Effect of Addition Bio Filler (|Beans Shell powder) Reinforcement By Polyester Composites

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Abstract— This work presents the production of composites with a polyester matrix reinforced with bio filler beans shell (bs).The effect of the beans shell (filler) on the mechanical properties of the composite was experimentally quantified. A preliminary study was earlier carried out the shell in terms of their chemical constituents, functional group and mechanical strength. The shell beans was ground and chemically treated to enhance good bonding and adhesion to the matrix. Composites were fabricated using a hand lay-up or contact mould method for different percentage compositions of the filler. Tests, with respect to the mechanical properties (ie. tensile, Hardness, impact) were carried out. The result obtained was compared with the in forced polyester plate at 10% filler loading, it showed a 79% improvement in tensile properties and 66% increase in impact strength. It was clearly observed that the inclusion of the filler (shell) added strength to the composite. 2. The chemical characterization was carried out by x-ray fluorescent spectrometer (XFR analysis).

Index Terms impact strength , Mechanical properties, beans shell(bs), hardness test, recycling, natural powder,safity inviroment, tensile test.

1 INTRODUCTION

Composites materials consisting of polymeric matrix materials and fiber particles have attracted scientific and industrial interest due to their improved properties. They exhibit superior property enhancement at low filler contents as compared with the counterparts, different types of polymer and fillers have be studied and used for preparation of polymeric composites: Organo clay in rubber (Gatos and Kocsis, 2005), polyester-clay (Park and Jana, 2003).Polypropylene have been used as polymers and reinforced by additions of silica, titanium dioxides, carbon filler particles, layered clays, fiber (Marchantk and Jayara, 2003; Choi et-al, 2006; Uma et-al, 1997). To produce more functional materials, different types of fillers can be used together to obtain diverse favorable properties from the composites. The study on the nutritive value of the shell beans . show that this is of reasonable portentous ratio and protein calorie percent capable of satisfying human protein energy requirement (Isichei and Achinwehu, 1988; Nwamara and Madueke, 2010). Also is economic value of the seed. A 50kg bag of the seed cost approximately three thousand and sixty five naira and is yet to meet the demand in the African Local Market. In its processed form, it is used as snacks (Nwamara and Madueke, 2010).
In this work, shell beans will be used as filler in a polyester matrix to
improve the material's inherent characteristics, especially; mechanical properties(hardness, tensile and impact strength).

2 The aim of this study

Is to improve the mechanical properties of beans shell (ps) filled reinforced PMC. The composites were prepared through hand lay-up technique. The specimens were characterized by mechanical tests.

3 MATERIALS AND METHOD

3.1. Bio filler (beans shell)

The beans shellpowder is a plant that belongs to a family of planate popularly known as Leguminosae and specie of Mimo soideae. Its botanical name is Pentaclethra macrophylla. The seed is covered by a pericarp or shell .

3.2 Polymer matrix composites (PMCs):

The most common advanced composites are polymer matrix composites. These composites consist of a polymer thermoplastic or thermosetting reinforced by filler.These materials can be fashioned into a variety of shapes and size. They provide great strength and stiffness along with resistance to corrosion. The reason for these being most common is their low cost, high strength and simple manufacturing principles.

3.3Thermosetting:

Thermoset is a hard and stiff cross linked material that does not soften or become moldable when heated. Thermosets are stiff and do not stretch the way that elastomers and thermoplastics do [16]. Several types of polymers have been used as matrices for natural fiber composites. Most commonly used themoset polymers are epoxy resins and other resins (Unsaturated polyester resins vinyl Ester, Phenolic Epoxy, Novolac and polyamide. Unsaturated polyesters are extremely versatile in properties and applications and have been a popular thermoset used as the polymer matrix in composites. They are widely produced industrially as they possess many advantages compared to other thermosetting resins including room temperature cure capability, good mechanical properties and transparency [16-17]. The reinforcement of polyesters with cellulosic fibers has been widely reported. Polyester-jute [18], polyester-sisal [19], polyester-core, polyester-banana-cotton, polyester-straw, polyester-pineapple leaf [20] and polyester-cotton-kapok [21], are some of the promising system [5].

3.4 Surface Modification

Chemical treatments were employed for surface modification of beans shell was soaked in 5% sodium hydroxide (NaOH) for

48hours and then washed many time in distilled water and dried in a hot air oven at 70°C for 8h and then stored in a vacuum desiccators' before preparation of composite. Copyright Form

4 Experimental procedure

The composites slabs were prepared by hand layup method or contact mould method. A metallic mould was prepared and the dimension of the mould was 40cm x 15cm and a depth or thickness of 0.3 Polyester resin (NYCIL 6043) belonging to ester family was used as the matrix material, methylethylketone peroxide (MEKP) introduced as the catalyst and combat derivative accelerator (CDA) was used as the hardener .Polyester resin and the hardener were mixed in the ratio of 100:2 by volume and the catalyst methylethyl-kettone peroxide added to effect the chemical reaction. Composites of five different bio filler compositions such as 0wt%3wt%,5wt% and 7wt% and 10wt% also a neat counterpart produced as control. The casting were left for 24 hours for proper curing at room temperature. Specimens of suitable dimension were cut for test. Tensile, hardness and impact test were carried out on each sample specimen. This was done according to ASTMD 638-90 with the aid.

5 Results and dissuasion

5.1 Tensile Strength

The tensile strength of the composite materials depend upon the strength and chemical stability of the matrix with the filler.

