Journal of Fibers and Polymer Composites 1 (1): 73-76 (2022)

**Journal of Fibers and Polymer Composites**

https://journals.gesociety.org/index.php/jfpc/index

# ADVANCEMENTS IN BIOFIBERS AND BIOPOLYMERS FOR BIOCOMPOSITES

Sanjay Mavinkere Rangappa[1], Edi Syafri[2]

[1]Natural Composites Research Group Lab, Department of Materials and Production Engineering, The Sirindhorn International Thai-German Graduate School of Engineering (TGGS), King Mongkut's University of Technology North Bangkok (KMUTNB), Bangkok, Thailand.
[2]Department of Agricultural Technology, Politeknik Pertanian Negeri Payakumbuh, 50 Kota, Indonesia

Recently, due to the environmental harm caused by synthetic materials, researchers and scientists are now focusing more on developing and using biofibers and biopolymers for making biocomposites. As a result, ecologically friendly biocomposites, which are made from biofibers and biopolymers, are being emphasized as the greatest alternative for preventing environmental damage and competing with synthetic composites in the composite field. Also, synthetic materials provide challenges in the manufacturing area due to energy consumption, material cost, and availability; as a result, biofibers and biopolymers are used as alternative renewable resources due to their processing conditions and low energy requirements. The biofibers (banana, kenaf, sisal, areca, jute, coir, flax, hemp, bamboo, silk, wool, etc.,) are available in cellulose and protein-based forms, both of which contain lignin, and are classified as plant, animal, or mineral fibers depending on their origin. Plant fibers mostly consist of cellulose, whereas animal fibers mostly consist of protein. These biofibers have lower flame retardant qualities and emit less $CO_2$ when burned. When these biofibers are used for making to a composite, their hydrophilic nature attracts water molecules, resulting in a reduction in the consistency as well as the adhesive nature with the matrix material. To avoid these issues, the biofibers are chemically treated, which improves their compatibility with the matrix phase. Biopolymers come in

*Received March 1, 2022; Accepted March 20, 2022; Published March 30, 2022*
*https://doi.org/10.55043/jfpc.v1i1.20*

a number of forms, ranging from non-biodegradable to biodegradable. Synthetic polymers are created from nonrenewable petroleum-based sources, whereas naturally degradable polymers can be obtained from renewable sources. Biopolymers include polylactic acid (PLA), polybutylene succinate (PBS), polybutylene succinate adipate (PBSA), polybutylene adipate co-terephthalate (PBAT), polycaprolactone (PCL), and thermoplastic starch (TPS). Low viscosity, weak resilience, low modulus, and temperature sensitivity, and high cost are all characteristics of biopolymers. Copolymerization, compositing, and mixing are some of the most frequent methods used to overcome these limitations. Biocomposites are used in a variety of industries, including the automobile industry, aerospace, construction materials, circuit boards, and home applications.

## References

[1] Madhu Puttegowda, et al. “Trends and Developments in Natural Fiber Composites” Applied Science and Engineering Progress, 2021.

[2] Sanjay M R, Suchart Siengchin, “Exploring the applicability of natural fibers for the development of biocomposites" eXPRESS Polymer Letters, 2021.

[3] Sanjay M R, et al. “Green-composites: Ecofriendly and Sustainability” Applied Science and Engineering Progress, 2020.

[4] Edi Syafri, et al. “Environmental Friendly Materials for Lightweight Structural Components” Journal of Applied Agricultural Science and Technology, 3(2), 2020.

[5] Sanjay M R, Suchart Siengchin, “Lightweight Natural Fiber Composites” Journal of Applied Agricultural Science and Technology, 3(2), 2019, 178.

[6] Sanjay M R, Suchart Siengchin, “Natural Fibers as Perspective Materials” KMUTNB International Journal of Applied Science and Technology, 4(11), 2018, 233. DOI: https://doi.org/10.14416/j.ijast.2018.09.001

[7] Sanjay M R, et al. “Lignocellulosic Fiber Reinforced Composites: Progress, Performance, Properties, Applications and Future Perspectives” Polymer Composites, 2021.

[8] Praveen Kumar, et al. “A comprehensive review on polymer composites in railway applications” Polymer Composites, 2022,

[9] Sanjay M R, et al. "Characterization and Properties of Natural Fiber Polymer Composites: A Comprehensive Review" Journal of Cleaner Production, 172, pp.566-581, 2018.

