EVALUATION OF IMPACT PROPERTIES OF BIOCOMPOSITE MATERIAL REINFORCED WITH WASTE CORNHUSK FIBER.

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***Abstract*-Composite materials are used widely in various manufacturing and construction applications worldwide. These composite materials are mostly manufactured from petroleum by products like glass fiber, carbon fiber, aramid, etc. While fabricating such fibers a lot of toxic gases are emitted in the atmosphere. Along with this, while working on glass fibers very fine particles of fibers are suspended in air which are carcinogenic and may cause harm to humans by inhaling it. A better feasible solution is to replace such petroleum derived fibers with naturally derived fibers which are renewable and non-polluting to environment. In this research, we have develop a bio-composite from waste materials in which fibers from unused corn husk were used as reinforcement and corn starch was use as matrix. The husk were treated with NaOH solution to separate the fibers from husk and to remove any wax present in it. The starch was prepared with gelatinization process. The laminates were fabricated with hot press moulding process. Later tensile testing were done to evaluate laminate strength.**

Keywords- Bio-composites, waste, cornhusk, corn starch, NaOH

I. INTRODUCTION

In this industrialized world there has been huge development in composite materials which gives wide range of applications with minimal processing cost. Composite material is a combination of various materials with varying physical and chemical properties where different strengths, weights, densities, volumes can be altered or added as per the client requirements. Mainly for long lifespan composites are made from synthetic materials obtained from petroleum products by long processing units. Carbon fiber, glass wool, aramid etc are some synthetic fibers which are affecting the global ecosystem.

In last, two decades there has been awakening among the people regarding conservation of environment for better future. So nowadays engineers are working on developing of “Green material” which will be obtained from natural fibers and resins. Bio-composites are blending of natural fibers and natural matrix. These materials will be completely eco-friendly by giving a clean and healthy environment. It will lead to better life standard for people mainly in developing nations. In nature, various natural fibers are available like cotton, kapok, milkweed, coir, flax, hemp, jute, ramie, kenaf, pineapple, abaca, henequen, sisal, wheat, maize, barley, rye, oat, rice, bamboo, bagasse, esparto, phragmites, etc. In German automotive production there has been increase in the use of natural fibers from 9,600 tons in 1999 to 19,000 tons in 2005 without using cotton and wood [1]. This shows bio-composites have made good progress in last few years.

Some of the developing nations such as India, Philippines, Malaysia, Indonesia and some of the African countries have made National projects on utilization of their agro wastes [1]. Different types of composites are made from different fibers like banana with corn starch matrix[2], rice straw with corn starch matrix[3], green coconut fibers with cassava starch, corn starch [4] etc. As in India, the corn production is high so with that it has its waste which is in the form of husk. These waste husk have fibers which can also be used in making bio-composites and these fibers were not yet used in making composites so taking under this in consideration we decided to work on corn husk fibers.

II. EXPERIMENTATION DETAIL

A. Material

Waste corn husk were collected from the local market and were clean to remove dust by washing them under running tap water. For extraction of fibers from corn husk they were treated with alkaline treatment. Diluted NaOH solution with water was used (5gm/ltr) [5], extracted fibers were then washed thoroughly with running tap water until the pH level of 7.5-8 was reached.

Fig:1- Waste Corn Husk

Fig:2- Alkaline Treatment

Fig:3- Extracted Fibers

Corn starch was obtained from local retailers and glycerine was obtained from local medical store for preparation of thermo setting starch matrix. The thermosetting starch was developed by mixing corn starch with glycerine and the mixture was stirred continuously while heating. After that water was added to the mixture while being stirred and heated until no granules were present. The prepared matrix was kept in air tight container overnight.[1]

Fig:4- mixing of corn starch and glycerine

Fig:5- Heating of Mixture

Fig:6- Prepared Matrix

B. Sample preparation.

For the preparation of sample, fiber extracted were placed in the die carefully with caution of spreading the fiber equally throughout the die. The prepare thermosetting starch was emulsify before adding it in the die. The laminate placed in the die was hot compressed at temperature of 140℃ ± 10 ℃ for three to four hours. The die was then allowed to cool in atmospheric condition.

Fig:7- Fiber and Matrix placed in Die

Fig:8 Finished Laminate

C. Impact Testing

The impact test was performed on the laminate by ASTM D 256. Test was carried on the Charpy Impact Testing Machine. The sample tested were having varying fiber and matrix content.

Fig:9- Tested sample with 20% fiber

Fig:10- Tested sample with 30% fiber

III. RESULTS

D. Impact test

The specimen tested had good impact properties and the strength increases as the fiber content in the laminate increases.

Table no.1:- Impact Test Results

Fiber %	Sample	Volume(m^3)	Impact (Joules)	Stress[σ] (MPa)
20	A_1	4.095×10^{-6}	53	12.942
	A_2		49	11.965
	A_3		51	12.434
30	B_1	2.457×10^{-6}	50	20.35
	B_2		48	19.53
	B_3		49	19.943

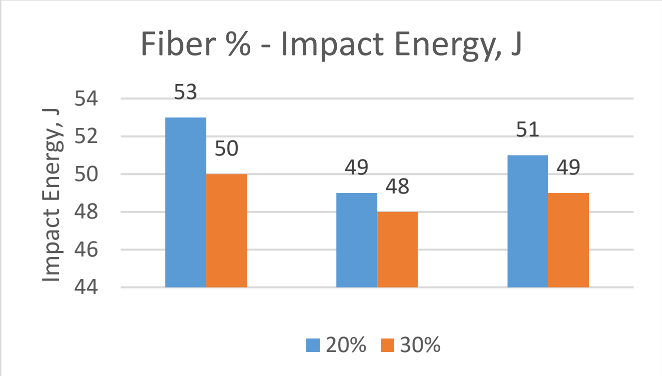

Fig:11-Graphical Representation of Results

IV. CONCLUSION

The bio-composite laminate made from corn husk fiber and corn starch is completely natural and has good impact strength. As the fiber content increases enduring stress taking capability of the composite increases.

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