ISSN 2347 - 3983
Volume 9. No. 7, July 2021
International Journal of Emerging Trends in Engineering Research
Available Online at http://www.warse.org/IJETER/static/pdf/file/ijeter01972021.pdf
https://doi.org/10.30534/ijeter/2021/01972021

A Short Review on Fly Ash, Rice Husk Ash and Rice Husk Composites

[1]Aniket Mahadeo Kunbithop, [1]Ganesh Shahaji Chavan, [1]Omkar Shahaji Chavan,
[1]Krushna Sanjay Panchal [2]Akhya Kumar Behera
1.BTECH Student, G.H Raisoni College of Engineering and Management, Wagholi, Pune, India
2. Assistant Professor, G.H Raisoni College of Engineering and Management, Wagholi, Pune, India
Email- akhya.behera@raisoni.net

ABSTRACT

Fly ash is generated during the combustion of coal and rice husk ash is generated by the combustion of rice husk for energy production. Fly ash is industrial waste and rice husk ash is agricultural waste that is widely available worldwide. The utilization of fly ash, rice husk and rice husk ash in various applications has done a great deal to solve the waste problem. The present paper gives a short review of the utilization of fly ash, rice husk and rice husk ash as a composite material. The developed composite material is used in various applications, such as in the automobile industry and in other applications.

Key words: Fly ash, Rice husk, Rice husk ash, composite, epoxy

1.INTRODUCTION

A composite material is defined as a macroscopic composition of two or more distinct materials, having recognizable interface between them [6]. Fly ash waste is waste from coal-fired plants and is produced in plant boilers. Amongst the traditional agricultural waste of rice husks are large volumes produced by rice milling [1]. Nowadays, the automotive industry is looking for lightweights, minimizing the vehicle's total weight. The demand for lightweight materials, for instance for ships' surfaces, resulted in the development of thermosetting resins based on fly-ash, rice husk and rice husk ash [2]. Various techniques are used for preparing ash composite materials, such as the hand lay-up method, the spray method and the filament winding method. The hand lay-up technique with the matrix as the epoxy was used to prepare the composites. During the testing, it was observed that composites have improved qualities such as tensile strength, bending strength and impact strength [2,8]. A different weight percentage of fly ash and resin has been used to prepare the composite. The material was compressed and tested for effect by taking different fly ash weight percentages [3]. Fly ash and rice husk ash or rice husk are still being added to epoxy fiber composites to minimize density as well as enhance the composite modulus [4]. With low concentrations of fly ash, damping capacity and thermal stability were improved. Salinizing of fly ash has been investigated to improve tensile strength and toughness [5]. Epoxy resins are widely used in a variety of engineering and design applications, including pipeline sand slurries for oil refineries, helicopter propellers, pump rotor blades, high-speed vehicles, commercial and military aviation, and automobile applications. This will not only reduce the cost of construction, but also save the environment from land pollution. Different fillers are introduced into the resin during processing to improve its processing and product performance and to lower construction costs [7]. We reviewed journal papers and their procedures for synthesizing composites and their performance in this paper.

2. MATERIAL

The Fly Ash, Rice Husk Ash and Rice Husk composite materials were prepared by using Epoxy as a reinforcement material. Fly Ash, Rice Husk and Rice husk Ash as a reinforcement material.

2.1. Epoxy

Epoxy is a thermosetting resin used as a matrix in composites. The advantages of epoxy resin contribute to reduced composite deformation during treatment, permeability to other materials and high composite strength. Epoxy is used majorly in industrial applications [8].Research has been conducted in various industrial fields for polymer matrix composites by the addition of industrial waste and agriculture waste to reduce the weight and improve the strength [8].

2.2. Fly Ash

Fly ash is industrial waste that collects in the dust collector that flies into the atmosphere, where, at the bottom, it sticks to the incinerator's interior wall due to its weight. Fly ash is less expensive and has high strength [8].

