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TECHNICAL NOTE

# Effect of Redmud Particulates on Mechanical Properties of BFRP Composites

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ABSTRACT

This article reports the effective usage of redmud (RM), an industrial waste, as a novel filler in polymer matrix. The composite has been fabricated with redmud as secondary reinforcement in banana fiber reinforced polyester (BFRP) using compression molding technique. The mechanical properties such as tensile, flexural and impact strength have been studied for different fiber weight percentage, weight percentage of red mud and chemical treatment of fiber. It is observed that the addition of 10 wt percent of redmud improves the impact and flexural properties for both NaOH, silane treated and untreated banana fiber but there is a decreased trend for tensile strength. It is also found that banana fiber particulate composites have superior mechanical properties than the banana/polyester. Addition of redmud to the banana fiber decreases the moisture absorption of the composites. The studies of the scanning electron microscopy (SEM) have been done to know the fracture mechanism.

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## 1. INTRODUCTION

The usage of natural fibers finds more interest among the researchers due to its easy availability, high strength, low cost and more importantly its environmental friendly aspect. Several types of natural fibers such as sisal, bamboo, okra, pineapple, jute, banana, coconut and palmyra are used as a reinforcement along with polymer matrix composites as reported by many researchers. Banana fiber due to its high strength and stiffness is used as a better reinforcement in both thermoplastic and thermoset matrices. Mechanical properties studies on banana fiber reinforced polyester, epoxy and vinyl ester resin has been done and the results are reported [1-7]. In the case of short fiber, the mechanical properties of the composites depends on factors such as fiber length, fiber weight percentage and fiber orientation [8]. The surface modification of fiber using alkali solution and different types of silanes, also enhance the properties to a marginal extent as demonstrated in earlier investigations [9]. N. Venkateshwaran et al. dealt the tensile, flexural and water absorption studies of banana-epoxy composite materials and recommended that these properties can be improved by the hybridization effect of sisal/ banana fiber in different weight percentages [10]. It is also reported that banana fiber reinforced polyester composites with specimen prepared by resin transfer molding [RTM] and compression molding technique with fiber length of 30 mm and weight percentage of 40% was found to be optimal in which enhanced properties were observed [11]. The usage of silica as filler along with banana fiber reinforced epoxy composite and their mechanical properties have been studied. It is noticed that the impact strength of composites increased by the epoxy materials and silica filler. Water absorption studies were also done and it is seen that the silica filled banana composites were suitable for moisture applications [12].

Mechanical and physical properties of unidirectional banana fiber reinforced epoxy filled with silica microparticulates were also carried out and the results indicate that banana fiber with 30%wt showed better mechanical strength. At the same time, the addition of silica filler improves the porosity and moisture absorption but decrease the mechanical strength [13]. Studies on Palmyra fiber reinforced with

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roofline resin was conducted and the optimal weight percentage and fiber length were obtained. In addition, the effect of hybridization of glass fiber reinforced with Palmyra fiber reports increased mechanical strength and decreased moisture absorption [14]. Mechanical properties studies on bio composites has been performed by using bamboo fiber as reinforcement along with polypropylene matrix. The results indicate that more loading of bamboo decreases the mechanical strength [15]. Tensile, flexural and impact strength of sun hemp fiber reinforced with waste polyethylene bags were carried out. The results showed that upto a fiber volume fraction of $0.30V_f$ the tensile, flexural strength increases but the impact strength increases only upto $0.20\ V_f$. Most importantly, the environmental pollution due to waste polyethylene bags can be reduced [16]. Tensile, flexural, and impact properties of coir fiber reinforced polyester composites along with calcium carbonate as a filler reinforcement have been studied by Sathiyamurthy et al. [17].

