Poly(butylene succinate) ionomer (PBSi)의 생체적합성과 생분해에 관한 연구

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Biocompatibility and Biodegradation of Poly(butylene succinate) ionomer

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1. Introduction

In previous study, we examined poly(butylene succinate) ionomer (PBSi) and confirmed that PBSi showed acceptable mechanical and rheological properties to apply in various field, due to the physical cross-linkage formed by ion aggregation. Besides, the incorporation of ionic groups led to the change of surface properties such as the hydrophilicity and surface morphology, which could affect hydrolytic degradation.

Based on these consideration, PBSis are expected to offer advantages as a cell-compatible biomedical material, since the surface property of PBSi might profoundly affect the interaction between resulting PBSi and cultured cells. This study deals with degradation behavior and evaluation of *in vitro* cytotoxicity as well as the cell growth rate on PBSi.

2. Experimental

2.1. Material and Degradation

PBSi were synthesized employing two step polycondensation according to previously reported procedure. Hydrolytic degradation was performed in phosphate buffer solutions (pH 7, pH 12) and stirred at 60 rpm in stirring bath at 37℃. Degraded films were dried for 24 hours in vacuum at room temperature and were measured the weight loss.

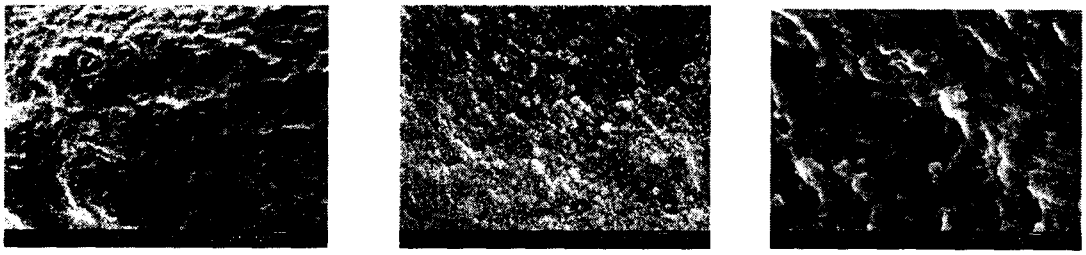
2.2 Biocompatibility

The biocompatibility tests were evaluated by both direct contact assay and indirect contact assay. For the indirect biocompatibility studies, the incubated cells with material extracts were expressed Neutral Red and MTT assay as a percentage of the values cells incubated with negative control extracts. For direct contact assay, the polymer films were sterilized by immersing them in 70% (v/v) ethanol for 5h and then rinsed with distilled water. Dulbecco's modified Eagle's medium and Ham's F12 (DMEM/F12) (Gibco) supplemented with 10% fetal bovine serum (FBS), 100 units/㎖ penicillin, and 100 ㎍/㎖ streptomycin was gently added to the cell culture dishes. The cultures were maintained at 37 ℃, and humidified atmosphere containing 5% CO2.

The cell growth and morphology were evaluated by inspection under a scanning electron microscope (SEM).

3. Results and Discussion

Figure 1 shows the interfacial surface of PBS and PBSis after hydrolytic degradation at pH 7 for 4 months. The degradation morphology of PBSi-3 were observed as separate clusters with size of 40-50 nm with the degraded matrix phase. PBSi-5 shows the morphology of surface including an occasional clusters with relatively larger size of about 100nm. After hydrolytic degradation, PBSi-5 showed not only surface morphology with distinct hole but also a discontinuous surface containing larger cluster with size of about 100 nm. These results seem to suggest the probability that matrix parts between clusters are favorable for hydrolytic degradation.



(a) (b) (c)

Figure 1. SEM images for PBS and PBSis after degradation for 4 months. (a) neat PBS, (b) PBSi-3, (c) PBSi-5

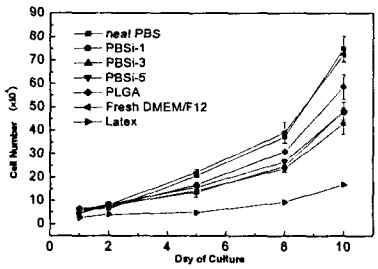


Figure 2. The cell numbers after indirect contact assay

Figure 2 shows the cells numbers measured after the incubation of cells with the material extracted from resulting polymers. PBSis exhibited low number of cells than that of positive control specimen and neat PBS, which may be due to faster degradation of PBSis. From cell morpholgy and direct cantact assay (not shwon), PBSis may be served as potential medicine materials such as scaffold and suture.

4. Conclusions

The biodegradation rate of the PBSi was drastically accelerated with increasing ion content. At initial culture of cells, PBSis appeared decent biocompatible results with human cells. These results suggest that the PBSis prepared in this study may serve as a potential cell-compatible biomedical material.