



Effect of water absorption on the dynamic mechanical properties of pultruded jute fiber reinforced polyester composites

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1. Introduction

Fibre reinforced polymer composites (FRP) have been widely used to replace metal and wood because of their high specific tensile strength, good fatigue resistant, low density, reduction of tool wear, enhancement of energy recovery, good biodegradability and corrosion resistance (Varelidis *et al.*, 1998). Recently, there is the tendency of replacing synthetic fibre such as glass fiber with natural fibre for polymer composites. The reasons are mainly due to the low cost, sustainability and environmental issues (Bradly and Grant, 1995). However, one of the main concerns of using natural fibre reinforced polymer composites is their susceptibility to moisture absorption which can affect the physical, mechanical and thermal properties. Moisture diffusion in polymeric composites has shown to be governed by three different mechanisms (Espert *et al.*, 2002). The first involves diffusion of water molecules inside the micro gaps between polymer chains. The second involves capillary transport into the gaps and flaws at the interfaces between fibre and the matrix. The third involves transport of microcracks in the matrix arising from the swelling of fibers (particularly in the case of natural fibre composites). Apparently, natural fibre reinforced polymer composites will be subjected to

various water conditions where the diffusion mechanisms are expected to differ significantly from one condition to another. Therefore, in this study, three different water treatments were chosen. The effect of three different water treatments on the dynamic mechanical properties was investigated. The dynamic mechanical properties between standard and immersed samples were compared and the effects of pH and immersion time were also recorded.

2. Experimental

2.1. Materials

The PJRC contains approximately 70% of the fibre and typically 30% of unsaturated polyester matrix was used in this study. Jute fibres were supplied by Alam Fiber Impex Ltd, Bangladesh in roving form. Unsaturated polyester resins (Crystic P9901) was supplied by Revertex (Malaysia) Sdn. Bhd. The pultruded composite specimens were produced by pultrusion process which manufactured by using a thermoset pultrusion machine at MMFG Composites Sdn. Bhd, Subang Jaya, Selangor, Malaysia. The PJRC were immersed in typical water treatments such as the sea water (pH 8.9), distilled water (pH 7), and acidic water (pH 5.5) for 21 days (504 hours).

2.2. Apparatus and procedures