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Mechanical properties of microporous foams of biodegradable plastic

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ABSTRACT

Permeable microporous foams and membranes of biodegradable polyesters are currently used in the area of tissue engineering and drug delivery systems. Their mechanical properties are useful in the medical applications. The foams should mechanically fit to the tissues where the foams were implanted. In this study, we investigated the mechanical properties of the foams of biodegradable polyesters by compression tests. Microporous foams of poly(L-lactic acid), poly (ε-caprolactone), and poly(3-hydroxybutyrate-co-3-hydroxyvalerate) were prepared by thermally induced phase separation method. The compression tests were performed at 23–24°C with a universal testing machine. The structure of the microporous foams depended on the kinds of polymers, polymer concentrations, and quenching temperatures. The cell size of the foams was smaller when the polymer concentration was higher or the quenching temperature was lower. We analyzed the stress–strain diagrams of the foams in the compression test. The lower the relative density of the foams to the solid materials the lower the elastic limit stress was. The relative Young's modulus and relative elastic limit stress of the foams were approximately proportional to the square of their relative density and less dependent on their cell size. The dependences were similar to those of open-cell foams of polyurethane.

Keywords: Biodegradable plastic; Microporous foam; Thermally induced phase separation; Mechanical properties; Open cell foam

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