2.3. Rice Husk

Rice husk is found naturally blade of the rice grains. In different polymer matrices, rice husk ash is a kind of natural fiber obtained from sewage sludge and organic waste. Rice husks are among the traditional residues that are easily obtained from the rice milling process in huge quantities [8].

2.4. Rice Husk Ash

Rice husk ash fillers are made from rice husks, that are typically considered agricultural waste and a health risk. Rice husk is burned outside of the rice mill in the open areas then conversion of rice husk into rice husk ash. Other supplementary materials, such as slag, silica fumes, and fly ash, were shown to be superior to rice husk ash. Rice husk ash includes 86% to 96% silica, as well as organic compounds, alkalis, and other organic compounds.[6]

3. PROCESSING METHOD OF COMPOSITES

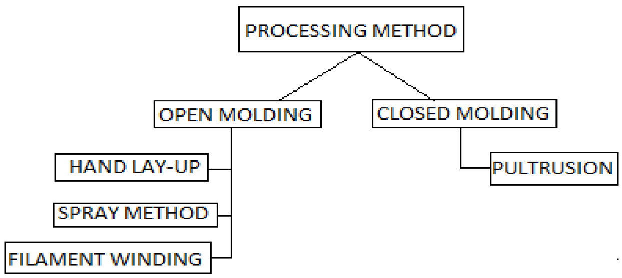

Figure1: Processing Method of Composite

3.1. Open Molding

Open molding is cheap and the production of composites is an efficient way. Open processes for molding include spray up, hand layup and filament winding, etc. A single-sided shell is used to act as a form and the cosmetic surface of the component is employed in this process. On the prepared mold surface, a gel cover is applied. The open molding processes use various methods, such as hand lay-up, spray-up, filament and casing methods.

3.1.1. Hand Lay-Up Method

The hand lay-up method is the most common because the least amount of equipment is needed than spraying and filament winding method. The cost of this process is less than the entire process. It having the capacity to a produced wide range of products. In that, both sides of the hybrid composite are finished and there is more control of fiber orientation than in the spray method.This process is used for the preparation of small and large items, including ships, tanks and showers [9]. Figure 2 shows the schematic of the hand lay-up process.

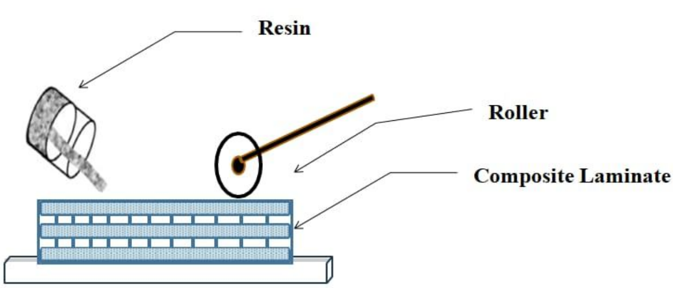

Figure 2: Schematic Figure of Hand Lay-Up Process

3.1.2 Spray Method

The spray method is also called the spray layup process. In that error can be corrected by re-spraying. This method is slower than the hand lay-up method and there is no control of fiber orientation. This process is not environmentally friendly. In that only one side of the hybrid, composite is finished. Figure 3 shows a schematic image of the spray process.

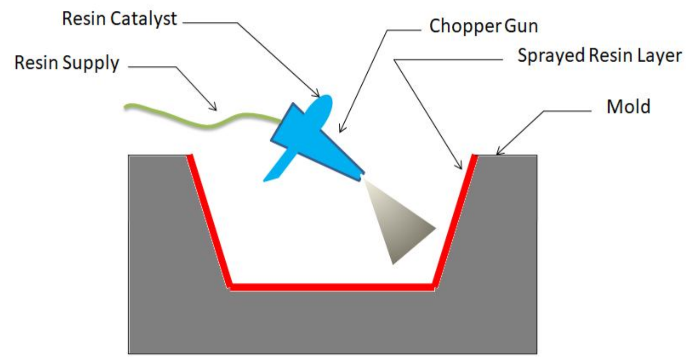

Figure3: Schematic Image of Spray Method

3.1.3. Filament Method

The filament method is an automated process. It is the high-speed process than both of hand lay-up method and spray method. It is an expensive method. In that expensive die are used but that dies are easily messed up.