Redmud emerges as the major waste material during production of alumina from bauxite by the Bayer's process. The redmud which is derived from the bauxite by different methods is potentially applicable to use in building materials due to its strength [18-20].The use of redmud is justified as a potential filler in composite material, using polypropylene as a matrix material. X-ray diffraction and differential scanning calorimeter analysis are carried out and the results indicate that the crystallization effect of the polymer increases with the increase in RM content [21]. An earlier investigation demonstrated that redmud, an industrial waste, used as filler along with bamboo fiber and glass fiber reinforced epoxy composites have been found to improve mechanical properties [22, 23]. Singh et al. reported about sisal fiber reinforced polyester filled with redmud and compared the results with glass fiber. Flexural strength, tensile strength and water absorption studies were carried out for the prepared specimens and the results were reported for the addition of redmud of different fiber loading [24]. Studies on the flexural and compressive strength of geopolymer reinforced phenol resin have been done by Kamalloo et al. and observed that 12 wt% of phenol resin produced enhanced strength [25]. A new type of hybrid composite materials known as fiber – metal laminates (FML) have been developed by Rajabi and Kadkhodayan [26] in which glass-fiber reinforced polypropylene composite laminate and aluminum AA1200-O as the core and skin layers, respectively have been used. Naceri [27] investigated the moisture diffusion properties of glass fiber reinforced epoxy composite. Using the weight gain method, the equilibrium moisture content and the diffusion can be measured. To the authors knowledge, there is no work yet carried out for banana fiber untreated/treated, reinforced with redmud as a novel filler. The present work is focused on the effects of redmud filler along with banana fiber treated and untreated reinforced polyester composites, and its effect on the mechanical properties.

## 2. EXPERIMENTAL PROCEDURE

**2. 1. Materials Used** Banana fiber (Musaceae family) a type of bast fiber, is extracted from the bark of banana plant. Fibers were purchased from local markets in India. The properties of banana fiber were shown in Table 1.

Polyester of density 1.2 g/mL was mixed with catalyst. Resin was purchased from M/s. Vasavibala Resins, Chennai, India. Redmud is collected from M/s. Madras Aluminium Company (MALCO) at Salem, India, and is sieved to obtain particle sizes in the range of 13μm. The composition of redmud is shown in Table 2.

## 3. PROCESSING OF COMPOSITES

**3. 1. Alkali Treated Banana Fiber** Banana fibers were treated with 4% concentration of NaOH to remove the cellulose content in the fiber. In general, the alkali treatment not only remove the non cellulosic component but also the cellulosic component that the microscopic level of destruction in cellulosic component of plant fibers.The transformation of cellulose I to cellulose II was take place during the alkali treatment.This could lead to the formation of amorphous cellulose at the expense of crystalline cellulose [28]. A quantity of 60 g sodium hydroxide is mixed with 1 Lit of distilled water in the tub and the banana fibers are immersed in the diluted NaOH for 1hr. After 1hr, the fibers are taken out and cleaned with distilled water and dried at room temperature for 24 hr.

**TABLE 1**. Properties of Banana Fiber [10]

| Properties | Banana fiber |
|---|---|
| Cellulose% | 63–64 |
| Hemicelluloses% | 19 |
| Lignin% | 5 |
| Moisture content% | 10-11 |
| Density ($kg/m^3$) | 1350 |
| Flexural modulus (GPa) | 2-5 |
| Microfibrillar angle | 11 |
| Lumen size (mm) | 5 |
| Tensile strength (MPa) | 54 |
| Young's modulus (GPa) | 3.4878 |

**TABLE 2.** Composition of Redmud (wt%)

| $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | $Na_2O_3$ | CaO |
|---|---|---|---|---|
| 15.21 | 16.8 | 33.8 | 11.87 | 2.45 |

**3. 2. Silane Treated Banana Fiber** After NaOH treatment, four drops of Trichlorovinyl silane is added to one liter of distilled water, and allowed for the silane particles to filter. NaOH treated fiber is to be immersed in silane treated water for 1hr. Then, the silane treated fiber is dried at room temperature for 24 hr.

**3. 3. Fabrication of Composites** The banana (untreated/fiber treated with NaOH and silane) fiber are cut into optimum fiber length of 30mm which has been reported in early investigations [2]. The unsaturated polyester resin of grade 2303 is used as a matrix. In order to initiate the curing reaction prior to reinforcement, 2% cobalt nephthalate used as an accelerator is mixed thoroughly in polyester resin and then 3% methyl-ethyl-ketone-peroxide (MEKP) used as catalyst is mixed in the resin. The Fibers are arranged in random orientation. Redmud having particle size 13μm is used as filler. First, the polyester is mixed with redmud (manual mixing), and poured in the mould made of EN90 of dimensions 180x160x3mm. After placing the mould in the machine, the mould is subjected to a curing under compressive pressure of 15MPa. After 3hr of curing, the mould is removed from the compression molding machine and placed inside the hot air oven to next 24hours for post curing to prepare the composite combinations.

