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Evaluation of photohaemolysis caused by O-InTBPPc-loaded PLGA-PEG nanoparticles

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Introduction

Photodynamic therapy (PDT) is a therapeutic modality that involves a systemic or topic administration of a photosensitizer, a light source and oxygen molecules[1]. Phthalocyanines (Pc) are a class of photosensitizers with a large potential for use in PDT because of their photochemistry properties[2]. However, Pc have a limited solubility in certain solvents, hampering their administration, and consequently, application in the phototherapy[2]. For solve this problem, 1,4-(tetrakis[4-(benzyloxy) phenoxy]phthalocyaninato) indium (III) (O-InTBPPc) was encapsulated into nanoparticles of PEGylated poly(lactide-co-glycolide) (PLGA-PEG). Results have reported that nanocarriers improve the photodynamic efficacy of photosensitizer[3], but few works have discussed about the efficiency of encapsulation to reduce the photosensitivity in healthy cells. Therefore, this work evaluated the difference between the free and encapsulated O-InTBPPc in the photohaemolysis process.

Results and discussion

Erythrocytes solution (0.5% v:v) was incubated for 0-3h with the free and encapsulated O-InTBPPc (8 µmol/L) in phosphate buffer saline (PBS, pH 7.4) containing 0.01 mmol/L of Tween® 20. Dimethylformamide was used (0.03% v:v) for the photosensitizer solubilization in the experiments performed with the free O-InTBPPc. The irradiation was performed using a laser diode 665 nm with a light dose of 7.5-15 J/cm^2 and a power of 104 mW. The oxyhemoglobin (OxHem) deliveried for haemolysed cells was monitored at 540 nm imediately or after 24h of irradiation. Results shown that the free and encapsulated O-InTBPPc were not cytotoxic (without light) or photocytotoxic (with light) when the OxHem was quantified imediately after irradiation período (not shown). However, the photohaemolysis was observed after 24h of irradiation for the free and encapsulated photosensitizer. The average values of haemolysis increased from (6 ± 2)% to (53 ± 7)% when the red blood cells were irradiated in the presence of the free O-InTBPPc, and from (7 ± 1)% to (72 ± 6)% for the encapsulated photosensitizer, considering all incubation times (Figure 1). Interesting, the photohaemolysis was also observed in the incubation time of 0h for the free and encapsulated photosensitizer (O-InTBPPC was added into the red blood cells suspension, and after homogeneization the cells was irradiated). After 0-1h of incubation, the haemolyis increased from (66 ± 7)% to (77 ± 3)% for experiments perfomed with the encapsulated O-InTBPPc, and from (43 ± 9)% to (56 ± 9)% using the free O-InTBPPc. Probably the photohaemolysis observed for the encapsulated O-InTBPPc was caused for molecules adsorbed on the nanoparticle surface or localized into the polymeric matrix but near the particle surface since the free crystals of O-InTBPPc were not observed in the nanoparticulate formulation by scanning electron microscopy, and the laser was also not photocytotoxic. Results suggest that the O-InTBPPc-loaded nanoparticles were (39 ± 11)% more photocytotoxic for erythrocytes than it was the free O-InTBPPc.

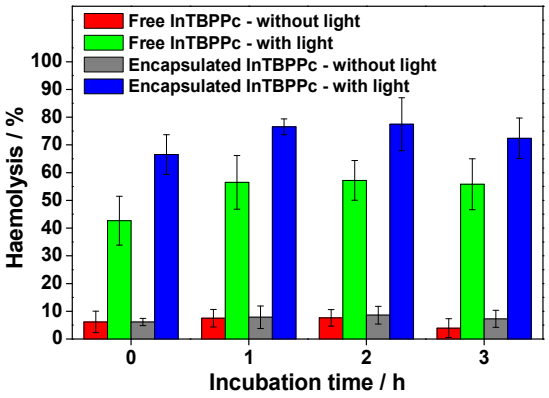

Figure 1. Photohaemolysis caused by O-InTBPPc.

Conclusion

The photohaemolysis caused by encapsulated O-InTPPc was more severe compared to the free photosensitizer. Therefore, the encapsulation did not reduce the photocitotoxic effect on the healthy cells caused by free O-InTBPPc.

Acknowledgments

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