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The role of lignin on the mechanical performance of polylactic acid and jute composites

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ABSTRACT

The present work shows the feasibility of incorporating properly treated jute strands into a polylactic acid (PLA) thermoplastic matrix. The role of lignin in the interaction between jute strands and PLA was assessed by means of gradually decreasing the amount of lignin and producing composites. Five different lignin contents were studied and the resulting strands were incorporated into the PLA matrix at the ratio of 30 wt%. Composites were produced in a discontinuous extruder and standard specimens were injected and characterized at tensile. It was found that as the amount of lignin was decreased, the interface between the matrix and the reinforcement was properly improved, since tensile strength was increased up to 46 % and FTIR analysis revealed the existence of H-bonds however they cannot be clearly related with an interaction between both phases. Both macro and micromechanical analysis showed that jute strands with a lignin content of 4 % were the most suitable to be used as PLA reinforcement, mainly due to their higher intrinsic mechanical properties, better interaction with PLA and dispersion within the matrix. Overall, it was found that it is possible to obtain high-performance bio-based and presumably biodegradable composites with potential to substitute current oil-based commodities.

Keywords: polylactic acid; jute; biocomposites

1 INTRODUCTION

The world's population is increasing day by day and, by 2050, is expected to be more than 9 billion people in Earth. Taking into account that consumers' behavior depends on economics, resource constraints, technology, societal values, style of governance and planet's capacity to support its population and their lifestyles, several actions towards the development of new materials and products must be adopted [1]. Earth has a limited capacity to supply resources which, nowadays, is clearly insufficient to guarantee a sustainable growth and development