A Study Mechanical Properties for Bark Fiber Reinforced Polyester Composit

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Received in :27 September 2012 Accepted in:17 Marcl 2013

Abstract

Bark fiber has high potential use for composite reinforcement in biocomposite material.
The aim of this study is the mechanical properties of Bark fiber reinforced polester composite with varying fiber weight fraction (0% , 5% , 10% , 20%, 30% and 40%) hand lay-up technique which was used to prepare the composite , specimens for tensile , flexural and impact test according to the ASTM D638 , ASTMD790 , and Iso-179. The over all results showed that the composite is reinforced with Bark fiber at weight (10%) higher mechanical properties , and the composite showed improved mechanical (Flexural).

Key words: Natural fibre;Polyester Composite; Mechanical propperties

Introduction

Natural fiber reinforced polymer composite have rasid great interest among material scientists and engineers in recent years due to the need for developing an environmentally friendly material[1]The use of panels made of natural fibre-reinforced compositeswhich are increasing in the automobile indusry[2],It has been observed that natural fibre reinforced composites have properties similar to traditional synthetic fibre reinforced composites. Natural fibre composites have been studied and reviewed by a number of researchers(Dufresne 1997;Dufresne and Vignon 1998;Mao et al 2000;Kaith et al 2003;Nakagaito et al 2004;2005;Bhanagar and Sain 2005).One of the most appropriate examples of this is the substitution of inorganic fibres such as glass or aramid fibres by naturral fiber(BledzkiandGassan 1999;Chauhan et al 1999;Chakraborty et al 2006).All these properties have made natural fibres very attractive for various industries currently engaged in searching for new and alternate prducts to synthetic fibre reinforced composite[3] . New environmental regulation and uncertainty about petroleum and timber resources have triggered much interest in developing composite material from natural fiber [4] . Significant research efforts have been made and currently being spent in developing natural fiber reinforced composites .

Natural fibers have advantages over synthetic or man made fibers such as galss and carbon due to these reasons : Low cost , low density , acceptable specific strength properties , ease of sepration , carbon dioxide sequestration and biodegradability [5] , for household's applications ,furniture composite panels are made from chopped natural fiber that produces wood-replacement products [6] , one of the most widely used natural fibers is Bark fiber which has been successfully incorporated in variety of applications . Bark fiber is the outermost layers of stems and roots of woody plants , plants with bark include trees , woody vines and shrubs [7]

Material and Method

The fibers was Bark fiber obtained from pine bark and the matrix used was polyester , and used the method Hand lay-Up technique for manufacturing the composite with varying fiber weight fraction (5%, 10%, 20% , 30%, 40%) the tensile and flexural tests were carried out using testing machine , Instron 1195 tensile , while impact test used type charpy test , the tensile flexural and impact tests were in accordance to the ASTM D638 , ASTD790 , and Iso-179[8- 10] .

Results and Discussion

The experimental results of tensile strength are shown in figure 1 , the general conclusion can be said that the fiber loading significantly affects the mechanical properties of the composites . the fiber has proven its function by the increase of the tensile strength as compared to neat polyester .

It also can be observed that the composite of (20%) fiber content showed the highest tensile strength .

Fig2 shows that the addition of fiber significantly affects the flexural strength of the composite .

It also can be noticed that the optimal fiber content in order to obtain the highest flexural strength for composite was (10%) wt . The addition of break fiber in the composite also shows significant effect of the impact strength .

Based on the results, there is asimilar trend as shown fig. (1,2) and (3) where the properties for composite showed steep decline beyond their optimum values .

This was due to higher fiber content load to higher fiber to fiber contact . As a result, it led to poor interfacial bonding between the fiber and the matrix and hence adecrease in the

mechanical properties . Thus , it can be said that the maximum fiber content to allow the fiber to fully moistened is by the matrix for compositeswhich were subjected to the optimum fiber content , This explains why beyond the optimum weight fraction , the mechanical properties composites were experiencing steep decline. The size of the fiber affects the interfacial shear , normal stress and fracture characteristics dramatically [11] .