**3. 4. Scanning Electron Microscopy (SEM)** Scanning electron microscopy was performed for all fractured samples using Hitachi S-3000 model**.**

## 4. RESULTS AND DISCUSSION

**4. 1. Tensile Strength** The effect of Redmud with pure polyester on tensile strength is shown in Figure.1.

RM of different lower weight percentages (5%, 10%, 15%, 20% wt) has been taken and it is observed that more and more addition of redmud decreases the tensile strength value due to the non uniform distribution of Redmud [22]. By addition of 5% wt redmud with pure polyester the tensile strength shows decreased trend then by addition of 10% wt redmud with pure polyester it gets increased to 42 MPa then by further addition of redmud (15%wt and 20%wt) the tensile strength goes on decreasing trend which may be due to dispersion of redmud along with the matrix. Manual mixing process involved in improper mixing of redmud results in uneven trend in mechanical properties. For pure polyester the tensile strength value is 43 MPa is decreased to 30 MPa. The decrease in value is due to the stress transfer takes place along the edges in short banana fiber. In the case of tensile strength for short banana fiber, the strength mainly depends on the fiber length, fiber orientation, and bonding between fiber and matrix. Composites are prepared by varying fiber percentage and redmud percentage. It is observed from the previous research works that the optimal fiber length of banana fiber is found to be 30 mm. Hence, fiber length is taken as 30mm and the fiber percentage is varied from 10% to 40%wt. Rectangular shape specimens are cut from the hybrid composites plate and tested in the universal testing machine and the results are discussed below. Five specimens are tested and the results averaged for each weight ratio. When compared to the untreated (UTC) the alkali treated composites (ATC) and silane treated composites (STC) shows increased strength due to the better fiber matrix interaction. The tensile properties of the composites depend on the weight percentage of redmud filler and fiber elongation in the composite system. The failure rate of the composites increases with the increase in redmud content. Table 3 shows the effect of RM on tensile strength of banana fiber composites. A little drop in tensile strength is observed due to the addition of 10% weight of RM and then it decreases continuously for further addition of RM due to low stresses causes matrix failure.

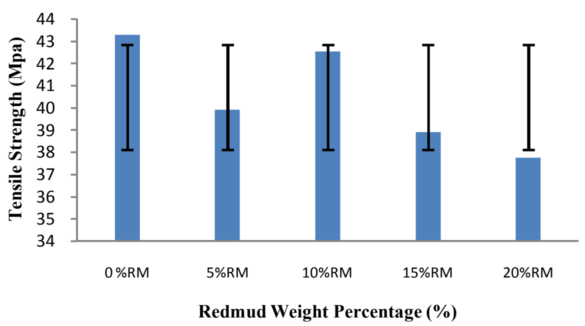


**Figure 1**. Tensile strength of Redmud/Pure Polyester Composites

**TABLE 3.** Effect of Redmud on the Tensile Strength of Untreated/Treated Banana Fiber Composites

| S.No | Redmud weight percentage | Untreated banana fiber | NaOH treated banana fiber | Silane treated banana fiber |
|---|---|---|---|---|
| **1** | 0 | 30 | 35 | 36 |
| **2** | 10 | 35 | 27 | 21 |
| **3** | 20 | 21 | 28 | 13 |
| **4** | 30 | 9 | 21 | 18 |
| **5** | 40 | 7 | 18 | 13 |