3.2. Closed Molding

In the closed molding process, composite materials are processed and cured and closed to the environment. Firstly, when a two-side finish is required, and secondly, when a high production volume is required, closed molding is considered in two cases. Closed molding is a costly method compared to open molding.

3.2.1 Pultrusion Method

The pultrusion method is a readily automated process. The labor cost of this process is very low. The finished parts are very strong. This process is more expensive than the open molding process. This process is not affordable. Pultrusion is used for making components such as trusses, tubes and shafts in a golf club. Figure 4 depicts a schematic representation of the extrusion process.

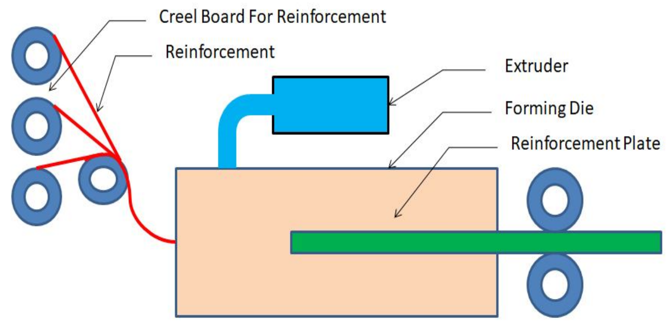

Figure 4: Schematic Figure of Pultrusion Method

4. RESULT AND DISCUSSION

As we studied many research papers on this, we analyzed that the properties of the composite are changed by varying the weight of the fraction of Fly ash, Rice Husk and Rice Husk Ash and Epoxy.

4.1 Impact on Mechanical Properties

Padhee "*et.al* " had prepared the composite by using a wooden-sized mold that was used to cast the composite plate. The specimens were examined with various rice husk and fly ash weights as shown in figure 5. The fly ash (5%) combined with epoxy and hardener was thoroughly mixed with gentle agitation to reduce the air interference with different weights in the rice husk (10, 15 and 20%). In a 10:1 ratio, epoxy and hardener have been mixed. The mixture is then poured into the mold cavity using the hand layup technique. A mold release agent has been introduced to the inner mold surface to rapidly and easily remove the composite sheets. The formation of air bubbles has been effectively avoided. The mold could be healed within 24 hours at room temperature. After 24 hours the specimens were tested from the mold, which was cut into various sizes for further experiments as standard, then observations are,

a) Fly Ash (b) Rice husk

(c)

Figure 5: (a) Fly Ash and (b) Rice husk (c) Rice Husk Ash [8]

In decreasing order, rice husk concentrations of 10, 15, and 20% have maximum strengths of 35, 33, and 32 MPa. The strength of the composite decreases with an increase in rice husk concentration. The rice husk of 10% gives the maximum strength of 35 MPa to the hybrid composite. Figures 5, 6, 7, and 8 show the stress-strain diagram of composite sheets of rice husk volume fraction of 10, 15 and 20% respectively.

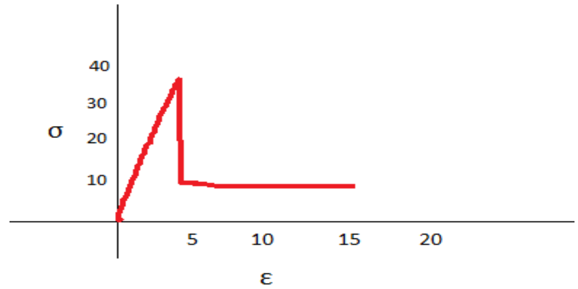

Figure 6: Stress-strain curve of 10% of Rice Huskcomposite [8]

