Accepted Manuscript

Extending the value chain of corn agriculture by evaluating technical feasibility and the quality of the interphase of chemo-thermomechanical fiber from corn stover reinforced polypropylene biocomposites

M. Delgado-Aguilar, F. Vilaseca, Q. Tarrés, F. Julián, P. Mutjé, F.X. Espinach

PII: S1359-8368(17)32161-3

DOI: 10.1016/j.compositesb.2017.11.006

Reference: JCOMB 5368

To appear in: *Composites Part B*

Received Date: 27 June 2017

Revised Date: 18 September 2017

Accepted Date: 2 November 2017

Please cite this article as: Delgado-Aguilar M, Vilaseca F, Tarrés Q, Julián F, Mutjé P, Espinach FX, Extending the value chain of corn agriculture by evaluating technical feasibility and the quality of the interphase of chemo-thermomechanical fiber from corn stover reinforced polypropylene biocomposites, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.11.006.

Extending the value chain of corn agriculture by evaluating technical feasibility and the quality of the interphase of chemo-thermomechanical fiber from corn stover reinforced polypropylene biocomposites

By:

Delgado-Aguilar, M.[a], Vilaseca, F.[b*], Tarrés, Q.[a], Julián, F.[c], Mutjé, P.[a], Espinach, FX.[c*]

[a] Laboratory of Paper Engineering and Polymer Materials (LEPAMAP), Department of Chemical Engineering, University of Girona, C/ M. Aurèlia Capmany 61, Girona 17071, Spain

[b] Advanced Biomaterials and Nanotechnology (BIMATEC), Department of Chemical Engineering, University of Girona, C/ M. Aurèlia Capmany 61, Girona 17071, Spain

[c] Design, Development and Product Innovation (PRODIS), Department of Organization, Business Management and Product Design, University of Girona, C/M. Aurèlia Capmany 61, Girona 17071, Spain

[*] Escola Politecnica Superior. Avda. Lluis Santalo, s/n, 17071 Girona, Spain. Francisco.espinach@udg.edu, Fabiola.vilaseca@udg.edu, tlf. +34 650 206 884, FAX +34 972 418 399

ABSTRACT

With the increasing concerns towards the environment, industries are interested in substituting glass fibers by natural fiber. Nonetheless, filaments or strands from jute, hemp or abaca, are mainly used as reinforcement. Such fibers are, in some cases, more expensive than the glass fibers that are replacing. Grain corn harvest creates a huge amount of by-products in the shape of corn stover. These stover usually remains in the field to be incinerated, or recovered to prepare feedstuff, or bedding for livestock. Besides, corn is a globally spread crop, and consequently, corn stover becomes available as renewable source for reinforcing fibers. The aim and main novelty of the research is transforming a by-product as corn stover into a cheap source of reinforcing fibers to obtain competitive biocomposites. To do so, such biocomposites must show mechanical properties comparable to those materials currently present in the market. In this work, biocomposites reinforced with natural fibers from corn stover are used as reinforcement of polypropylene; their mechanical properties are investigated and compared. Moreover, the interphase between the reinforcement and the matrix is also modelled by means of the Kelly and Tyson equation to assess its quality.

Keywords: A. Fibres; B, Interphase, Strength; E, Injection molding

1 INTRODUCTION

Corn is one of the most extended crops in the world, and in some countries like the USA is the most widely grown [1]. The estimated corn stocks availability is of 153 million dry tons every year in the USA [2]. The worldwide production of corn for the 2016 was about 1030 million Tons. After harvesting, corn generates high amounts of by-products, in the shape of straws, but also as stover [3, 4]. In terms of constituents, corn stover is composed of stalks (including pitch), leaves, husks, and cob, being all of them lignocellulosic materials, rich in