanomaterials can produce a temperature increase upon interaction with near infrared (NIR) light. However, the poor colloidal stability and modest photothermal capacity of this nanomaterial limit its application in cancer photothermal therapy [1,2].
- In this work, GO was functionalized with an albumin-based coating containing sulfobetaine methacrylate brushes (SBMA-*g*-BSA) and it was loaded with a prototypic heptamethine cyanine (IR780), in order to improve its colloidal stability and photothermal capacity, respectively [3].

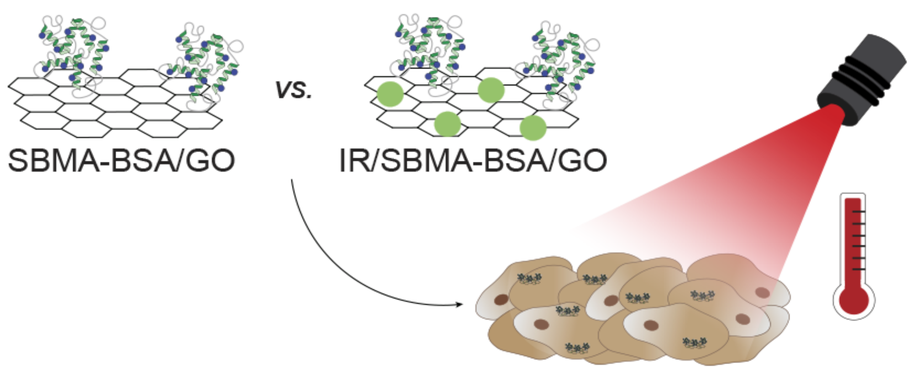
Materials and Methods



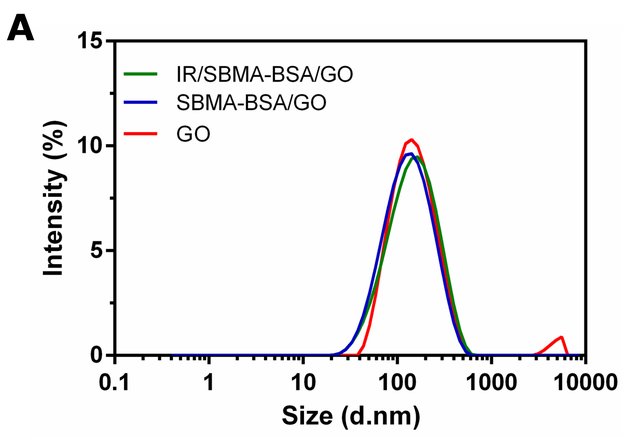
Physicochemical and Biological characterization

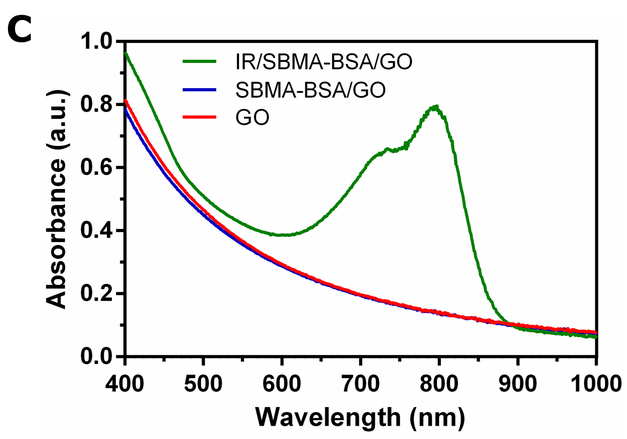
Size distribution
Stabillity
Vis-NIR absorption
Photothermal capacity
Cytocompatibility
Photothermal therapy