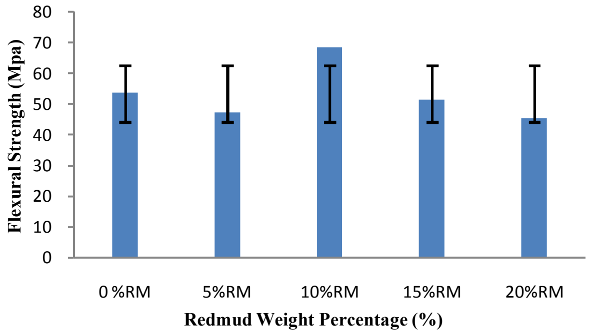


**Figure 2.** Flexural strength of Redmud/Pure Polyester Composites

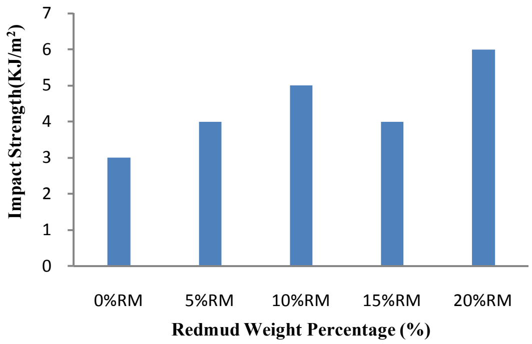


**Figure 3.** Impact strength of Redmud/Polyester Composites

**TABLE 4.** Effect of Redmud on the Flexural Strength of Untreated/Treated Banana Fiber Composites

| S.No | Redmud weight percntage | Untreated banana fiber | NaOH treated banana fiber | Silane treated banana fiber |
|---|---|---|---|---|
| 1 | 0 | 47 | 78 | 58 |
| 2 | 10 | 80 | 56 | 127 |
| 3 | 20 | 29 | 54 | 108 |
| 4 | 30 | 30 | 36 | 58 |
| 5 | 40 | 20 | 26 | 43 |

**4. 2. Flexural Strength** The flexural test is conducted by three points bend test in the universal testing machine. A span of 50mm and a crosshead speed of 2 mm/min was maintained for entire test. Flexural test is performed on all samples as per the standard ASTM D 790 of dimension 127x13x3mm$^3$.

The effect of RM with pure polyester on flexural strength is shown in Figure 2, where the addition of 10%wt RM shows high flexural strength when compared with other weight percentages .

It shows the same trend as that of tensile strength where the manual mixing and dispersion of RM along with the matrix shows uneven trend in results [22]. In the case of flexural strength, same as that of tensile strength the value of pure polyester 53Mpa is decreased to 48Mpa for banana fiber reinforcement. Composites reinforced with 30 mm length, silane treated banana fiber with relative weight percentage of RM has maximum flexural strength of 127 MPa. Among all composites combinations, alkali treated composites (ATC) and silane treated composites (STC) shows increase in the flexural strength when compared with untreated fiber composites (UTC). The treatment of fiber with alkali increases the flexural strength and the same has also been reported by Pothan et al. [9]. The Effect of RM on flexural strength of untreated/treated banana fiber composites is shown in Table 4. The Flexural strength result shows that the composites reinforced with 10% RM having high strength.

**4. 3. Impact Strength** The impact strength is the ability of a material to absorb and dissipate energies under impact loading. Pure resin has very low impact strength but reinforcement of banana fiber with it increases its impact strength significantly. The impact energy absorbed by the composites depends on the fiber arrangement and fiber matrix interface. The debonding of fiber and matrix due to fiber pullout are reasons for the failure of composites due to impact loading [13]. The effect of RM with pure polyester on impact strength is shown in Figure 3, where the addition of RM steadily increases the impact strength for all weight percentages.

The impact value of pure polyester is 3KJ/m$^2$. The impact strength of banana fiber/polyester composites is 165 KJ/m$^2$. The increased strength is due to the high impact energy absorbed by the banana fiber reinforcement. Among all composites combinations, alkali treated composites (ATC) and silane treated composites (STC) shows decrease in impact strength when compared with untreated fiber composites (UTC).

**4. 3. 1. SEM Studies** SEM image of pure polyester is shown in Figure 4(a) where the dispersion of the matrix is uniform along the surface. Presence of gaps are also noted which may be due to the formation of voids. SEM image of banana/polyester composite without redmud have been shown in Figure 4(b) where the strong bonding between fiber and matrix was observed gives better strength. SEM image on the effect of RM with 10% wt on tensile strength is shown in Figure 4(c), by increasing proportion of RM, tensile strength gets decreased. This due to more homogeneity in nature. SEM image of pure polyester after flexural test is shown in Figure 4(d) where the formation of bubbles and blow holes is observed which results in decreased flexural strength.

SEM image on the effect of RM with 10% wt on flexural strength is shown in Figure 4(e). There is no gap between fiber and matrix. Strong bonding is clearly noted which gives high flexural strength value.

