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Bio composite from bleached pine fibers reinforced polylactic acid as a replacement of glass fiber reinforced polypropylene, macro and micro-mechanics of the Young's modulus

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1 **Bio composite from bleached pine fibers reinforced polylactic acid as a**
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3 **mechanics of the Young's modulus**

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10 **Abstract**

11 The search of more environmentally friendly material is not an end in itself. Such materials must
12 also show competitive mechanical properties, comparative prices and a good adaptation to the
13 manufacture processes. Nowadays, Glass fibers had been traditionally used as reinforcement of
14 polyolefin for mold injected products. Natural fibers and non-oil-based polymers are seen as possible
15 replacements. Nonetheless, the substitution of a mineral reinforcement or an oil-based matrix by
16 renewable alternatives is not enough. From an engineering point of view, stiffness is one of the most
17 relevant properties of composite materials. In this work, commercial Kraft Bleached pine fibers were
18 used as reinforcement for a polylactic acid-based thermoplastic. Composite materials with 15 to 35%
19 w/w of reinforcing fibers were prepared, mechanically characterized, and compared with
20 polypropylene-based composites. A fiber tensile modulus factor was defined in order to characterize the
21 net contribution of the fibers to the Young's moduli of the composites. The intrinsic Young's modulus of
22 the fibers was back calculated by means of the Hirsch model, and its matrix dependence or
23 independence was examined. The moduli were also obtained by Halpin-Tsai equations with Tsai-Pagano
24 methods and then compared to establish the influence of the aspect ratio.

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