Notes

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BIODEGRADATION OF POLY (*p*-PHENYLENE TEREPHTHALAMIDE) FIBER BY MICROORGANISM

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ABSTRACT: Poly (*p*-phenylene terephthalamide) fibers (Kevlar 29) were degraded by *A. flavus* on agar slant medium. The biodegradation resulted in the increase in diameter and the bending of fiber, but did not cause complete disintegration of fibers. The aspects of the biodegradation of Kevlar 29 were remarkably different from those of Kevlar 49.

Poly(*p*-phenylene terephthalamide) (PPTA) is a typical rigid polymer that can be processed into high tensile-strength and high-modulus fibers. The fibers are produced from the aromatic polyamide by liquid crystal spinning. Kevlar 29 and Kevlar 49 are two of commercial PPTA fibers produced by Du Pont de Nemours Co., Ltd. These two products have equal specific gravity and tensile-strength, but Kevlar 29 has lower tensile-modulus and higher extendability than Kevlar 49 [1-3].

We previously reported several features of biodegradation of Kevlar 49 [4]. The purpose of this study is to clarify the differences between Kevlar 49 and 29 with respect to features of biodegradation.

A Kevlar 29 fiber specimen was inoculated with *Aspergillus flavus* and incubated on agar slant medium deficient of carbon and nitrogen sources at 30 °C for 8, 15 and 30 days. Control specimens were processed in the same way except for the lack of inoculation with microbe. The degraded fibers were observed by optical microscopy and scanning electron microscopy (SEM). The SEM specimen was coated with gold to 15 nm thickness.

Splits in the direction of fiber axis (A) and increase

in diameter (B) were observed (Fig. 1(a)) after 15 days of biodegradation. The increase in diameter (C and D) was observed (Fig. 2(a)) after 8 days of biodegradation. The increasing (E) and the decreasing (F) in diameter and the bending (G) of the fiber were observed in Fig. 2(b) with the fibers biodegraded for 30 days. These features of the biodegradation of Kevlar 29 fibers are different from those of Kevlar 49 [4]. The smooth surface of the degraded fiber (C and D) suggests that the fiber structure of Kevlar 29 are more flexible than that of Kevlar 49. The sharp bendings of the degraded fiber (G) suggests that Kevlar 29 is less rigid than Kevlar 49. The complete degradation of Kevlar 29 fibers was not observed as in the case of Kevlar 49.

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(a)

(b)

Fig. 1. Optical micrograph of Kevlar 29 fiber degraded by *Aspergillus flavus* on agar slant medium at 30°C for 15 days (a) and control Kevlar 29 fiber (b).

(a)

(c)

(b)

Fig. 2. Scanning electron micrograph of Kevlar 29 fiber degraded by *Aspergillus flavus* on agar slant medium at 30°C for 8 (a), 30 (b) days, and control Kevlar 29 fiber (c).