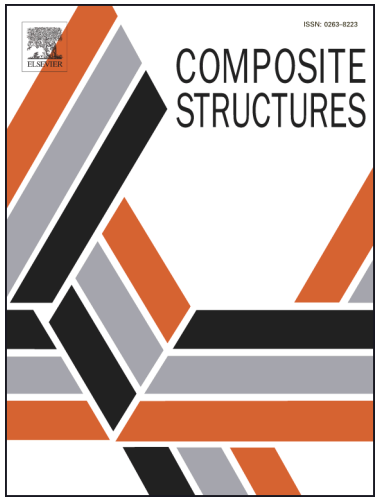

Analysis of low-velocity impact on flax/pla composites using a strain rate sensitive model

E. Jalón, T. Hoang, A. Rubio-López, C. Santiuste

PII: S0263-8223(18)30673-1
DOI: https://doi.org/10.1016/j.compstruct.2018.02.080
Reference: COST 9430

To appear in: *Composite Structures*

Received Date: 15 February 2018
Accepted Date: 26 February 2018

Please cite this article as: Jalón, E., Hoang, T., Rubio-López, A., Santiuste, C., Analysis of low-velocity impact on flax/pla composites using a strain rate sensitive model, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.02.080

ANALYSIS OF LOW-VELOCITY IMPACT ON FLAX/PLA COMPOSITES USING A STRAIN RATE SENSITIVE MODEL

*E. Jalón[1], T. Hoang[1], A. Rubio-López[2], C. Santiuste[1]**

Department of Continuum Mechanics and Structural Analysis, Universidad Carlos III de Madrid, Avda de la Universidad 30, 28911, Leganés, Spain

INDRA TGP, Ctra. Loeches, 9, 28850 Torrejón de Ardoz, Spain

*Corresponding author: Phone +34916249920, csantius@ing.uc3m.es

Abstract

The mechanical behaviour of conventional composites is usually assumed as linear-elastic up to failure. However, the mechanical behaviour of natural fibres based composites is non-linear with a significant influence of strain-rate. This study presents a FEM model to analyse the impact behaviour of FLAX/PLA composites. The constitutive model includes the consideration of plastic strains and the influence of strain rate. The model was validated through comparison with low-velocity impact tests. Numerical prediction were in agreement with experimental results conducted with two impactor nose at different impact energies.

Keywords: Biocomposite; Impact behaviour; Finite Element Analysis (FEA); Natural fibres

1. INTRODUCTION

During the last years, natural fibres have been introduced as reinforcements in order to develop biodegradable composites [1,2]. In terms of matrices, non-biodegradable polymeric materials (such as epoxy, polyethylene or polypropylene) are typically used with natural fibres [3]. However, biodegradable matrices (such as polysaccharides, proteins, polyesters, lignin, lipids, etc.) can also be used to obtain 100 % eco-sustainable composites [3-5]. The introduction of fully biodegradable composites can reduce the use of non-biodegradable materials and non-renewable resources. The main advantages of biocomposites are their low cost, lightweight and less energy consumption for their production. Biodegradable composites are applied in different industrial applications and engineering fields such as packaging, biotechnology, automotive industry or environmental technology, offering significant advantages in terms of environmental impact, cost and weight [3,6-8].

One of the most relevant drawbacks of traditional composites is their sensitivity under low-velocity impacts [9]. Therefore, there are numerous studies about the low-velocity impact behaviour of traditional composites. The development of predictive FEM models has been used to get a better understanding of the impact behaviour of composites [10-13]. For instance, Antonucci et al. [10] used cohesive elements to predict delamination evolution on carbon fibres composites under multiple low-velocity impact tests. Ivañez et al. [11] studied the low-velocity impact behaviour of sandwich beams. The FEM model results were used to