Bioproduction of Advanced Biomaterials: Harnessing Bacterial Cellulose and Yeast Symbiosis for Nanocomposite Leather Fabrication

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Abstract

In this investigation, Acetobacter xylinum and Gluconacetobacter xylinus were employed to synthesize a nanostructured cellulose layer with exceptional quality, derived from waste materials. After purification and decolorization processes, the resultant cellulose layer was either transformed into sheets or incorporated with diverse materials to yield extended filaments, suitable for applications spanning composites, textiles, and nano-scale materials.

Characterization of the synthesized material revealed notable biocompatibility with biological systems, rendering it particularly advantageous for healthcare applications. Additionally, its inherent properties demonstrate potential for enhancing packaging solutions. The multifaceted implications of this discovery signify its promising utility across diverse domains, presenting innovative prospects in materials science and technology.

Keywords: Bacterial cellulose, Artificial leather, Nanoscale structures, Biocompatibility Healthcare.

References

1. Soledad Roig Sánchez. Novel bacterial cellulose materials: structuration, functional nanocomposites and photocurable hydrogels. Doctoral thesis 2021

2. Luis Quijano. Embracing Bacterial Cellulose as a Catalyst for Sustainable Fashion (Senior Honors Thesis). Thesis · December 2017.DOI: 10.13140/RG.2.2.34100.55684

3. Muling Zeng. Origami magnetic cellulose: controlled magnetic fraction and patterning of flexible bacterial cellulose.26-May-2014. DOI: 10.1039/c0xx00000x

4. AL-Kalifawi, E. J., & Hassan, I. A. (2013). Factors influence on the yield of bacterial cellulose of kombucha (khubdat humza). Baghdad Science Journal, 11(3), pp. 1420-1428.

5. Henninger, C. E., Alevizou, P. J., & Oates, C. J. (2016). “What is sustainable fashion?”, Journal of Fashion Marketing and Management: An International Volume, 20(4), pp. 400-416. doi: 10.1108/JFMM-07-2015-0052

6. Jayabalan, R., Malbasa, R. V., Loncar, E. S., Vitas, J. S., & Sathishkumar, M. (2014). A review on Kombucha Tea – Microbiology, composition, fermentation, beneficial effects, toxicity, and tea fungus. Comprehensive Reviews in Food Science and Food Safety, 13, pp. 538-550. doi: 10.1111/154104 337.12073

7. Hwang J.W., Yang Y.K., Hwang J.K., Pyun Y.R., Kim Y.S. Effects of pH and dissolved oxygen on cellulose production by Acetobacter xylinum BRC5 in agitated culture. J. Biosci. Bioeng. 1999; 88:183–188. doi: 10.1016/S1389-1723(99)80199-6.

8. J. Xiang. Layer-by-layer assembly of antibacterial composite coating for leather with cross-link enhanced durability against laundry and abrasion. Appl. Surf. Sci. (2018)

9. S. Barshan. Optimization and characterization of bacterial cellulose produced by Komagatacibacter xylinus PTCC 1734 using vinasse as a cheap cultivation medium Int. J. Biol. Macromol.(2019)

10. Fernandes M, Gama M, Dourado F, Souto AP (2019) Development of novel bacterial cellulose composites for the textile and shoe industry. Microb Biotechnol 12:650–661.