

PRODUCTION OF POLYCAPROLACTONE/CURCUMIN MEMBRANES AND ITS EFFECTIVENESS IN CELLS GROWTH, pH SENSITIVITY AND RELEASE OF CURCUMIN

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Introduction and objective: The development of advanced wound dressings (AWD) has been increasingly widespread in recent years. PCL is a biodegradable polymer widely used to produce biomaterials for drug delivery. Extracted from *Curcuma longa* rhizomes, curcumin (CC) is a polyphenol with antimicrobial, anti-inflammatory and pH indicator properties. The present study discusses the production of polycaprolactone (PCL) mats incorporated with CC by Solution Blow Spinning (SBS), a technique that allows the production of ultrafine fibers. The fibers were analyzed by scanning electron microscopy (SEM) and the membranes were characterized regarding their *in vitro* cytotoxicity, sensitivity to pH, solubility and CC release in water. [1,2].

Methodology: An 18 wt% PCL solution in chloroform/acetone (3:1) was prepared under stirring for 2h at 60°C. PCL/CC solutions were prepared by adding 3 wt% of CC (in relation to polymer mass) to PCL solution. A glass syringe was used to spin 25 cm away from the collector using 25 psi of pressure at 30 mL/h. L929 cells were used to evaluate the membranes cytotoxicity, Fourier-transform infrared spectroscopy (FT-IR) was used to evaluate the interactions of their components while the diameter and morphology of fibers were characterized by SEM. CC release, pH sensitivity and solubility tests were also performed.

Results and discussion: The PCL mats presented a white color while the PCL/CC mats resulted in a bright yellow color that turns orange and reddish with the increase in the pH value of tested solutions. Although some color changes were observed with pH increase, in the pH range observed in wounds (between 4.0 and 9.0) was not evident the color changes, not allowing the direct visual observation of pH changes in wounds, since the more perceivable color changes are observed above pH 9.0. The ultrafine fibers of the mats were characterized by SEM, allowing the observation of their morphology and the interactions observed between curcumin and PCL were elucidated by FT-IR. The water solubility value observed after 72h was 11.66 ug/mL for PCL/CC membranes and PCL membrane did not solubilize. Despite the hydrophobic nature of curcumin, this bioactive compound was released in water, what indicates the ability of the PCL/CC membranes to deliver this potential antimicrobial molecule. The cytotoxicity test, performed with mouse fibroblast cells resulted in 92.3±7.4% and 116.3±11.1% of viable cells for PCL and PCL/CC membranes, respectively. Since AWD are directly involved in fibroblast cells growth during wound repair, this result indicates both mats as promising candidates to produce AWD.

Conclusions: Here, the effectiveness of PCL/CC membranes releasing curcumin was confirmed. In addition to the release of CC even in water, it was observed that cells growth was greater in PCL/CC membranes than in PCL membranes. Changing color according to pH sensitivity did not prove to be advantageous, since there is no perceptible change in the targeted pH ranges. The morphology of the ultrafine fibers and interactions of the polymer with the CC were adequate for the purpose of the dressing.

References

1. Akrami-Hasan-Kohal M. et al., New J. Chem. 44, 10343–10351, 2020.
2. Merrell J.G. et al., Clin Exp Pharmacol Physiol. 36(12), 1149–1156, 2009.

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