Developing Tapering Process of 100% PLA and PLA/PBT Blended Monofilaments using Alkaline Hydrolysis

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1. INTRODUCTION

The rapid increase in the volume of use of synthetic polymers has contributed to the solid waste management problems in recent years. Total management of polymers waste requires complementary combinations of recycling, incineration for energy and biodegradation [1].

Biodegradable polymers are necessary in the design, synthesis and application of biomedical implants, drug release systems and toothbrushes etc.

In the present work, it was intended to research optimum condition of producing tapered PLA and PLA/PBT blended monofilaments, surface morphology of them by alkaline hydrolysis.

2. EXPERIMENTALS

Materials

PLA and PLA/PBT blended monofilaments supplied by Shinyoung Co. Ltd. were used without further pretreatment. Table 1 shows specifications of PLA and PLA/PBT blended monofilaments.

Table 1. Specifications of specimens

Item	Diameter lengths(mm)
PLA monofilaments.	0.16, 0.17, 0.20
PLA/PBT monofilaments.	0.16, 0.17, 0.20

Alkaline Hydrolysis

PLA and PLA/PBT blended monofilaments were treated in 40 – 50% alkaline solutions at 40 -90 ‘C within 60 min.

Morphology

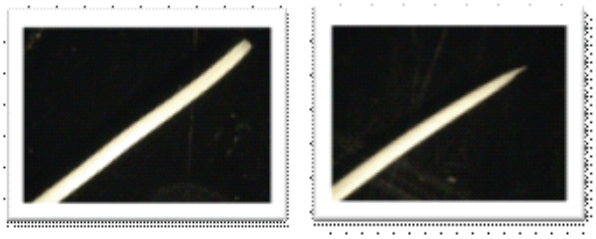
Photographs by image microscope and SEM(JEOL Co.; JSM-6390; Au coating).

3. RESULT and DISCUSSION

3.1 Optimum tapering process of PLA monofilament using alkaline solution.

The Optimum tapering processes of PBT monofilament, generally, were treated in 45% alkaline solution at 100 above for 60-120 min.

In case of PLA, on the other side, tapering processes are very different from PBT monofilament. Photographs 1 show surface morphology of not tapered and tapered PLA monofilament. Its tapering processes were gentle conditions in comparison with PBT monofilament. This was maybe caused by crystalline structure.



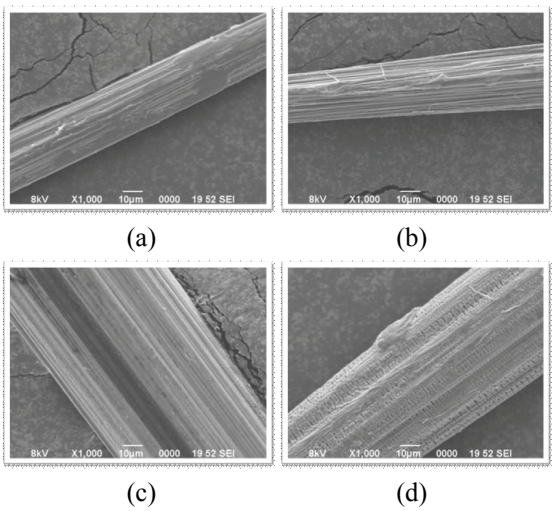
(a) (b)

Photograph 1. Surface morphology photographs of PLA monofilaments
(a) Not tapered monofilament
(b) Tapered filament

3.2 Optimum tapering process of PLA/PBT blended monofilament using alkaline solution.

Photograph 2 shows surface morphology of PLA /PBT blended monofilaments using alkaline hydrolysis according to PBT/PLA blended ratios. According to increasing PLA ratios, the cracks of length direction could be observed by scanning electron microscopy(X 1000).

These are due to hydrolysis of PLA composition first.



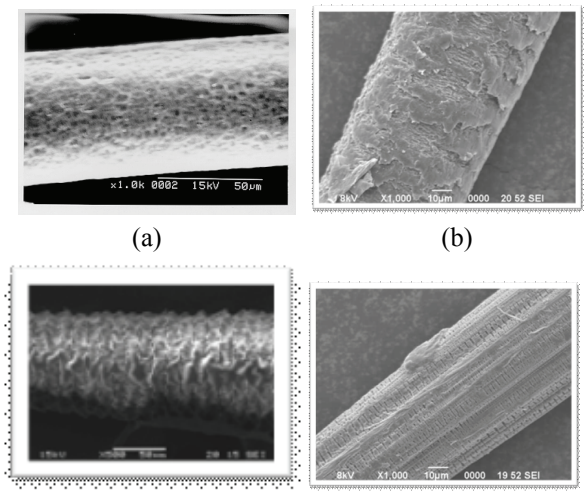
(a) (b)

(c) (d)

Photograph 2. Surface morphology (X 1,000) photographs of PLA/PBT blended monofilaments using alkaline hydrolysis.(volume ratios)
(a) PBT/PLA (95/5), (b) PBT/PLA (90/10)
(c) PBT/PLA (85/15), (d) PBT/PLA (80/20)

3.3 Comparison of surface morphology using alkaline hydrolysis according to polymer materials

Photograph 3 shows surface morphology according to polymer materials by alkaline hydrolysis. The shape of cracks on the surface was different from polymer materials. Round type cracks, scale type cracks similar to wool, the cracks of length direction, respectively, could be observed.



(a) (b)

(c) (d)

Photograph 3. Comparison of surface morphology by alkaline hydrolysis
(a) 100 % PBT, (b) 100% PLA
(c) 100% PTT, (d) PLA/PBT blended

4. REFERENCES

[1] S. J. Huang, *J. Macromolecular science- pure and Applied Chemistry*, 1995, A32, A, 593