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IR780 loaded Sulfobetaine Methacrylate-Albumin Nanoparticles for Breast Cancer Photothermal Therapy

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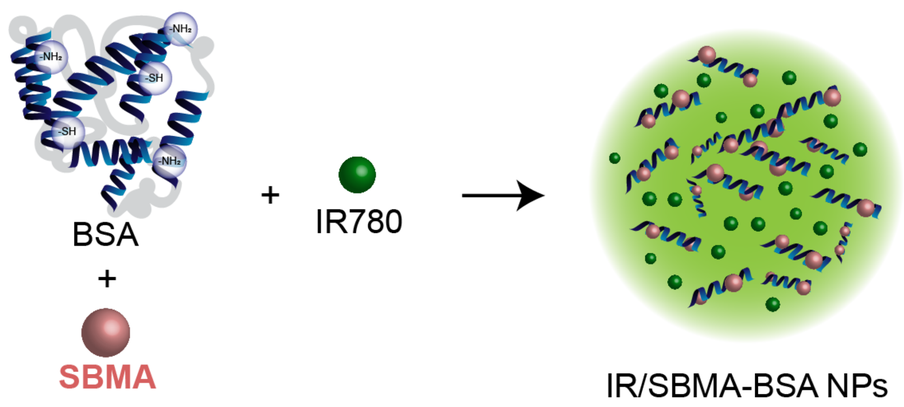
Introduction

- Nanomaterials with a long blood circulation time can become accumulated in the tumor zone by taking advantage from the enhanced permeability and retention effect as well as the dynamic vents occurring in the tumor's vasculature [1]. To enhance the nanomaterials' stability in blood circulation, these have been functionalized with poly(ethylene glycol). However, poly(ethylene glycol)-coated nanomaterials were recently found to be immunogenic [2];
- In this work, sulfobetaine methacrylate (SBMA) brushes were grafted on bovine serum albumin (BSA) nanocarriers to investigate the capacity of this modification to improve the nanoparticles' colloidal stability. Then, IR780 was loaded into these nanoparticles (IR/SBMA-BSA NPs) for enabling their application in breast cancer phototherapy.

Materials and Methods



Characterization:

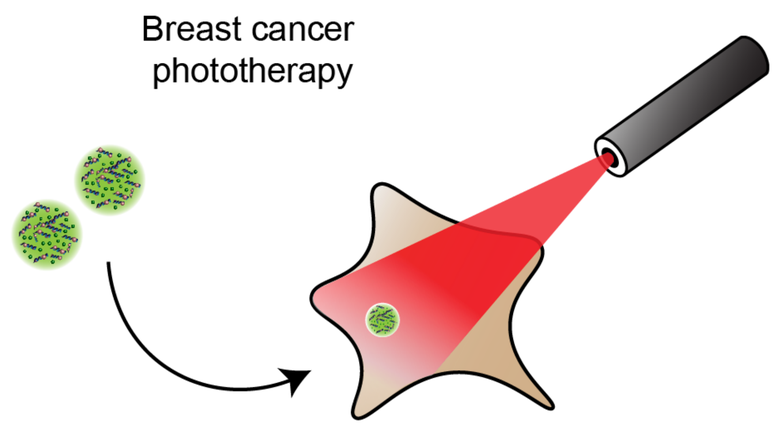
Size distribution

Colloidal stability

Optical properties

Cellular uptake

Photothermal therapy



Results and Discussion

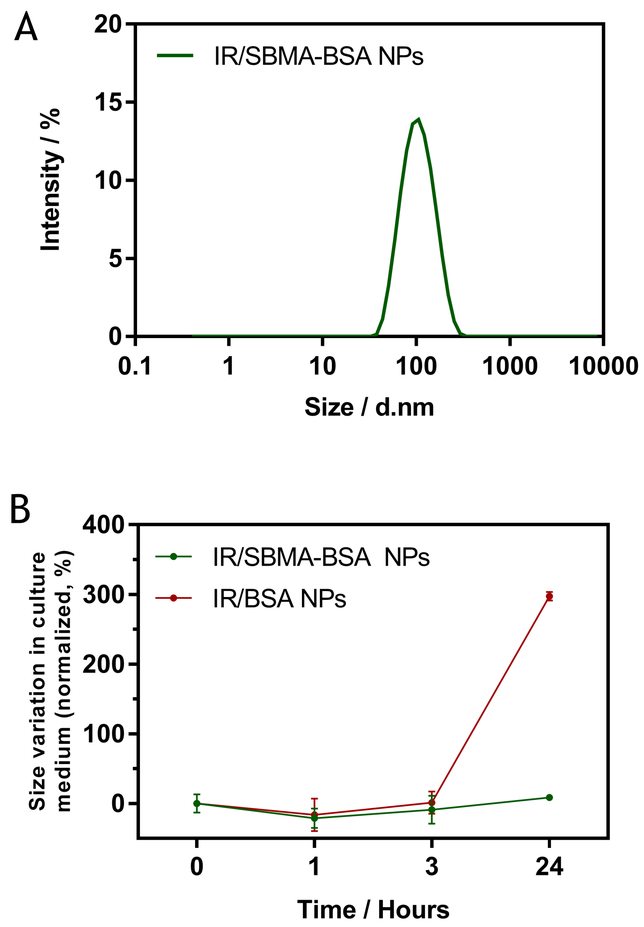


Fig. 1: DLS size distribution of IR/SBMA-BSA NPs (A) and size variation of IR/SBMA-BSA NPs and IR/BSA NPs in DMEM-F12 with 10% of FBS (B).