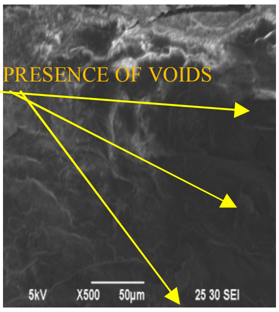


**Figure 4(a).** SEM image of Pure Polyester after tensile test

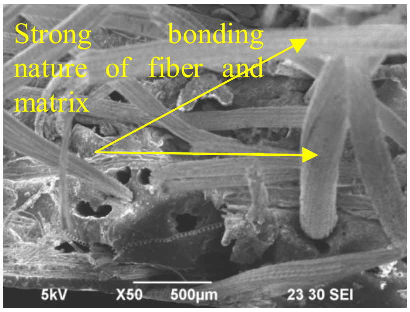


**Figure 4(b).** SEM image of Banana/Polyester after tensile test

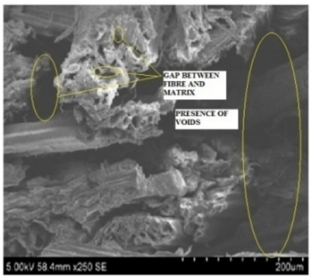


**Figure 4(c).** SEM studies on the effect of 10% wt Redmud on the Tensile strength of 30% wt banana fiber untreated composites

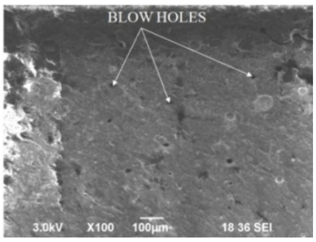


**Figure 4(d).** SEM image of Pure USP after Flexural test


**Figure 4(e).** SEM studies on the effect of 10% wt Redmud on the flexural strength of 30% wt banana fiber untreated composites

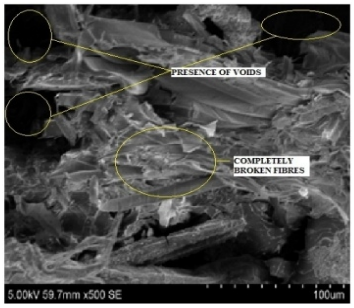


**Figure 4(f).** SEM studies on the effect of 30% wt Redmud on the Flexural strength of 10% wt banana fibre untreated composites

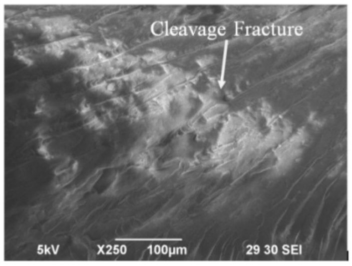


**Figure 4(g).** SEM image of Pure USP after Impact test

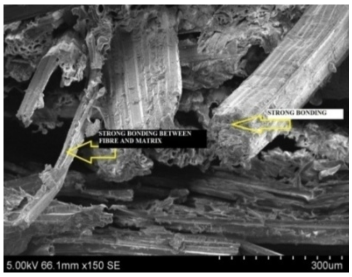


**Figure 4(h).** SEM studies on the effect of 10% wt Redmud on the impact strength of 30% wt banana fiber untreated composites

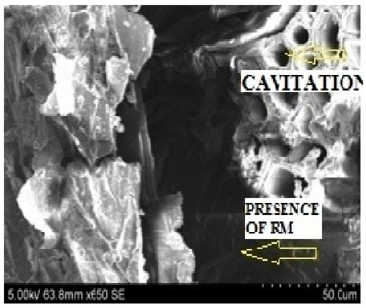


**Figure 4(i).** SEM studies on the effect of 30% wt Redmud on the impact strength of 10% wt banana fiber untreated composites

The presence of voids is observed from Figure 4(f). The gap between fiber and matrix is more which results in low flexural strength value for 30% wt RM filled banana fiber composites

SEM image of pure polyester after impact test is shown in Figure 4(g) where the presence of semicircular arc markings which results in cleavage fracture phenomenon decreases the strength. This could be due to the brittle nature of polyester that leads to easy growing of crack along the direction of crack initiation. SEM image of RM with 10%wt banana fiber composites impact strength is shown in Figure 4(h). It is clearly evident that no fiber pull out phenomenon takes place and also there is strong bonding between the fiber and matrix. It results in more impact energy absorbed which give to high impact strength. In addition, the roughness in the surface shows the presence of redmud which makes bonding better. In the case of Figure 4(i) with 30% wt RM banana fiber composites, cavitation phenomenon takes place as is clearly identified. Formation of cavity makes poor bonding between matrix and fiber which results in low strength. It may be also due to less fiber content and more RM content as observed by the rough surfaces.

