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DEVELOPMENT AND MECHANICAL CHARACTERIZATION OF BIO-COMPOSITES FOR APPLICATION IN LIGHT-WEIGHT CONSTRUCTION

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ABSTRACT

The present study reports the development of bio-composites for applications in light-weight construction and their mechanical characterization. Bio-composites were developed though impregnation of non-woven fabrics made of natural plant fibres (jute, flax, etc.) with a bio-epoxy resin though vacuum infusion technique. The developed composites were characterized for mechanical properties such as tensile, flexural and impact behaviour and their performance was compared with that of plaster board which is a conventional material used in construction. According to the experimental results, the developed bio-composites exhibited much better mechanical performance as compared to plaster board at much lower weight and thickness and therefore, these materials can be advantageously used in construction applications due to good mechanical performance and environmental benefits.

Keywords: bio-composite, natural fibre, mechanical properties, light-weight construction.

INTRODUCTION

The construction industry, nowadays, is demanding for light-weight environment friendly materials in order to address the sustainability issues. A tremendous interest is being paid on the bio-composite materials for this purpose as they possess several advantages over the conventional construction materials such as light-weight, low environmental impact, less health hazard, produced from renewable resources, etc. (John, 2008). Eco-composites are commonly produced from various natural plant fibres such as sisal, flax, jute, coir, etc. and bio-resins. The reinforcements made from natural fibres can be either unidirectional fibres or woven or non-woven fabrics and this fact strongly influence the mechanical properties of bio-composites. Although reinforcements in the form of woven fabric is more common, non-woven fabrics are also getting much attention in recent times due to their low cost, light-weight, flexibility and Z-directional properties that minimize delamination problem in composites (Tejyan, 2012). In the present study, bio-composites were fabricated from non-woven fabrics made of natural fibre and bio-epoxy resin and characterized for various mechanical properties such as tensile, flexural and impact behaviour. The mechanical performance of these composites was compared to that of plaster board panels.

RESULTS AND CONCLUSIONS

The comparison of weight, thickness and charpy impact energy between plasterboard panel and flax bio-composites is shown in Figure 1. It can be noticed that the bio-composite has

similar impact properties at much lower thickness and weight. Similar trend was also obtained in case of other mechanical properties as well.

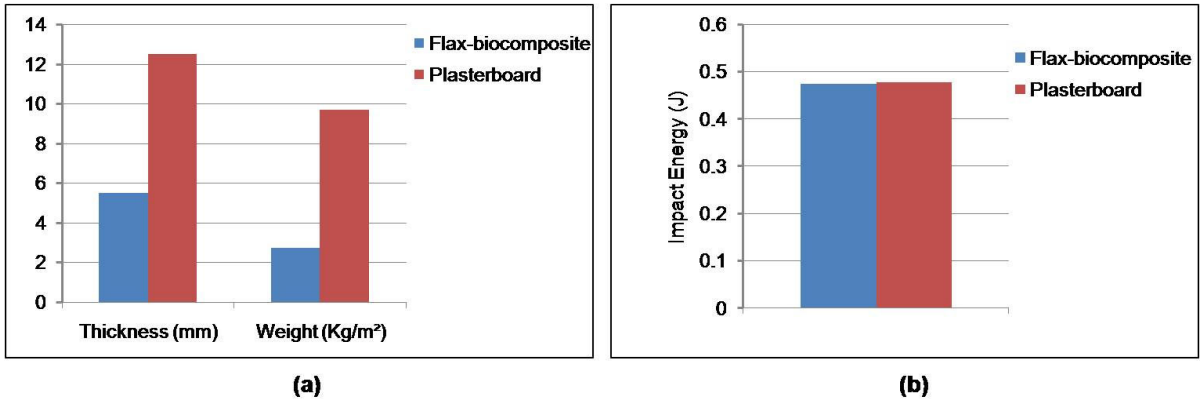

Fig. 1 - Comparison of thickness and weight (a) and impact energy (b) between plaster board and bio-composite

Therefore, the experimental results reflect that the developed bio-composites have better specific mechanical properties as compared to plaster board panels and hence, can be advantageously used for construction of different parts of building as roofs, floors, dividing walls, etc.

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