Fibers and Polymers, vol. 20(1): 100-112

Correlations between fibre diameter, physical parameters, and the mechanical properties of randomly oriented biobased polylactide nanofibers

Fulltext nonprintable link: https://rdcu.be/brVJt

Selatile, Mantsopa K
Ray, Suprakas S
Ojijo, Vincent O
Sadiku R

ABSTRACT:

In this study, the tensile properties of systematically optimised, biodegradable polylactide (PLA) electrospum fibres are investigated in order to illuminate the influences of the factors that affect their mechanical properties such as fibre diameter, alignment, inter-fibre bonding, mat porosity, and packing density. The effect of fibre diameter was studied by varying the PLA concentration. The effect of fibre-fibre interaction enhancement was also investigated. The extent of anisotropy on the mechanical properties of the mats was evaluated as a function of the collector drum speed in the rotational (0 ^{o}), transverse (90 ^{o}), and diagonal (45 ^{o}) directions. The results demonstrate a strong correlation between the fibre diameter and the mechanical properties. Thinner fibres exhibit better mechanical properties, which are then further enhanced by fibre fusion and alignment. Other mat characteristics have minimal effects on the mechanical properties. The fibres produced at drum speeds of <250 rpm, exhibit isotropic character. Fibre alignment is observed beyond this speed, with strong enhancement of properties in the direction of drum rotation. In summary, randomly oriented fibres with isotropic responses to mechanical properties may be used in applications such as air filtration.