**4. 4. Treatment of Fibers** The result shows that 40% weight fraction of NaOH/silane treated fiber without RM filler has high tensile strength of 30Mpa. This is due to the strong bonding nature of fiber and matrix as shown in Figure 4(b). It is also reported by earlier researchers that the alkali treated fiber surfaces were rougher than untreated fibers [29]. Without NaOH/silane treatment, 30% weight fraction of untreated fiber filled with 10% RM composites shows high tensile strength compared to other composite combinations. In general, the addition of RM along with banana fibre reinforcement decreases the tensile strength. This is due to the non uniform distribution of redmud particulates along the surface which occcupies a particular surface area and blocks the bonding of matrix and fibre which results in poor tensile strength. Similar results are also reported for sisal reinforced polyester and bamboo reinforced epoxy composites [22, 24].

The flexural strength of untreated composites reinforced with 10% of RM filler achieves 80MPa which is only 56MPa for NaOH treated fiber and it is 127 MPa in the case of silane treated fiber. It shows that NaOH treatment on fiber results in poor flexural strength due to the poor adhesion between fiber and matrix by the presence of RM along the surface. The fiber gets separated silane treated fiber is seen to have more flexural strength in all weight percentages of RM due to better interlocking of fiber and matrix along with redmud. Reduction of fiber content and more addition of RM filler content shows decrease in flexural strength value.

The treatment of fiber with NaOH removes all the non cellulose components. Morevere, due to the more adhesion between fiber and matrix the plastic deformation of the composites starts increasing which results in reduction of impact energy absorbed [9].The effect of RM on the impact strength of untreated and treated banana fiber composites is shown in Table 5.

The comparison of impact strength shows that 30% weight fraction of untreated fiber with 10% of red mud filler has high impact strength of 264 $KJ/m^2$. There is no significant improvement in property beyond 10% of redmud in the matrix which is due to reduction of fiber content proportionately. The effect of redmud on ATC results in better and increased adhesion between fiber and matrix which increases the strength of the composites, but it is not the only deciding factor of the composites. For impact strength, the impact energy absorbed decreases due to plastic deformation phenonmenon which results in low strength [28]. When compared with ATC, STC shows improved impact results due to vinyl functional group which shows better interface between fiber and matrix.

**4. 4. 1. SEM Studies** It is observed from Figure 5(a) that the presence of voids result in fiber getting completely separated from matrix which yield to low strength. The non uniform distribution of RM particulates occupies the sharp edges of the composites also results in poor strength as shown in Figure 5(a). From Figure 5(b), it is identified that the crack propagation is also a reason for decreased tensile strength. From Figure 5(c), it is observed that the fibers are not uniformly distributed. The fibers gets detached from matrix and they are arranged in patches resulting in crack formation which is the reason for poor strength of NaOH treated banana fiber filled RM. Silane treated banana fiber with 10%wt RM shows high flexural value among all. The fiber and matrix were tightly packed as shown in Figure 5(d). In addition, completely broken fiber is clearly observed after attaining the maximum energy which gives high strength value. Figure 5(e) shows very less presence of fiber which get dispersed from the matrix resulting in low strength. The effect of RM on NaOH treated fiber shown in Figure 5(f), where the poor chemical reactions between RM and NaOH results in the formation of sodium. Thus, it results in debonding and leads to low impact strength. The silane treated fiber with 10% wt RM is shown in Figure 5(g). The homogeneous nature and tight packing results in strong bonding between fiber and matrix. Therefor, the strength gets increased.

**TABLE 5**. Effect of Redmud on the Impact Strength of Untreated/Treated Banana Fiber Composites

| S.No | Redmud weight percntage | Untreated banana fiber | NaOH treated banana fiber | Silane treated banana fiber |
|---|---|---|---|---|
| **1** | 0 | 165 | 51 | 34 |
| **2** | 10 | 264 | 36 | 47 |
| **3** | 20 | 77 | 28 | 42 |
| **4** | 30 | 20 | 28 | 41 |
| **5** | 40 | 12 | 17 | 35 |


**Figure 5(a).** SEM studies on the effect of 10% wt Redmud on the Tensile strength of 30% wt NaOH treated banana fiber composites

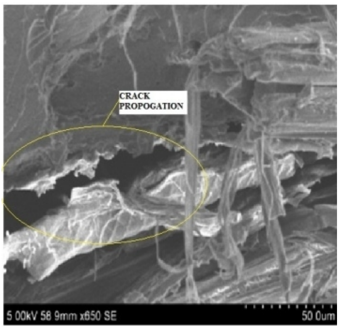


**Figure 5(b).** SEM studies on the effect of 10% wt Redmud on the Tensile strength of 30% wt Silane treated banana fiber composites

