



Zinc phthalocyanine tetrasulfonate-loaded polyelectrolytic PLGA nanoparticles for photodynamic therapy applications

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ABSTRACT

Background: Photodynamic Therapy (PDT) is a modality for the treatment of neoplastic tissues, which is based on the administration of a phototherapeutic agent and light irradiation at an appropriate wavelength, aiming to locate and destroy the target cell with the formation of reactive oxygen species. Nanoencapsulation technology presents itself as a tool for incorporation of bioactive substances aiming to improve their solubility in physiological environment, obtain a longer circulation time in the organism, administration of lower dosages and the minimization of side effects. The present work aimed at the development of poly (lactic acid-glycolic acid) (PLGA) nanoparticles coated with polyelectrolyte film layers for encapsulating zinc phthalocyanine tetrasulfonated (ZnPcSO₄) as a bioactive substance model.

Methods: PLGA nanoparticles were produced by the double emulsion/solvent evaporation technique and polyelectrolytic coating was performed using polyalkylamine hydrochloride (PAH) as a weak polycation and poly (4-styrene sulfonate) (PSS) as a strong polyanion by layer-by-layer self-assembly technique (known as layer-by-layer-LbL). The nanoparticulate system was studied by scanning electron microscopy, steady-state, and their biological activity was evaluated using *in vitro* cancer cell lines by classical MTT assay.

Results: The polyelectrolytic PLGA nanoparticles had an average diameter of 384.7 ± 138.6 nm, restricted distribution size with a polydispersity index. The obvious change in zeta potential indicates successful alternation in polycation (PAH) and polyanion (PSS) deposition directly in PLGA nanoparticles. Scanning electron microscopy (SEM) analysis showed that the formed system had morphology spherical, typical of these release systems. The loading efficiency was $82.1 \% \pm 1.2 \%$. The polyelectrolytic nanoparticles loaded with phthalocyanine maintained their photophysical behavior after encapsulation. Cell viability was determined, obtaining 90 % cell death.

Conclusions: Therefore, the presented work depicts ZnPcSO₄-loaded polyelectrolytic PLGA nanoparticles as a promise drug delivery system for phototherapeutic agent, which are thus expected to have superior therapeutic efficiency than free drug.

1. Introduction

PDT is a medical treatment based on a photoprocess that consists of the combination of three principal elements: a photosensitizer (PS), a light source to activate the PS and molecular oxygen (³O₂) to generate highly cytotoxic singlet oxygen (¹O₂) species [1–3]. This therapeutic

technique can ablate tumors and potentially reduce side effects, compared to conventional radiotherapy, chemotherapy, and surgery modalities [4–6].

Most photosensitizers which are used clinically or in preclinical development have a significant hydrophobic character and strongly aggregate in aqueous media, including phthalocyanines [7].

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