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**Trabajo de integración Curricular previa a la observación del título de
Ingeniería Industrial**

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**Caracterización de un material compuesto de
matriz polimétrica con refuerzo híbrido de pambil y bambú,
como alternativa eco-amigable**

burbujas y zonas de cristalización en la matriz polimérica, los cuales generan vacíos que reducen la resistencia mecánica y favorecen fallas prematuras por concentración de esfuerzos. Asimismo, aunque estos materiales han sido considerados en sectores como automotriz, aeroespacial y de construcción, la presencia de dichos defectos limita su desempeño bajo cargas elevadas o impactos. Por otro lado, su uso resulta más adecuado en aplicaciones estructurales, como recubrimientos, elementos decorativos que requieren de cierta resistencia a caídas o capas en sistemas de sonorización, donde las exigencias mecánicas son menores.

Palabras clave: Ensayos destructivos, flexión, tracción, defectos estructurales, comportamiento mecánico, adhesión fibra-matriz.

II. ABSTRACT

The growing environmental problems associated with the use of conventional synthetic materials, especially those derived from petroleum, have generated negative impacts such as the accumulation of non-biodegradable waste and increased pollution. Studies of composite materials play an important role in engineering, contributing to it as an eco-friendly alternative. Likewise, natural fibers reinforced with polymers offer advantages such as their low cost, lightness, and ease of processing. For this reason, the development and use of alternative materials based on natural fibers emerges as a sustainable solution, reducing the environmental footprint and promoting the use of renewable resources. The main objective of this study was to characterize the mechanical properties of polymer matrix composite materials reinforced with natural fibers from pambil and bamboo, to evaluate their viability as an eco-friendly alternative.

In this regard, reinforcement fractions corresponding to the natural fibers of pambil and bamboo were determined. Furthermore, for the mechanical characterization of the composite, destructive tensile and flexural tests were performed following standardized norms such as ASTM D3039 and ASTM D790. The experimental results showed that the composite material exhibited acceptable mechanical behavior, with an average tensile strength of 13.54 MPa, a Young's modulus of 2.66 GPa, an average flexural strength of 23.07 MPa, and a modulus of elasticity of 24.22 GPa. Thus, it demonstrated better mechanical performance in the flexural tests compared to the tensile tests.

Analysis of the results indicated that the combination of bamboo fibers and pambil particles contributes to increased stiffness in the composite material, making it viable for industrial applications with low structural demands. However, microscopic analysis revealed defects such as bubbles and crystallization zones in the polymer matrix, which create voids that reduce mechanical

strength and promote premature failure due to stress concentration. Furthermore, although these materials have been considered for use in sectors such as automotive, aerospace, and construction, the presence of these defects limits their performance under high loads or impacts. On the other hand, their use is more suitable for structural applications, such as coatings, decorative elements requiring some resistance to drops, or layers in sound reinforcement systems, where mechanical demands are lower.

Keywords: Destructive testing, bending, tension, structural defects, mechanical behavior, fiber-matrix adhesion.