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BIOCOMPATIBLE ALBUMIN NANOCAGES AS J-AGGREGATES CARRIERS FOR ENHANCED PHOTOTHERMAL THERAPY

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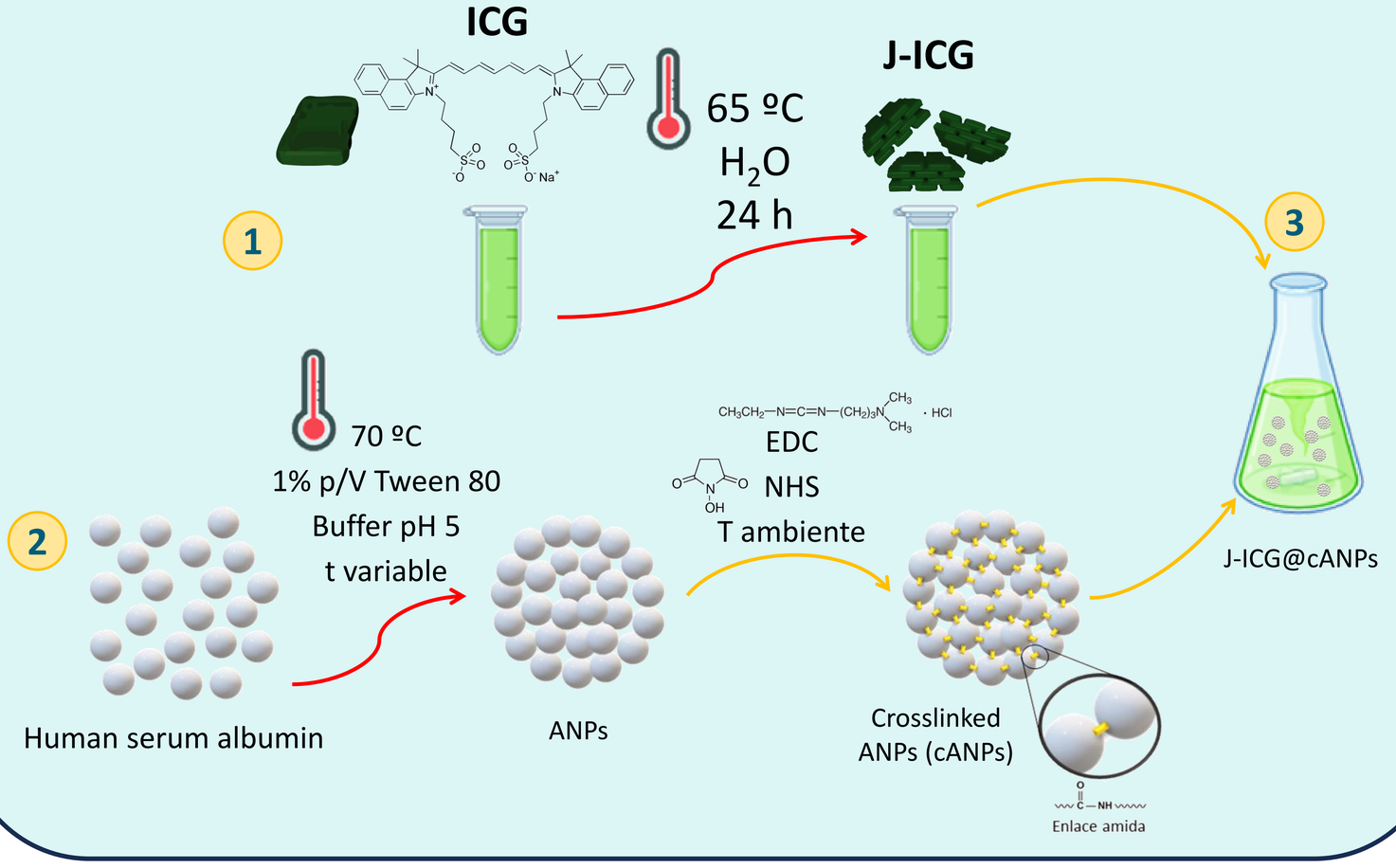
Introduction

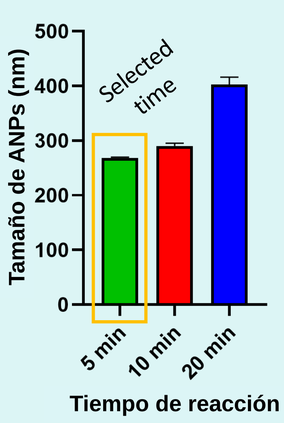
The emergence of oncolytic nanoreactors has increased interest in photothermal therapy as one of the most efficient treatments for tumor cells. These nanoreactors enable the formation of drugs directly at the site of application. In this context, indocyanine green (ICG), an FDA-approved photothermal agent, exhibits the ability to form aggregates that act as nanoreactors [1], known as J-aggregates. These aggregates shift the light absorption of ICG towards the near-infrared (NIR) region, providing enhanced stability, higher sensitivity, and facilitating irradiation. However, incorporating these nanoreactors into nanoparticles is advantageous to achieve higher accumulation in tumor cells through the enhanced permeability and retention (EPR) effect, while also improving distribution and pharmacokinetics. Albumin nanoparticles (ANPs) are promising platforms in nanomedicine as nanocarriers due to their non-toxic and non-antigenic nature. They can be prepared under mild reaction conditions and allow the incorporation of significant amounts of drugs, thereby improving distribution and pharmacokinetics [2,3]. In this work, we aimed to incorporate ICG J-aggregates (J-ICG) into ANPs prepared through a simple method to be applied as photothermal therapeutic agents.