[10] Sanjay M R, et al. "A Comprehensive Review of Techniques for Natural Fibers as Reinforcement in Composites: Preparation, Processing and Characterization" Carbohydrate Polymers, 207, pp. 108–127, 2019.

[11] G Rajeshkumar, et al. "Environment friendly, renewable and sustainable poly lactic acid (PLA) based natural fiber reinforced composites – A comprehensive review" Journal of Cleaner Production, 2021, 127483.

[12] B Brailson Mansingh, et al. "Sustainable development in utilization of Tamarindus indica L. and its by-products in industries: A review" Current Research in Green and Sustainable Chemistry, 4, pp. 100207, 2021.

[13] K J Nagarajan, et al. "A comprehensive review on cellulose nanocrystals and cellulose nanofibers: Pretreatment, preparation and characterization" Polymer Composites, 2021,

[14] J Praveen Kumara, et al., "A comprehensive review on the effect of synthetic filler materials on fiber reinforced hybrid polymer composites" The Journal of The Textile Institute, 2021,

[15] G Rajeshkumar, et al. "Sustainable Natural Fiber/Nano-Clay Reinforced Hybrid Polymeric Composites: Materials and Technologies Review" Polymer Composites, 2021,

[16] Praveen Kumar, et al. "Influence of nanofillers on biodegradable composites: A comprehensive review" Polymer Composites, 2021,

[17] Praveen Kumar, et al. "A review on extraction, chemical treatment, characterization of natural fibers and its composites for potential applications" Polymer Composites, 2021,

[18] Hemath Mohit, et al. Mrityunjay Doddamani, "A comprehensive review on performance and machinability of plant fiber polymer composites" Polymer Composites, 2021,

[19] A Vinod, et al. "Renewable and Sustainable Biobased Materials: An Assessment on Biofibers, Biofilms, Biopolymers and Biocomposites" Journal of Cleaner Production, 258, pp. 120978, 2020.

[20] Ashish George, et al. "A Comprehensive Review on Chemical Properties and Applications of Biopolymers and their Composites" International Journal of Biological Macromolecules, 154, pp. 329–338, 2020.

[21] Sabarish Radoor, et al. "A review on the extraction of pineapple, sisal and abaca fibers and their use as reinforcement in polymer matrix" eXPRESS Polymer Letters, 14 (4), pp. 309–335, 2020.

[22] Praveen Kumara J, et al. "Effect of natural filler materials on fiber reinforced hybrid polymer composites: An Overview" Journal of Natural Fibers, 2020,

[23] M Ramesh, et al. "Lifecycle and Environmental Impact Assessments on Processing of Plant Fibres and its Bio- composites: A Critical Review" Journal of Industrial Textiles, 2020.

[24] Mohit H, et al. "A comprehensive review on mechanical, electromagnetic radiation shielding, and thermal conductivity of fibers/ inorganic fillers reinforced hybrid polymer composites" Polymer Composites, 2020,

[25] Jiratti Tengsuthiwat, et al. "A Comprehensive review on 3D-MID Technology for surface modification of polymer based composites" Polymers, 2020,

[26] T G Yashas Gowda, et al. "Natural Fibers as Sustainable and Renewable Resource for Development of Eco-friendly Composites: A Comprehensive Review" Frontiers in Materials, Polymeric and Composite Materials, 2019.

[27] Krittirash Yorseng, et al. "Information on United States Patents in works related to 'Natural Fibers': 2000-2018" Recent Patents on Materials Science, 2019.

[28] P Madhu, et al. "A Review on Synthesis And Characterization of Commercially Available Natural Fibers: Part-I" Journal of Natural Fibers, 2018.

[29] P Madhu, et al. "A Review on Synthesis and Characterization of Commercially Available Natural Fibers: Part-II" Journal of Natural Fibers, 2017.

[30] T G Yashas Gowda, et al. "Polymer matrix-natural fiber composites: An overview" Cogent Engineering, 2018.

[31] Sanjay M R, et al. "Applications of Natural Fibers and Its Composites: An Overview" Natural Resources, 2016,7, pp.108-114.

Dr. Sanjay Mavinkere Rangappa
Member of Editorial Board

Dr. Edi Syafri
Editor-in-chief