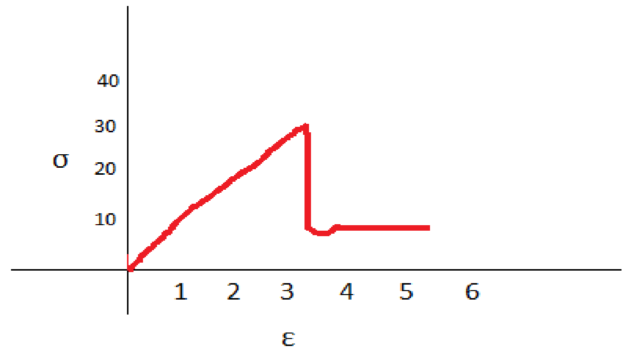

Figure 7: Stress-strain curve of 15% of Rice Husk composite[8]

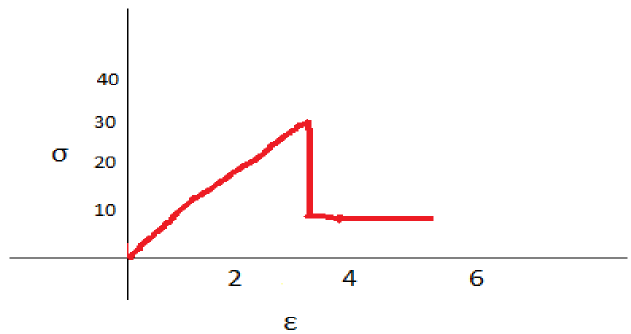

Figure 8: Stress-strain curve of 20% of Rice Husk composite [8]

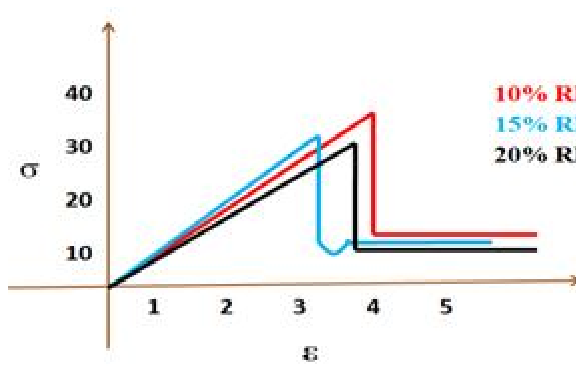

Figure 9: Stress-Strain Curveof 10%, 15, % and 20% Rice Husk composite [8]

Flexural Test

The composites have 10, 15 and 20 volume fraction of RH the flexural modulus of 4881.75, 2846.7 and 2884.8 MPa respectively. The flexural modulus at 10% RH is the highest, followed by 15% and 20% RH[8].

Water Absorption Test

The fly ash composites prepared by using the hand layup technique have been analyzed in the water absorption test. The weights of composites were measured by electronic balance after absorption of water. The composites have weight gained after absorption of water for up to 72 hours of 5, 15 and 20% of 10, 15 and 20% RH respectively. The voids in the composite increased as the RH vol. percentage increased[8].

Hardness and Impact Strength Test

The hardness of the composite was tested with a rock well hardness tester to the ASTM standard (D-785). The hardness of 10, 15 and 20% RH composite shows 65, 60.8 and 70RC respectively. The hardness of 20% RH is higher as compared to 10 and 15% of the RH composite. The impact strength of the 10% RH composite was 8.91 J/m as compared to 15 and 20% RH of 16 and 20.8 J/m respectively. The impact strength of the composite increases with an increase in RH concentration [8].

Effect on Viscosity

Sim "*et al* " have been prepared composite by the stir casting process. The slurry was produced by adding the epoxy in the same manner as the volume of epoxy with such a diluent of 5 wt.%. First, the viscosity of the mixture was measured, whereas the amount of fly ash continued to increase at room temperature from 0 to 10, 30 and 50% of the volume of the fraction. Second, the temperature changes with viscosity and slurry viscosity have been measured at 10%, 30% and 50% of the volume of the fraction respectively. A viscometer was used to measure the viscosity change rate[9].