From Fig. 2. it is observed that composite high optimum by (10% wt) exhibited maximum ultimate strength (74MPa) when compared with other filled composites but lower than the un-filled composite this may be due to good particle dispersion and strong polymer/filler interface adhesion for effective stress transfer but further increase in filler content (up to 15 % Vol.), the tensile strength is found to be less this is due to more filler material distribution in the material.

5.2 Hardness test

The hardness values shown in Fig. 3 indicated that increase in filler content increases the hardness. The addition of filler content increases the hardness of composite material due to increase in the resistance strength of polymer to plastic deformation. In this case, the polymeric matrix phase and the solid filler phase would be pressed together and touch each other more tightly.

5.3 Impact test

From Fig. 4. it is observed that composite high optimum by (10% wt) exhibited maximum ultimate strength (66MPa) when compared with other filled composites but lower than the un-filled composite this may be due to good particle dispersion and strong polymer/filler interface adhesion for effective stress transfer but further increase in filler content (up to 15 % Vol.), the impact strength is found to be increase due to more filler material distribution in the material.

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6 Helpful Hints

6.1 Figures and Tables

Fig (1) beans shell

Element	Ca(%)	Fe(%)	K(%)	Mn(Ppm)	Cu (Ppm	Co (Ppm)
Concentration	1.58	0.18	9.46	112	53	6 1.32

Table 1 XRF result of chemical compositions of the shells

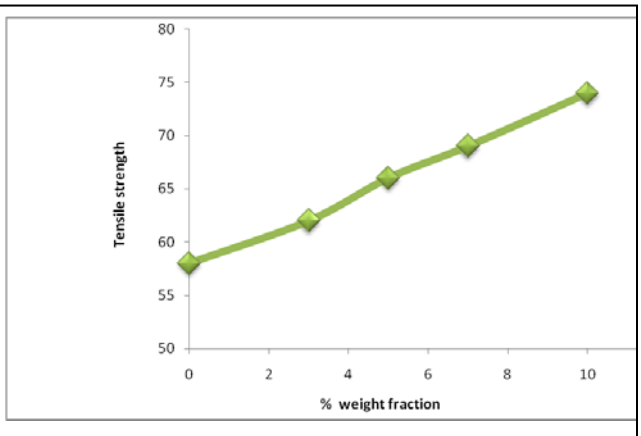
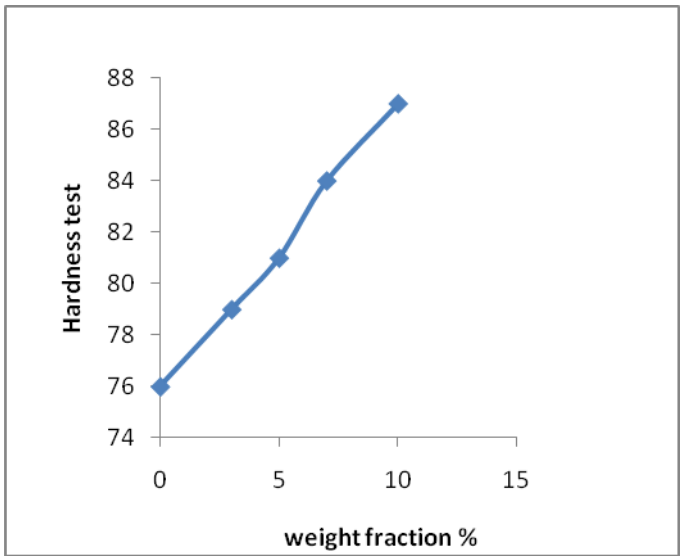


Fig. 1 F**igure (2) Ultimate Tensile Strength for different composition of composite**

Figure **(2) Ultimate Tensile Strength for different composition of composite**



Fig(3) Hardness test

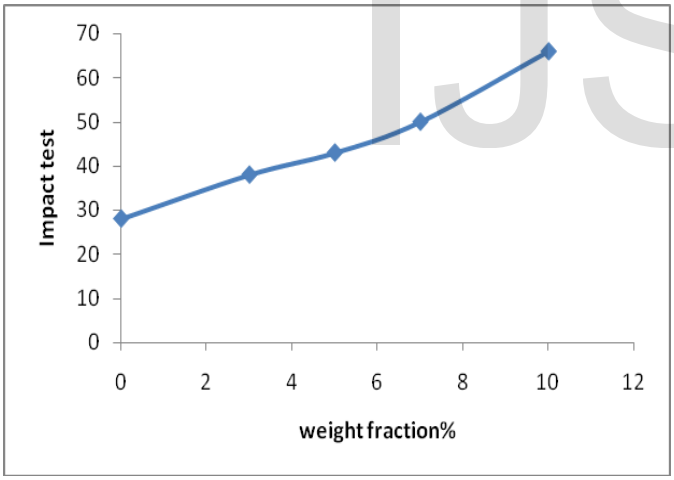


Fig (4) Impact test

7CONCLUSION

From the results obtained in the tests, it was established that the tensile properties of the composites produced with filler showed an appreciable improvement. When 10% filler content was studied, it was noted that up to 74 Mpa on strength when compared with the neat resin. There was also an increased hardness with addition of filler when 10% filler content , it was noted that up to 87 on strength when compared with the neat resin.. There was also decreased impact strength with addition of filler in the composite when 10% filler content was studied , it was noted that up to 28 on strength when compared with the neat resin . Composite filled by 10% Vol. of matrix beans shell (MSb) exhibited maximum hardness number, tensile strength, and impact test this may be due to uniform dispersion and decrease in inter particle distance with increasing particle

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