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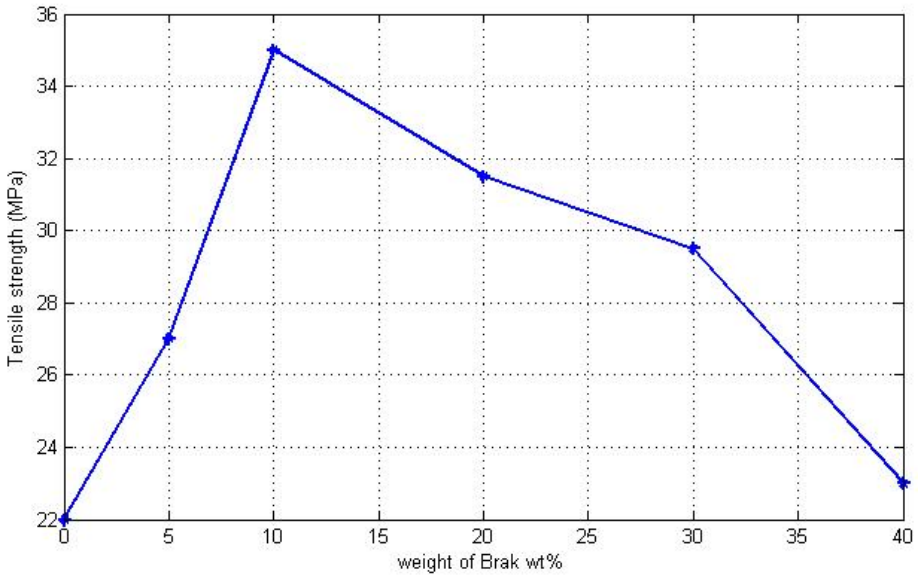
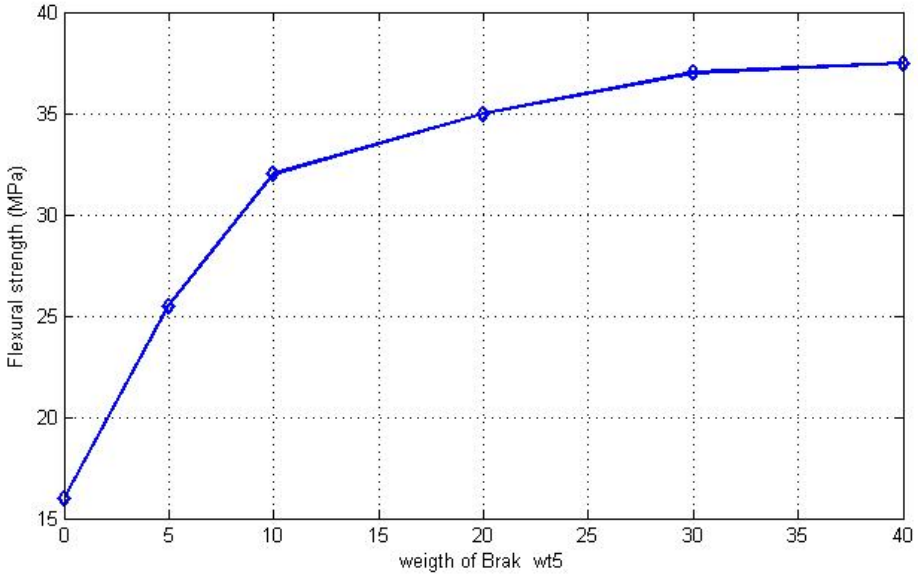
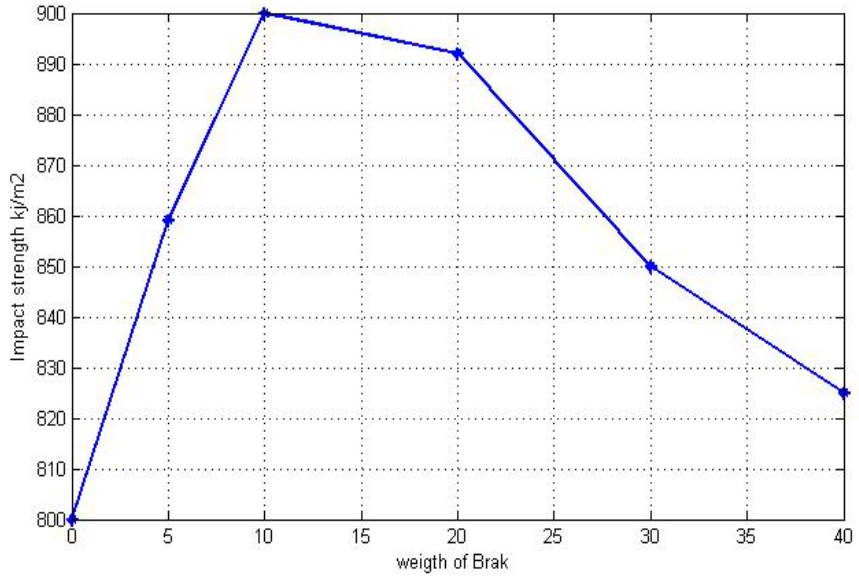


Figare No.(1): Variation of the tensile strength of polestar with weight of bark fiber



Figare No.(2): variation of the flexural strength of polestar with weight of bark fiber



Figare No.(3): Variation of the Impact strength of polestar with weight of bark fiber

دراسة الخواص الميكانيكية لمتراكبات البولي استر المدعمة بلحاء الشجر

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استلم البحث 27ايلول 2012 قبل البحث 17اذار2013

الخلاصة

لحاء الشجر من الالياف التي تتحمل اجهادات عالية عند تدعيمها في المواد ، لذلك فالهدف من هذه الدراسة تدعيم مادة البولي استر التي تعد مادة اساس باللحاء الشجر بنسب وزنية مختلفة هي (40% ، 30% ، 20%،10% ، 5% ، 0%) وحضرت العينات بتقنية التصنيع اليدوي (Hand Lay-up) و استخدمت الفحوصات الميكانيكية كل من الشد ،الصدمة ،متانة القوة (Flexural) و حسب المواصفات (ASTM D638,ASTM D790,ISO-179) .كل النتائج اظهرت ان هناك تحسنا في الخواص الميكانيكية ولاسيما عندما تكون النسبة الوزنية(10%) من الليف اما بصورة عامة فقد كانت افضل النتائج الميكانيكية هو الفحص (Flexural) أو متانة القوة و السبب في ذلك يعود إلى عملية التصنيع و توزيع الليف داخل العينة .

الكلمات المفتاحية:الالياف الطبيعية،متراكبات البولي استر،الخواص الميكانيكية للمتراكبات