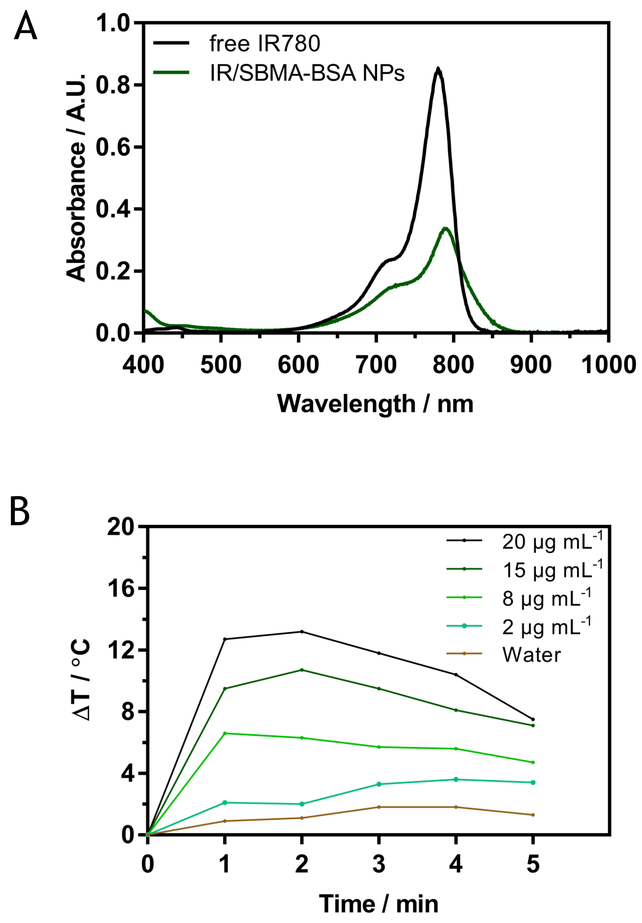


Fig. 2: Absorption spectra of free IR780 and of IR/SBMA-BSA NPs (A) and photothermal capacity of IR/SBMA-BSA NPs (808 nm, 1.7 W cm^{-2}) .

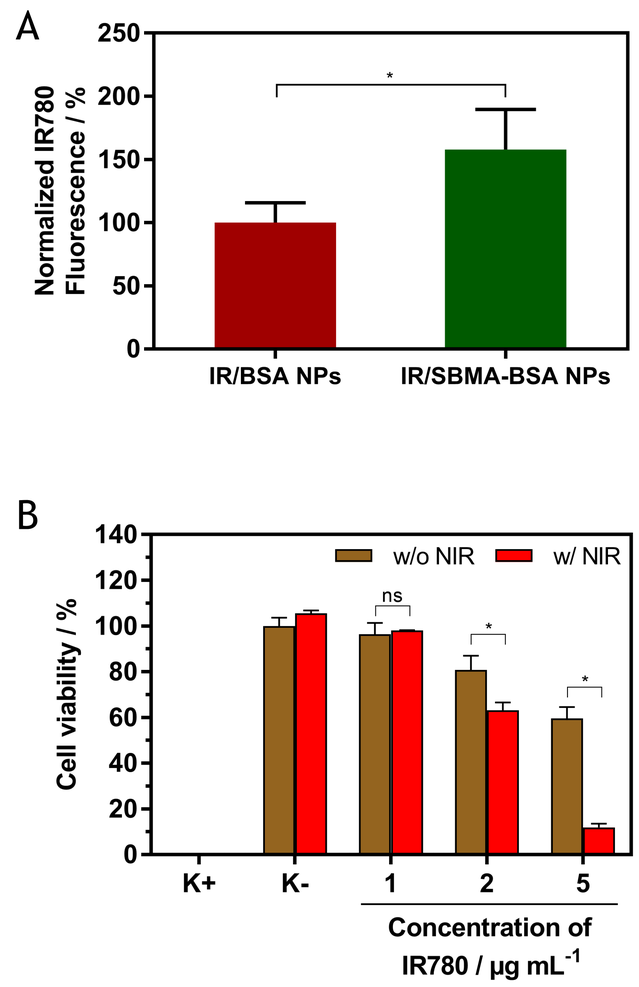


Fig. 3: Uptake of IR/BSA NPs and IR/SBMA-BSA NPs by MCF-7 cells (A) and therapeutic effect by IR/SBMA-BSA NPs towards MCF-7 cells w/o NIR and w/NIR laser irradiation (808 nm, 1.7 W cm^{-2}, 5 min).

Conclusion

IR/SBMA-BSA NPs revealed promising physico-chemical, optical and biological properties for application in breast cancer phototherapy.

References

[1] C.G. Alves, D. de Melo-Diogo, R. Lima-Sousa, I.J. Correia, *International Journal of Pharmaceutics*, 2020, 582, 119346.

[2] A. S. Abu Lila, H. Kiwada and T. Ishida, *Journal of Controlled Release*, 2013, 172, 38-47.

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