Radioiodine encapsulation in alginate microparticles for precise dosage in thyroid disorders

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Alginate is a natural polysaccharide extracted from brown seaweed, which wide application in the biomedical and pharmaceutical fields [1,2]. Due to its biocompatibility, biodegradability, low toxicity, low cost, and gelling capacity, alginate has been widely used to encapsulate different substances for controlled drug delivery systems [1,2]. Alginate can produce polymeric microparticles through interaction with ionic reticulation agents, as divalent cations, resulting in cross-linked structures [1,2]. During this process called ionotropic gelation, different substances can be loaded on the polymeric matrix. The diffusion process allows the encapsulated drug release from the polymeric microparticles. pH, temperature or solvent changes can accelerate the drug release [1,2].

Improvements in radiopharmaceuticals administration procedures is a permanent demand [3]. For example, the radioiodine dose administration for the treatment and diagnosis of thyroid disorders presents problems such as the lack of precision in the dose, the possibility of patients and professionals' contamination, and the unnecessary exposure of the patient salivary glands to the ionizing radiation [4]. This project aims to circumvent these administration limitations by encapsulating radioiodine in alginate microparticles. In this new form of presentation, the risk of contamination is reduced, and a more precise dose of radioiodine is metabolized. In this way, controlled drug delivery can turn radioiodine administration into a more effective and safer procedure. More specifically, the goal of this work is to prepare microcapsules loaded with iodine. The alginate microparticles were prepared by the ionotropic gelation method. Previously, 300 mg of sodium iodide was dissolved in 20 mL of deionized water. Then, 400 mg of sodium alginate was dissolved in that solution. After, the solubilization occurred using ultrasonic and magnetic stirring. Separately, 40 mL of calcium chloride 1 % (w/v) were prepared in deionized water. Using a Pasteur's pipet, the alginate solution was gently dropped in the calcium chloride solution. The obtained microparticles were filtered in a sieve and washed in 20 mL of deionized water. Exudation was performed by visual inspection and comparing particles stored in olive oil and no media weekly for two weeks. Iodide quantification in the supernatant was performed through ultraviolet spectrophotometry to estimate the encapsulation efficiency. In this work, calcium chloride was used to cross-link with the alginate to result in the microparticles (18.64 g) displayed in Figure 1.

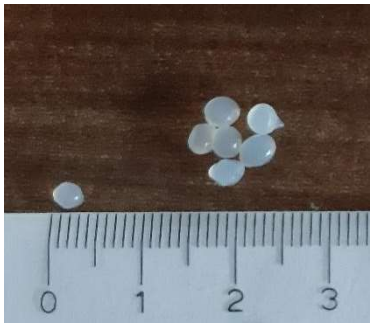

Figure 1. Alginate microparticles loaded with iodide

As observed in Figure 1, the iodinated microparticles are pretty spherical. Their average diameter equals approximately 3 mm. Encapsulation efficiency was about 0.65 mg of iodide per 177 mg of a microparticle. Moreover, oily media storage exudated much less liquid from the microparticles than the others naturally stored. The next step includes microparticles stability study to be verified in neutral, basic and acid pH ranges.

References

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