DIFFUSION OF DIFFERENT MOLECULAR WEIGHT PROTEINS THROUGH POLY E-CAPROLACTONE FILMS WITH ENCAPSULATED TRYPSIN

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The ability to promote nanoencapsulation within nanofibrous films for food packaging enables the possibility to have a double functionality: protection and bioactive compound dispensing. Aiming at a possible smart packaging material application, nanofibrous films from with encapsulated trypsin (PCL+tryp) were studied. Films' properties, structure and morphology were characterized using Differential Scanning Calorimetry (DSC), Termogravimetric Analysis (TGA), Swelling Degree (SD), mechanical properties evaluation and Scanning Electron Microscopy (SEM). This work also focused in the diffusion properties of PCL+tryp films. The solutes chosen for transport mechanism evaluation were bovine serum albumin (66.5 kDa), lysozyme (14.7 kDa) and lactoferrin (80 kDa). PCL+tryp films showed a reduction of average pore size in the range of 30% to 40%, and an average pore diameter of 1/3 of the size when compared to simple PCL film without encapsulation; hence the former were less permeable to larger molecules at some point (e.g. lactoferrin). The most appropriate mathematical model, which accounts for both Fickian diffusion and relaxation of polymer[1] was selected from literature and fitted to the experimental data using non-linear regression, in order to understand which mechanisms were responsible for the diffusion of the different proteins thru the films. Results have shown that with the increase of protein molecular weight (M_w), the amount of protein migration by relaxation of the polymer increases as well. However Kf (Fickian rate constant) is reduced, which is possibly related with the difficulty of migration for larger molecules. Figure 1 shows the adhesion of lactoferrin molecules to PCL nanofibers; after a diffusion test. Figure 1 also shows the higher compactness of the PCL+tryp film. This work allowed developing a PCL+tryp active film with good mechanical and chemical properties.

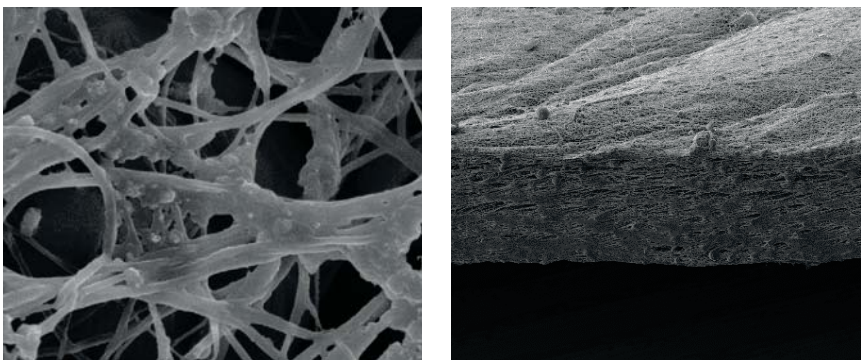

Figure 1- SEM images of PCL and PCL+tryp films. A- Lactoferrin fouling presented in the PCL nanofibers surface B- Transversal cut of PCL+tryp film

References

1. Berens, A. R., & Hopfenberg, H. B. (1978). Diffusion and relaxation in glassy polymer powders. 2. Separation of diffusion and relaxation parameters. Polymer, 19(5), 489-496.