engineering proceedings

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Abstract

Nanotribological Investigation of the Poly(3-hydroxybutyrate) Films Manufactured from the Storage Polyesters Produced by *Halomonas elongata* DSM 2581^{T} †

Marius Pustan [1,*], Corina Bîrleanu [1], Adorján Cristea [2] and Horia Leonard Banciu [2]

[1] Micro & Nano Systems Laboratory, Department of Mechanical Systems Engineering, Technical University of Cluj-Napoca, Cluj-Napoca 400641, Romania; Corina.Barleanu@omt.utcluj.ro (C.B.)
[2] Department of Molecular Biology and Biotechnology, Faculty of Biology and Geology, Babeş-Bolyai University, Cluj-Napoca 400006, Romania; cristea.adorjan@yahoo.com (A.C.); horiabanciu3@yahoo.com (H.L.B.)
* Correspondence: Marius.Pustan@omt.utcluj.ro
† Presented at the 1st International Conference on Micromachines and Applications, 15–30 April 2021; Available online: https://micromachines2021.sciforum.net/.

Abstract: Poly(3-hydroxybutyrate) (PHB) is a natural and biodegradable storage polyester, produced by numerous bacteria, which is considered a potential substituent for conventional plastics in the packaging industry. The improvement of the PHB material lifetime often involves mechanical and tribological characterization, which can be accurately performed on thin films. In this study, we aimed at the evaluation of the tribological properties, such as adhesion force, friction coefficient and wear resistance, of different polyester films, fabricated via the solvent casting method. Three polyester films were designed in this study, each containing 1% *w*/*v* constituents as follows: a PHBh film prepared out of the PHB, extracted from the extremely halotolerant bacteria, *Halomonas elongata* DSM2581^{T}, a PHBc film fabricated using a commercially available PHB, and a PHBVc film generated using the commercial poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV). The spectroscopy-in-point of AFM was used for adhesion force measurement based on multiple tests performed in a matrix, and the AFM lateral operating mode was applied for friction analysis under a controlled normal load. The fabricated PHBh film presented a thickness between 5 and 7 μm, a lower adhesion force (14 nN) as well as a smaller friction coefficient (0.15) compared to the PHBc and PHBVc. The tribological investigations of PHBh film revealed a biodegradable material with low roughness, as well as small adhesion and friction forces. Further optimization can be performed for the improvement of the PHBh film by copolymerization with other polymers, polyesters, and reinforcers, thus generating a feasible material with advanced tribo-mechanical features.

Keywords: poly(3-hydroxybutyrate); biodegradable polyester; nanotribological characterisation; adhesion; friction; AFM

Citation: Pustan, M.; Birleanu, C.; Cristea, A.; Banciu, H.L. Nanotribological Investigation of the poly(3-hydroxybutyrate) Films Manufactured from the Storage Polyesters Produced by *Halomonas elongata* DSM 2581^{T}. *Eng. Proc.* **2021**, *4*, 29. https://doi.org/10.3390/Micromachines2021-09564

Academic Editor: Ion Stiharu

Published: 14 April 2021

Supplementary Materials: The supplementary file is available online at https://www.mdpi.com/article/10.3390/Micromachines2021-09564/s1.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.