Poslinski "*et al* " have been prepared composite by using the stir casting process. The volume of 10% of FA gives the result. The influence of viscosity varies based on the volume percentage of the matrix, the filler materials used, and the temperature. The viscosity of the slurry drops as the temperature rises, but the fluidity of the epoxy resin rises. The viscosity varies depending on the volume percentage of the matrix as well as the filler materials used, as well as the temperature [11]. When comparable fly ash is 10% volume of fraction, the viscosity of the slurry is 0.256 Pa-s continues to decrease as the temperature rises 60^0C[12].

Damping Properties

Singh "*et al* " have been synthesized composite by using the hand layup technique process. The volume of 30% and 50% of FA gives the result. Sing et. al. has prepared a fly ash composite by using a hand layup process at room temperature. process. The volume of 15% of the FA gives a higher damping factor as compared to the other volume fractions of the FA. It is conducted on a vibration test machine for both the natural frequency and damping of the composite with fly ash epoxy resin glass fiber as filler and for the epoxy composite with different volumes of fraction. Several epoxy composites have been produced in this work. A cured epoxy composite damping test was performed with a tension-compression mode in the range of temperatures of 40 to 150°Centigrade and a frequency range of 10 to 800 Hz. The results show that the tangent delta (tan) values for composites with a 30 to 50% volume fraction of fly ash reach their peak values at glass transition temperatures, and the tan values reduce slowly with greater frequency, signifying that the damping properties of these kinds of composites seem to be better than those of other composites [14]. The inclusion of fly ash raises the natural frequency and damping factor of the composite by up to 15% by weight. The maximum increase in natural frequency is 52Hz and the damping factor is 4.55%. The natural frequencies, as well as the damping factor, are diminished when more than 15% of fly ash is added [14].

Tribological Properties

Majhi "*et al* " have prepared a fly ash composite by using the hand layup process. The volume of 10 % RHA gives the least wear rate. The higher weight percentage of the rice husk ash also shows a lower wear rate. Also, abrasive wear losses were reduced and wear resistance property was obtained. The specific wear rate has been reduced by the addition of rice husk ash. They found that 10 weight % of optimum fiber content gives maximum wear resistances is 0.7×10^{11} m3/nm [15]. The addition of rice husk ash with epoxy resin improves the wear-resistant property. The adhesiveness between rice ash and epoxy appears to be poor as the composite wear rate increases due to the accumulation of rice husk ash [15].

5.CONCLUSION

The Fly ash and rice husk are used as reinforcement with epoxy matrix to synthesis high performance composites by a different process. It is found that composites with 10% rice husk and 5 % fly ash, with an epoxy matrix, will be appropriate for structure application once natural fiber reinforced composites have been produced from waste, which includes fly ash and rice husk. For such purposes, composites with rice husk of 15 or 20% may not be used. The car industry is now looking for lightweight materials to reduce the vehicle's actual weight. The 15 and 20% rice husk composite can be used for the production of automotive components. However, these are not suitable for working in humid environments. However, it is recommended that 10% of the rice husk composite be designed for construction purposes such as packaging, interior decorations, washing machine bodies and household appliances. The fly ash fraction with Epoxy resin glass fiber reinforced composite volume increases. The composite damping capacity then increases, while the fly ash is increased by more than 15 % and the fly ash is additionally damped. Adding rice husk ash to the epoxy resin can help decrease abrasion loss considerably. The wear strength is also increased by using a 10% fraction of the weight of the fiber. If the surface of the rice husk ash seems to be well treated, the reinforced epoxy wear resistance composite property can be increased. With the addition of fiber, the specific rate of wear of the composite decreases. The weight found to be 10%. The maximum wear resistance is 0.7×10^{11} m3 /nm fiber content.