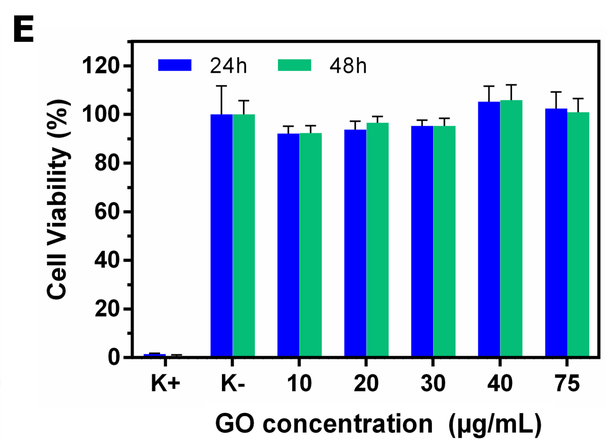
Cancer Photothermal Therapy

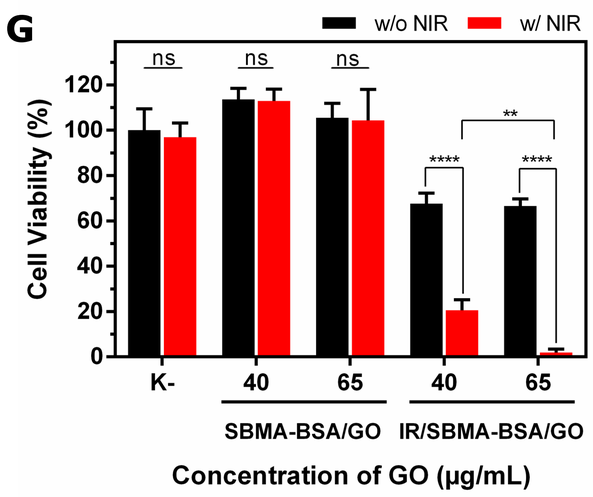


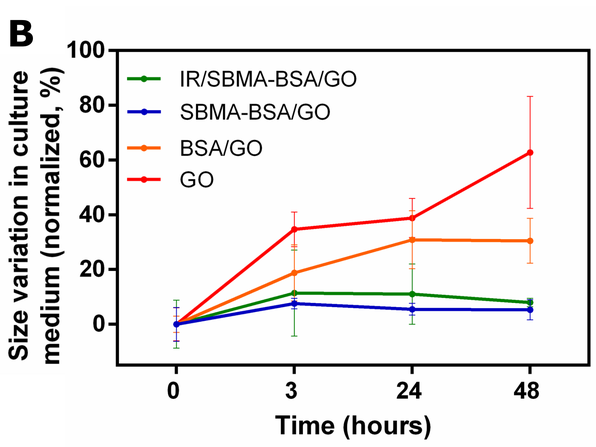
Results

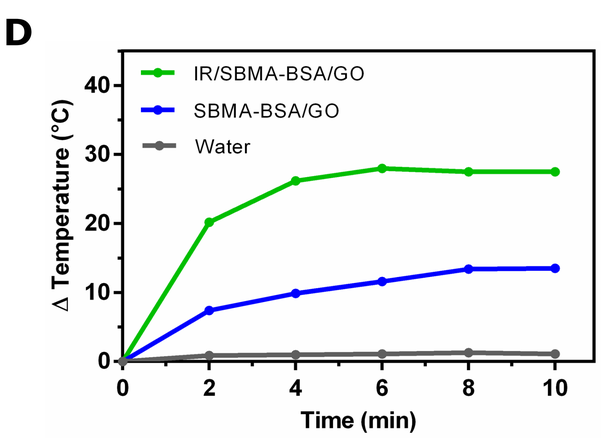












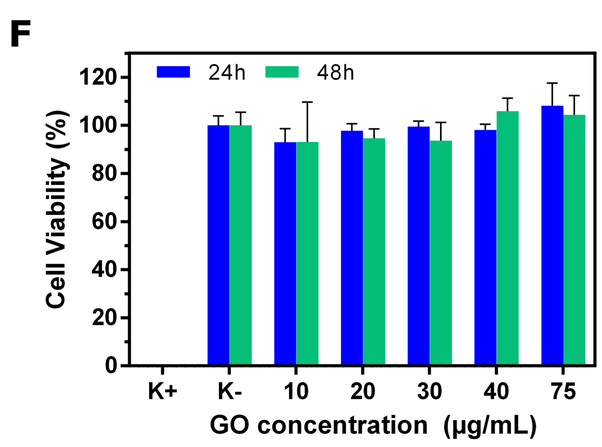


Figure caption:

A) Dynamic Light Scattering (DLS) analysis of IR/SBMA-BSA/GO, SBMA-BSA/GO and GO.

B) Size variation of IR/SBMA-BSA/GO, SBMA-BSA/GO, BSA/GO, and GO when dispersed in culture medium (DMEM-F12 supplemented with 10 % of FBS (v/v)).

C) Visible-NIR absorption spectra of IR/SBMA-BSA/GO, SBMA-BSA/GO and GO.

D) Temperature variation curves of SBMA-BSA/GO and IR/SBMA-BSA/GO during 10 min of NIR laser irradiation (808 nm, 1.7 W/cm^2).

E and **F)** Cytocompatibility of SBMA-BSA/GO towards NHDF (E) and MCF-7 cells (F) after 24 and 48 h of incubation

G) Therapeutic effect mediated by SBMA-BSA/GO and IR/SBMA-BSA/GO against MCF-7 cells without (w/o NIR) and with NIR (w/ NIR) laser irradiation (808 nm, 1.7 W/cm^2, 10 min).

Conclusion

- IR780/SBMA-BSA/GO is a promising agent for application in breast cancer photothermal therapy due to its improved colloidal stability and photothermal capacity.

References

[1] de Melo-Diogo, *et al.*, (2018), Functionalization of graphene family nanomaterials for application in cancer therapy, Colloids Surf., B., 171, 260-275.
[2] de Melo-Diogo, *et al.*, (2019), Graphene family nanomaterials for application in cancer combination photothermal therapy, Biomater. Sci, 7(9), 3534-3551.
[3] Melo, *et al.*, (2021), Sulfobetaine methacrylate-albumin-coated graphene oxide incorporating IR780 for enhanced breast cancer phototherapy, Nanomedicine, 16(6), 453-464.

Acknowledgments

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