Accepted Manuscript

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

M. Delgado-Aguilar, F. Julián, Q. Tarrés, J.A. Méndez, P. Mutjé, F.X. Espinach

PII: S1359-8368(17)30496-1

DOI: 10.1016/j.compositesb.2017.05.058

Reference: JCOMB 5081

To appear in: *Composites Part B*

Received Date: 9 February 2017

Revised Date: 23 March 2017

Accepted Date: 13 May 2017

Please cite this article as: Delgado-Aguilar M, Julián F, Tarrés Q, Méndez JA, Mutjé P, Espinach FX, 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, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.05.058.

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

Delgado-Aguilar, M.[a], Julián, F.[b], Tarrés, Q.[a], Méndez, J.A.[a], Mutjé, P.[a], Espinach, F. X.[a*]

[a] Group LEPAMAP, Department of Chemical Engineering, University of Girona, C/M. Aurèlia Capmany, nº61, Girona 17071, Spain

[b] Design, Development and Product Innovation, Dpt. of Organization, Business Management and Product Design, University of Girona, C/M. Aurèlia Capmany, nº61, Girona 17071, Spain

[*] Corresponding author: Francisco.espinach@udg.edu

Abstract

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