CHANGES ON SURFACE MORPHOLOGY OF STARCH BASED MATERIALS AFTER ENZYMATIC DEGRADATION

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Introduction

Biodegradable starch-based polymers have recently been proposed as materials with great potential for several orthopaedic applications in the biomedical field [NO CITATION DEFINITION-NO CITATION DEFINITION]. To be used in such applications it must exhibit adequate mechanical properties coupled with controlled degradation rates and an appropriate biological behaviour in terms of interaction with living tissues. In the present study, the effect of enzymatic degradation on surface morphology of starch-based polymers was evaluated using SEM. Special attention was devoted to the surface modification as material surface properties are determinant in biomedical applications.

Materials and Methods

The degradation of a thermoplastic blend of corn starch with poly(ethylene-vinyl alcohol) copolymer (60/40 mol/mol), SEVA-C was studied. Three different batches were tested, up to 90 days, using SEVA-C samples of different thickness (0.15 and 0.5 mm) in a Hank's balanced salt solution (HBSS) with α-amylase, at pH 7.4 and 37°C±1C, up to 90 days. Changes on surface morphology of SEVA-C, as function of immersion time, were followed by SEM (Leica Cambridge S360 microscope). The microstructure was studied after boiling the samples (films and square plates) in distilled water, under stirring for 5h.

Results and Discussion

Figure 1 shows SEM micrographs of SEVA-C surfaces after boiled for 50 and 90 immersion days in HBSS.

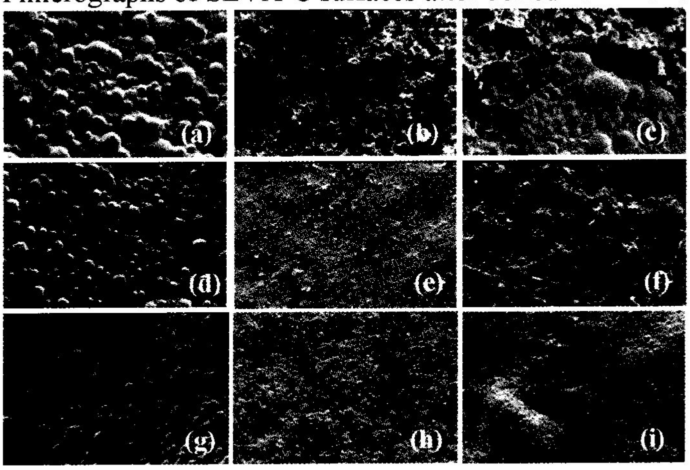

Figure 1 - SEM micrographs of SEVA-C surfaces after desegregation in boiling water for 5h, for control, after 50 and 90 immersion days, respectively (x 1500). (a), (b), (c) square plate; (d), (e), (f) 2 films and (g), (h), (i) 4 films.

SEM micrographs (figure 1) show great differences between square plates and films. After 50 immersion days large pores on the square plate were evident, as a result of amorphous mass loss. For longer immersion periods it was possible to observe at the same time a granular shape and small opening zones, as a result of non degraded zones and pores resulting from enzymatic degradation. On films, a smooth surface after the immersion periods is observed, as a result of granular loss zone after degradation. The control evidences an interpenetrating network between starch and the ethylene-vinylalcohol. This microstructure may difficult the enzyme access to reach the starch molecules (amorphous phase) strongly interpenetrated with the synthetic insoluble component. Moreover, the low porosity of the material makes the amorphous phase not completely accessible to the enzymatic attack, blocking the enzyme access.

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