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Novel 3-D composite components from cellulose materials

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1. Introduction

Natural composite materials have always been used by the human being although the biodegradable nature of biocomposites leads to the limitation of surviving examples from history. A number of high tech fibres (e.g. glass, carbon) have entered and dominated the composite industries since 1970's because of their superior mechanical and thermal properties, however, composite materials made from crop-based fibres are now receiving much interest and attention since they are considered to be an environmentally friendly product (Fan, 2001; Fan, 2001; Bonfield and Fan, 2000; Fan and Bonfield, 2002). However, studies on the natural fibre composites for building construction have highlighted some of the difficulties in moving the concepts forward into the market places due to:

(1) Inferior image when compared to highly engineered materials.

(2) Lack of knowledge on how to deal with natural differences in plant components and characteristics.

(3) Uncertainty of reactivity and functionality of crop-based fibre composites.

(4) Lack of knowledge of the demand/requirements of end user products/building regulations.

Important development breakthroughs are urgently required at a technical, economical and organizational level to ensure a sustainable and continuing development of crop-based fibres as building construction materials. Brunel University, UK has been engaged in a comprehensive programme to develop a range of innovative products from crop-based fibres and also has carried out a trial for commercial production. This paper is one of a series of papers presenting some of the summarised results from the research programme.

2. Materials and procedure

Sisal plant fibres (agave sisalana) were sourced from a commercial company. The sisal fibres came in two different types: a long continuous fibre form and in random mat form (Figure 1). Main properties of fibres used are tested with a density of 1330kg/m^3, tensile strength of 899 MPa and Emodulus of 8.8 GPa. A general

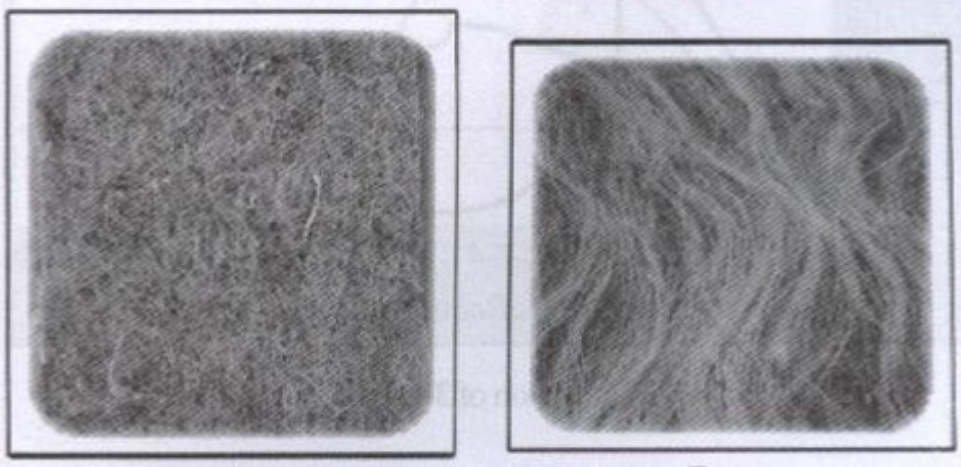

Fig. 1. Sisal materials used (A=Mat, B=long fibres)

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