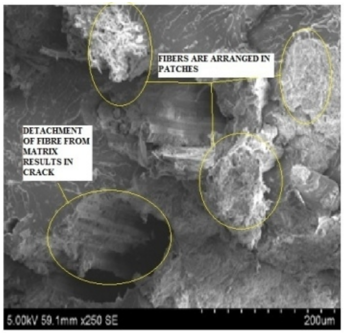


**Figure 5(c).** SEM studies on the effect of 10% wt Redmud on the Flexural strength of 30% wt NaOH treated banana fiber composites

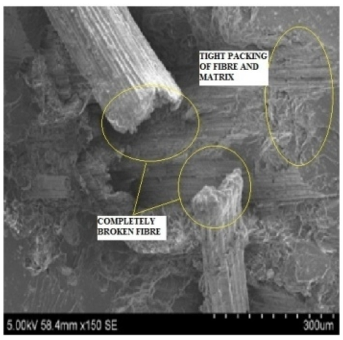


**Figure 5(d).** SEM studies on the effect of 10% wt Redmud on the Flexural strength of 30% wt Silane treated banana fiber composites

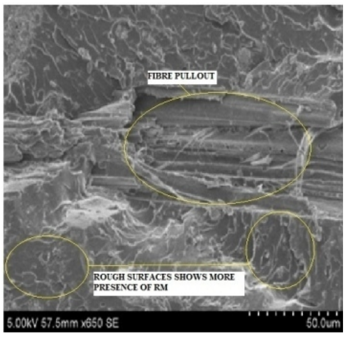


**Figure 5(e).** SEM studies on the effect of 30% wt Redmud on the Flexural strength of 10% wt Silane treated banana fiber composites

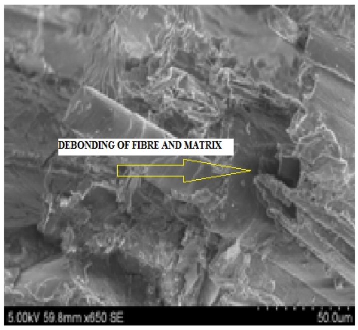


**Figure 5(f).** SEM studies on the effect of 10% wt Redmud on the impact strength of 30% wt NaOH treated banana fiber composites

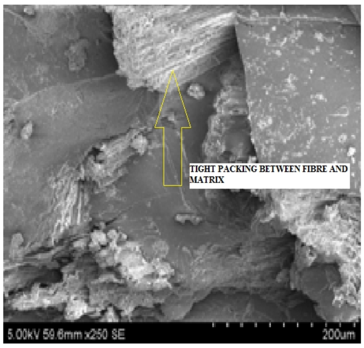


**Figure 5(g).** SEM studies on the effect of 10% wt Redmud on the impact strength of 30% wt silane treated banana fiber composites

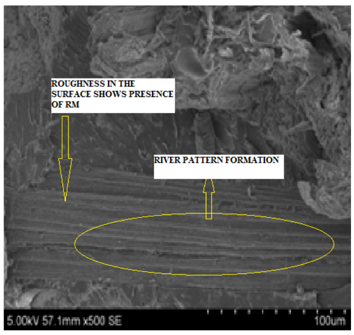


**Figure 5(h).** SEM studies on the effect of 30% wt Redmud on the impact strength of 10% wt silane treated banana fiber composites

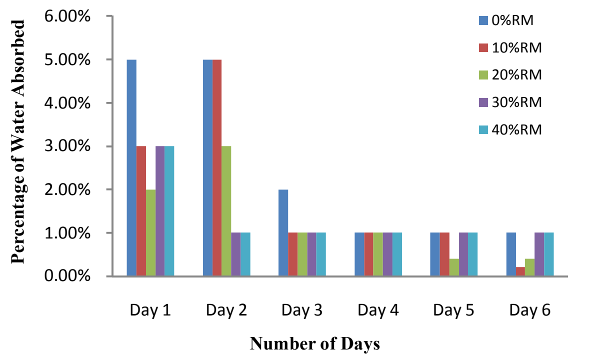


**Figure 6.** Effect of 10% wt Redmud on moisture absorption (distilled water) of 30% wt untreated Banana Fiber Composites

