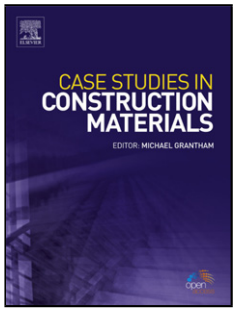

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Mechanical and thermal conductivity properties of hemp fiber reinforced polyurethane composites

S. Sair[1]*, A.Oushabi[1], A.Kammouni[1], O. Tanane[1], Y. Abboud[1], A. El Bouari[1]

[1]University Hassan II of Casablanca, Faculty of Sciences Ben M'sik, Laboratory of Physical - Chemistry of Applied Materials (LPCMA), Driss El Harti, B.P 7955, Sidi Othmane Casablanca.

*Corresponding author: sair.said@gmail.com (Tel:+212 6 62 47 39 06).

Abstract: The aim of the present work is to introduce natural hemp fiber as reinforcement in the preparation of partially biodegradable green composites. Composite of rigid polyurethane (PU) and hemp fiber (H.F) were prepared at different loading rates in (H.F) (5%, 10%, 15%, 20%, 25% and 30%). Water absorption, thermal conductivity, and mechanical properties of composite were investigated as a function of fiber content. The results show that, the thermal conductivity of composites increases linearly with density. The mechanical properties of composites with 15% wt fibers loading provided a 40% increase in strength. Measured properties showed that polyurethane-hemp fibers composite present good insulating properties compared to the traditional insulation materials (glass wool, mineral wool etc.). Therefore, (PU-HF) insulation may provide a promising solution for building insulation.

Keywords: hemp fiber, Polyurethane resin, green composites, thermal conductivity, mechanical properties, Water absorption.

1. Introduction

Recently, the use of natural fibers has increased considerably due to its availability, low-density and price compared to synthetic fibers [1]. Those factors are responsible for the apparition of a new polymer science and engineering research. Natural fibers were introduced with the intention of yielding lighter composites, coupled with lower costs, compared to the fiber glass reinforced polymer composites. Natural fibers have a lower density (1.2–1.6 g/cm^3) than that of glass fiber (2.4 g/cm^3), which ensures the production of lighter composites [2]. Conventional petroleum based epoxy resin [3, 4], polyurethane (PU), are used extensively with natural fibers, such as hemp, jute, sisal, and kenaf [5]. Recently, the rapidly expanding use of composite components in construction, sports, leisure, and other mass production industries, has been focused on sustainable and renewable reinforced composites [2, 5]. Building insulation is one of the most applications of this material, mechanical and thermal properties are the obvious needs in this area. Physical properties of polyurethane-based composites have been widely studied. Hadjadj et al. [6] demonstrated that Young's modulus of PU-Alfa fibers composite improved linearly with the embedded cellulose content, it increase by 250 % to 700 % when the fiber reinforcement is raised from 5 % to 30 %. Radzi et al. [7] have also studied the