6. ACKNOWLEDGEMENT

It gives me great pleasure and satisfaction to present the review paper titled "A Short Review of Fly Ash, Rice Husk Ash, and Rice Husk Composites".
We would like to take this opportunity to thank our guide, Assistant Professor Akhya Kumar Behera, for giving us all the help and guidance we needed. which also helped us in doing a lot of Research and we came to know about so many new things, we are really thankful to them. we really grateful to him for his kind support. His valuable suggestions were extremely beneficial.

REFERENCES

[1].Saxena M, Morchhale RK, Asokan P, Prasad BK. **Plant Fiber Industrial Waste Reinforced Polymer Composites as a Potential Wood Substitute Material**. *Journal of Composite Materials.* 2008;42(4):367-384.

[2].Harish S, Michael DP, Bensely A, Lal DM, Rajadurai A. **Mechanical property evaluation of natural fiber coir composite.***Materials characterization*. 2009 Jan 1;60(1):44-9.

[3].Singla M, Chawla V. **Mechanical properties of epoxy resin–fly ash composite**. *Journal of Minerals & Materials Characterization & Engineering.* 2010 Mar 20;9(3):199-210.

[4]. Rout AK, Satapathy A. **Study on mechanical and tribo-performance of rice-husk filled glass–epoxy hybrid composites**. *Materials & Design*. 2012 Oct 1;41:131-41.

[5].Subham, P. and Tiwari, S. K. **Effect of Fly Ash Concentration and its Surface Modification on Fiber Reinforced Epoxy Composite's Mechanical Properties**. *International Journal of Scientific & Engineering Research*, Vol.4, 2013,pp.1173-1180.

[6]. SBVJ, C. B., Arun, K., & Eswaraiah, B. **Fabrication and Testing of Natural (Sisal) Fibre Reinforced Polymer Composites Material**.*International Journal of Emerging Trends in Engineering Research*, Volume 3, No.5, May 2015.pp.2347 - 3983

[7].Vishnu, G. Manavendra, **Experimental Investigation on Thermal Properties of Fly Ash Reinforced Epoxy Composite**. *International Journal of Innovative Research in Science, Engineering and Technology*, Vol. 5, Issue 12, December 2016.pp.20723- 20729

[8].Mishra, Padhee. **Evaluation of Mechanical Properties of Rice Husk-Fly Ash-Epoxy Hybrid Composites**. *IOSR Journal of Mechanical and Civil Engineering*, Volume 14,Issue 3 Ver. VI. (May - June 2017).

[9].Sim J, Kang Y, Kim BJ, Park YH, Lee YC. **Preparation of fly ash/epoxy composites and its effects on mechanical properties**. *Polymers.* 2020 Jan;12(1):79.

[10]. Saleh, Nehad & H. Al-Maamori, Mohammed & Al-Jebory,, Mohamed. (2014). **Evaluating the mechanical properties of Epoxy resin with Fly ash and Silica fume as fillers**. *Advances in Physics Theories and Applications.* 30. 1.

[11].Y. Kang, W. Lee, J. Hwang and Y. Lee**. Influence of glass microsphere filler on the rheological behavior of an epoxy resin**. *International polymer process.* Published April 27, 2018

[12].Poslinski AJ, Ryan ME, Gupta RK, Seshadri SG, Frechette FJ. **Rheological behavior of filled polymeric systems II. The effect of a bimodal size distribution of particulates.** *Journal of Rheology*. 1988 Nov;32(8):751-71.

[13].Gu J, Wu G, Zhang Q. **Preparation and damping properties of fly ash filled epoxy composites**. *Materials Science and Engineering*: A. 2007 Apr 15;452:614-8.

[14].S. K. Tiwari, Ashwani Kumar, Dhananjay Singh. **Effect of Fly Ash on the Damping Behaviour of Glass Fiber Reinforced Composite**. Journal *of Experimental & Applied Mechanics* , Vol 5, Issue 2, September 2014.

[15].Majhi S, Samantarai SP, Acharya SK. **Tribological behavior of modified rice husk filled epoxy composite**. *International Journal of Scientific & Engineering Research.* 2012 Jun;3(6):180-4.