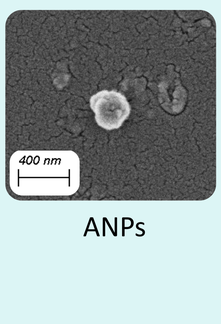
Methology

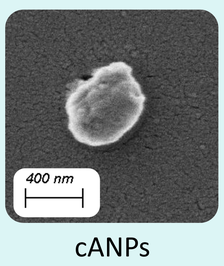


Results

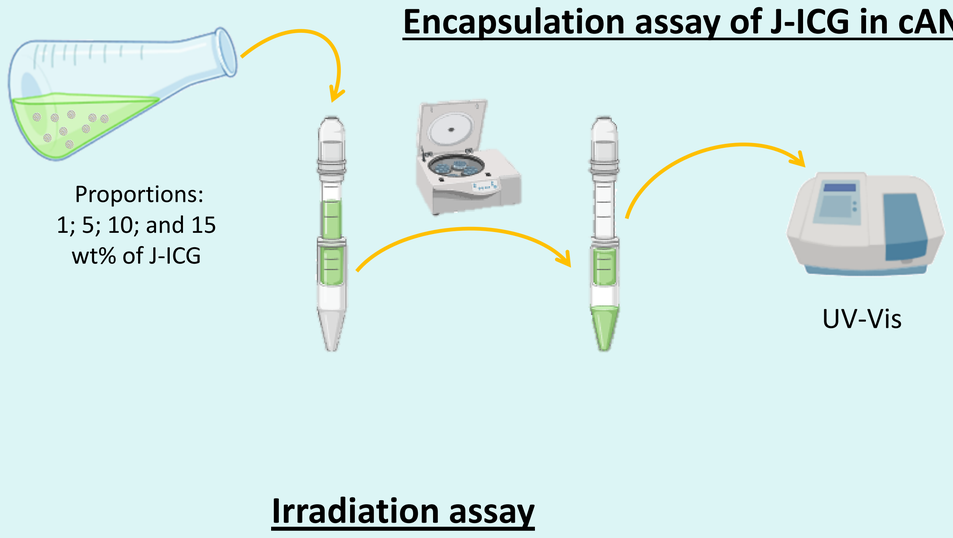
Characterization of nanocages

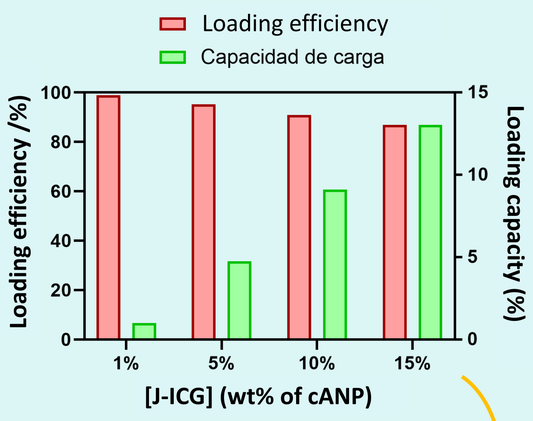




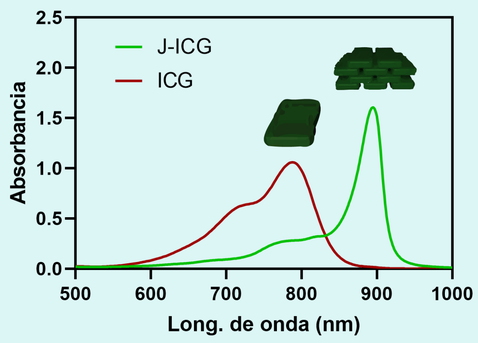


Encapsulation assay of J-ICG in cANPs

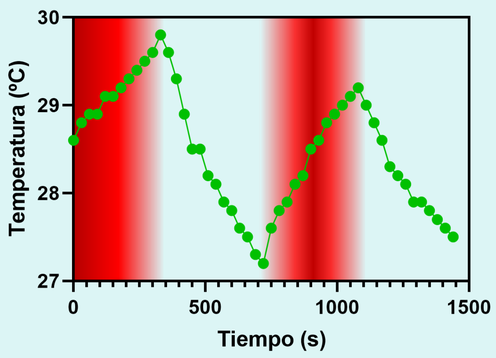




Spectroscopic characterization of ICG and J-ICG



Irradiation assay



Fluency = 0,125 W/cm^2
λ = 890 nm
[J-ICG] = 5 µg/mL

After encapsulation and irradiation, the aggregates maintain their spectroscopic properties

Conclusions

ANPs were synthesized and characterized by DLS and SEM, achieving precise size control. Subsequently, they were crosslinked without affecting their size. Simultaneously, J-aggregates were formed and incorporated into the cANPs with high encapsulation efficiency and significant loading capacity. Notably, the J-aggregates retained their spectroscopic properties after incorporation. A controlled temperature increase was also observed upon irradiating the aggregates with an NIR laser under mild conditions. These results support the feasibility and potential of combining ANPs and J-aggregates for application in photothermal therapy. Future studies will evaluate the stability of the nanoformulations under physiological conditions as well as their therapeutic capabilities.

Acknowledgements

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