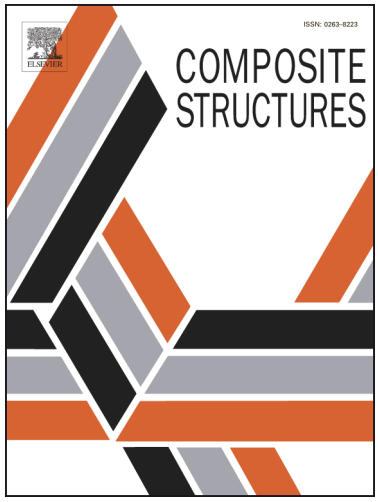

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B. Zuccarello, G. Marannano, A. Mancino

PII: S0263-8223(17)33849-7
DOI: https://doi.org/10.1016/j.compstruct.2018.04.007
Reference: COST 9561

To appear in: *Composite Structures*

Received Date: 17 November 2017
Revised Date: 13 March 2018
Accepted Date: 2 April 2018

Please cite this article as: Zuccarello, B., Marannano, G., Mancino, A., Optimal Manufacturing and Mechanical Characterization of High Performance Biocomposites Reinforced by Sisal Fibers, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.04.007

OPTIMAL MANUFACTURING AND MECHANICAL CHARACTERIZATION OF HIGH PERFORMANCE BIOCOMPOSITES REINFORCED BY SISAL FIBERS

B. Zuccarello*, G. Marannano, A. Mancino.

Università degli Studi di Palermo - Dipartimento dell'Innovazione Industriale e Digitale (DIID), Viale delle Scienze, 90128 Palermo,
(*) Corresponding author. E-mail: bernardo.zuccarello@unipa.it

Abstract
The increasing interest about eco-sustainable materials in the industrial production (automotive, civil construction, packaging), has led to the increase of the research works dealing with biocomposites. However, until now the most attention has been devoted to the development of short fiber biocomposites for non-structural applications, whereas only a few works have considered high performance biocomposites for structural applications. Consequently, the development of structural biocomposites from robust natural fibers, as sisal fibers, is a result expected from the scientific community, but not yet achieved. In order to give a contribution to the implementation of high performance biocomposites constituted by a green matrix reinforced by sisal fibers, the present work proposes a manufacturing process that allows to obtain good quality unidirectional biocomposites with fiber volume fraction up to 70%. In detail, it uses unidirectional "stitched" fabrics, properly obtained in laboratory from optimized fibers, and a curing under a proper pressure cycle. The comparison with independent data reported in literature, has evidenced how the proposed biocomposites exhibit mechanical properties higher than most of biocomposites described in literature, so that they can advantageously substitute not only materials as steel, aluminum and glass fiber reinforced plastics, but also other biocomposites reinforced by more expensive fibers.

Key words: biocomposites, natural fibers, sisal fibers, ecofriendly matrixes

1. INTRODUCTION

The increasing sensitivity to the environment protection and the recent laws against the environmental pollution given by the production of synthetic materials, have led to a wide attention toward biocomposites, i.e. to ecofriendly composite materials made by an eco-sustainable or renewable matrix reinforced by natural fibers. Between the various fibers that can be used for the implementation of interesting biocomposites, the agave fibers are very attractive because they are characterized by high mechanical properties as high tensile strength, good stiffness and high toughness. Moreover, they exhibit low damageability, good thermal and acoustic insulation, low skin irritability, high availability in the current market (surpassed only by flax), low embodied energy (lower than any other natural fiber), and very low cost. Despite such interesting properties, until now the agave fibers are used only for non-structural applications (filling material, soundproofing, thermal insulation, packaging etc.) in various fields of the industrial production. In more detail, in the automotive, naval and civil construction industry, the properties of lightness and low cost, both superior to that of any composite material reinforced by synthetic fibers, are particularly appreciated. In practice, such materials for non-structural applications are constituted by green thermosetting (partially biobased) or thermoplastic (recyclable and/or renewable) matrixes, reinforced by short or discontinuous randomly oriented agave sisalana (sisal) fibers. In general, they are manufactured by molding or by extrusion process, and are characterized by relatively low mechanical properties along with a sufficient stiffness.
Although recently various research works have been devoted to the implementation of high performance biocomposites that can be used for structural application, also by preliminary improvement of the fiber properties [1-18], the development of ecofriendly or renewable high