Abstract ID 435

BIOPLASTIC BLENDS FOR NATURAL FIBRE COMPOSITE MATRICES FOR NON-STRUCTURAL APPLICATIONS IN THE AERONAUTICAL INDUSTRY

R. Serôdio[(1)], P. F. Mendes[(2)], A. C. Marques[(3)], A. Garcês[(4)], C. G. Figueiredo-Pina[(5)]

[(1)]Escola Superior de Tecnologia de Setúbal, Instituto Politécnico de Setúbal, 2910-761 Setúbal, Portugal
[(2)]Centro de Química Estrutural (CQE), Instituto Superior Técnico - UL, Av. Rovisco Pais 1, 1049-001 Lisboa, Portugal
[(3)]CERENA, DEQ, Instituto Superior Técnico, Universidade de Lisboa, Avenida Rovisco Pais 1, 1049-001 Lisboa, Portugal
[(4)]LAUAK Portugal, Rua do Bairro da Estação, Grândola, 7570-205, Portugal
[(5)]Escola Superior de Tecnologia de Setúbal, Instituto Politécnico de Setúbal, Setúbal, Portugal

rita.serodio@estsetubal.ips.pt, pedro.f.mendes@tecnico.ulisboa.pt, ana.marques@tecnico.ulisboa.pt, antonio.garces@groupe-lauak.com, celio.pina@estsetubal.ips.pt

Keywords: PLA, PHA, PBS

Summary: According to the reports by the OECD, the annual production of plastic will reach 1.2 billion tonnes by 2060 [1]. These plastics are mainly employed as commodities for the packaging market or for manufacturing purposes [1]–[3]. Meanwhile, increasing concern regarding the environmental impact of plastic waste in the earth's ecosystem and human health motivates the transition towards a 'circular plastic economy' with the "reuse, reduce and recycle" approach, transitioning towards bioplastics [4].

Bioplastics are an emerging technology within the highly interdisciplinary Bioeconomy that combine research and innovation from multiple areas: Chemistry, Biology, or Materials Science [6]. Bioplastics are plastics that are either made from renewable resources ('bio-based'), made through biological processes, biodegradable or exhibit a combination of these properties [2], [3]. They are a promising eco-friendly alternative that can offer improved circularity by using renewable (non-fossil) resources, waste reduction, lower carbon footprint, biodegradation as an alternative end-of-life option. Meanwhile, second-generation biomass waste offers an inexpensive, low density, renewable, ethically acceptable and widely available feedstock to innovatively reuse agro and industrial waste in polymer composites fabrication. These can improve the properties and performance of the composites while maintaining their original biodegradability In the aeronautical industry research is being performed on bio-composites in light aircraft interiors and structural components. The weight reduction potential can reduce fuel consumption and greenhouse gas emissions.

Blends of Polylactic acid (PLA) with Polyhydroxyalkanoate (PHA) and Polybutylene succinate (PBS) have been produced by extrusion and tested. PHA is the polymer with the highest Storage Modulus of the three. When joined with PLA the values drop. However PLA will increase elongation and impact strength to the blend and might give the final material resistance to certain weathering conditions. Meanwhile, PBS joined with PLA increases the toughness of the material. For both PLA/PBS and PLA/PHA the tan delta with increasing weight percentages of PLA, increases the value of Tg. Therefore, PLA allows for the blend to maintain its stiffness for higher working temperatures. Furthermore, PHA will decrease the thermal stability of the blend while PBS increases.

References

[1] A. Jayakumar, S. Radoor, S. Siengchin, G. Hwa, and J. Tae, Recent progress of bioplastics in their properties , standards , certifications andregulations: A review, Sci. Total Environ., 878 (2023) 163156. http://dx.doi.org/10.1016/j.scitotenv.2023.163156.
[2] J. G. Rosenboom, R. Langer, and G. Traverso, Bioplastics for a circular economy, Nat. Rev. Mater., 7.2 (2022): 117-137. https://doi.org/10.1038/s41578-021-00407-8.
[3] P. Rai, S. Mehrotra, S. Priya, E. Gnansounou, and S. K. Sharma, Recent advances in the sustainable design and applications of biodegradable polymers, Bioresour. Technol., 325 (2021) 124739. https://doi.org/10.1016/j.biortech.2021.124739.
[4] G. Atiwesh, A. Mikhael, C. C. Parrish, J. Banoub, and T. T. Le, Environmental impact of bioplastic use : A review, Heliyon 7 (2021) e07918. https://doi.org/10.1016/j.heliyon.2021.e07918.