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PVA/chitosan hydrogels loaded with octenidine and 2-phenoxyethanol for wound dressings

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ABSTRACT

Introduction: Polyvinylacohol (PVA)/chitosan hydrogels are ideal candidates for the production of wound dressings as their combination can provide good mechanical and antibacterial properties, alongside the ability to be loaded and release drugs [1,2]. The main goal of this work is to evaluate the possibility of using PVA/chitosan hydrogels as platforms for the release of octenidine dihydrochlorate and 2-phenoxyethanol, a drug combination that has antiseptic, antibacterial and antimycotic properties.

Materials and methods: PVA aqueous solutions were prepared by dissolution at 90 °C and chitosan was added to get different mass ratios (3:1, 1:1) and a final polymer concentration of 5% w/w. The mixtures were poured in petri dishes and submitted to five cycles of freeze-thawing (18 h at −20 °C, 6 h at 23 °C in each cycle) to trigger polymerisation. After a washing step, they were lyophilised. Before testing, the samples were hydrated for 72 h. Swelling ratio, water content and degradation experiments in simulated exudate containing lysozyme were performed to assess the stability of the hydrogels. Contact angle was measured using captive bubble method and hydrogels structure was assessed using SEM. Drug loading was carried out by soaking the samples in Octiset® solution at room temperature. Drug release experiments were performed in simulated exudate using Franz cells.

Results: The hydrogels showed swelling ratios between ≈1300 and 2100% and high water contents of 93–95%. Degradation in the first 2 days in the presence of the protein was less than 37%. The hydrogels showed high hydrophilicity and porosity. Drug loading and release experiments (Figure 1) proved that the hydrogels are able to release both drugs in a controlled way during the first day.

Discussion and conclusions: The obtained results suggest that the proposed formulations possess drug retention abilities compatible with their use. They shall be suitable for the production of wound dressings with therapeutic properties. Further research should provide insight into the mechanical properties of the hydrogels, their antibacterial behaviour and the choice of a sterilisation method.

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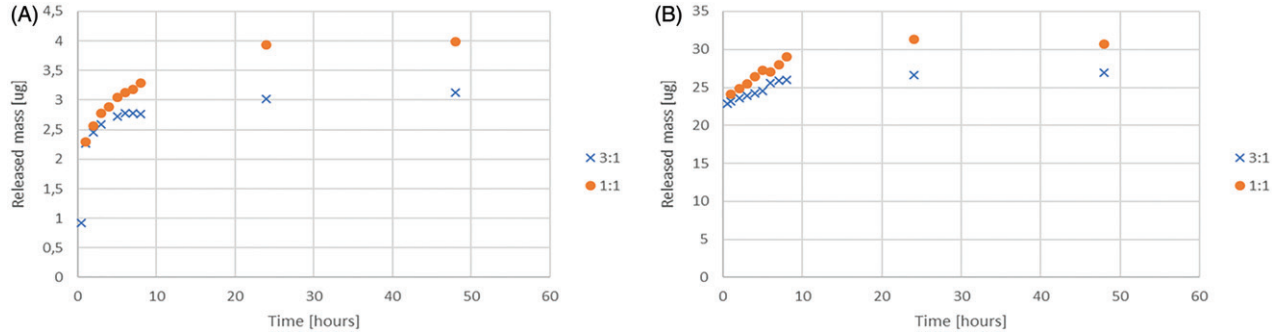

Figure 1. Cumulative drug release curves of octenidine dihydrochlorate (A) and 2-phenoxyethanol (B).

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Direct esterification of sucrose: novel lead-compounds against cancer

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ABSTRACT

Introduction: Phenylpropanoic sugar esters are a class of naturally occurring active substances, mainly found in ancient oriental medicinal plants (Figure 1), with a scope of activity ranging from antioxidant, antibacterial as well as anti-tumoral [1]. Though relatively simple in structure – owing to their resemblance to natural carbohydrates - few have been the successful attempts to obtain them in the laboratory, hampered mainly by the fact that the high similarity between functional groups in sugars restrains the feasibility of current methods and their reproducibility in industrial scales [2]. Our study aims for the development of reliable and effective methods for the synthesis of a library of phenylpropanoic esters derived from sucrose.

Materials and methods: The lead-compounds are obtained by treating sucrose with a vigorous basic medium. The preferential esterification in the sugar hydroxyls is catalysed by a metal halide salt. The different compounds obtained are meant to be tested and screened for their biological applications, with particular emphasis on their action against cancer cells.

Results: Our most appealing discovery is the possibility of directly enhancing the regioselectivity of the 2, 3′, 6 and 6′-hydroxyl positions in the sugar moiety induced by transition-metal salts as catalysts [3] (Scheme 1). Different metal salts induce the different hydroxyls mentioned for a direct esterification with the acylating agent, which reflects the specificity and versatility of this novel class of reactions.

Discussion and conclusions: We can conclude, so far, that cobalt and copper chloride salts give the best results in terms of yield (more than 30% conversion) and decreased reaction time (less than one hour). To further extend our knowledge about the metal-chelate directed acylation method, we are also experimenting with other halide salts, namely zinc, calcium, nickel and iron, as well as with derivatized molecules of sucrose. Thus, our work can certainly lead the development of novel drugs and resourceful cancer therapies.

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