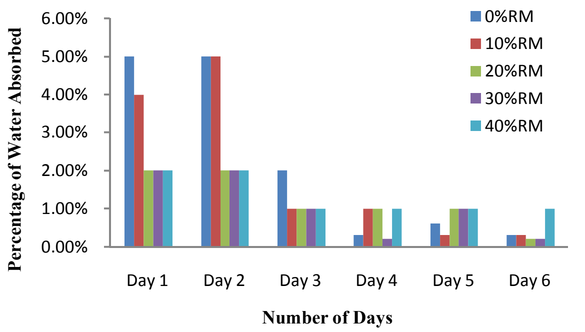


**Figure 7.** Effect of 10% wt Redmud on moisture absorption (sea water) of 30%wt untreated Banana Fiber Composites.

From Figure 5(h), silane treated fiber with 30% wt RM, the river pattern formation is observed which does not initiate the crack propagation. Thus, it results in high strength.

**4. 5. Moisture Absorption Studies** Water absorption test was conducted as per ASTM D570 with specimen size of 20 x 13 x 3 mm. Dry weight of all the specimen were taken using weighing machine with an accuracy of 0.1mg. The water absorption test was carried out using both sea water and distilled water. The specimen readings were taken for 24 hrs. Specimens were thoroughly wiped with tissue paper and then the weight is measured. Water absorption is expressed as increase in weight percent.

Percentage of Water Absorption = [(Wet weight - Dry weight)/ Dry weight] x 100 [10].

Percentage of water absorption in distilled and sea water of RM filled banana fiber untreated is shown in Figures 6 and 7. From this figure, the water absorption rate goes on decreasing as day progress and finally it attains the equilibrium state. In addition, more and more RM filler results in very less percentage of water intake as clearly indicated in the diagram for both cases. The result of water absorption shows that addition of RM filler and reduction of fiber weight fraction combination of composite materials has low percentage of water absorption. It may support that the RM filled banana fiber reinforced polyester composites are suitable for moisture affected areas applications.

## 5. CONCLUSIONS

- Hybrid composites of redmud as novel filler with banana/polyester composites with chemical treatments have been prepared successfully by compression molding technique.
- Superior mechanical properties are observed by addition of 10% redmud fillers to 30% weight fraction of untreated/treated fiber.
- The alkali treated composite exhibits better performance than Silane/untreated composite due to the strong fiber–matrix interaction as evident from the enhanced tensile and flexural properties. The SEM micrograph also witnessed for the results. The lower impact properties of the treated composites compared to the untreated composites is due to the improved fiber–matrix adhesion as evident from SEM images.
- Redmud filled banana fiber both treated and untreated composites are useful for moisture related applications which is confirmed through moisture absorption studies.
- Environmental pollution related issues are minimized drastically, by using the Redmud, an industrial waste, for useful Composite fabrication.
- From all the results, it is proposed that the composite can be used as building materials for wall panels, automotive parts, body panels, helmets and industrial fans.

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# Effect of Redmud Particulates on Mechanical Properties of BFRP Composites

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**چکیده**

این مقاله استفاده موثر از redmud (RM)، زباله صنعتی را به عنوان یک پر کننده جدید در ماتریس پلیمری گزارش داده است. کامپوزیت با RM به عنوان تقویت ثانویه در پلی استر تقویت شده فیبر موز (BFRP) با استفاده از روش قالب ریزی فشرده سازی ساخته شده است. خواص مکانیکی مانند کشش، خمش و مقاومت ضربه برای درصد های مختلف وزن الیاف، درصد وزن RM و تیمارشیمیایی فیبر مورد مطالعه قرار گرفته است. مشاهده شده است که اضافه کردن ۱۰ درصد وزنی از RM، اثر و خواص خمشی فیبر موز تیمار شده با سیلان و همچنین تیمار نشده را بهبود می بخشد، اما روند کاهشی برای استحکام کششی وجود دارد. همچنین نشان داده است که کامپوزیت های ویژه فیبر موز دارای خواص مکانیکی بهتری نسبت به موز / پلی استردارند. افزودن RM به فیبر موز جذب رطوبت کامپوزیت ها را کاهش می دهد. مطالعات اسکن میکروسکوپ الکترونی (SEM) برای دانستن مکانیسم شکستگی انجام شده است.

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