DEVELOPMENT OF COMPOSITE BOARD BY USING BIODEGRADABLE PROTEIN FIBER

A PROJECT REPORT

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BONAFIDE CERTIFICATE

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ABSTRACT

Chicken feathers are disposed into the waste stream and land filling/ animal feed without any value utilization. According to the recent survey, about 3.8 billion pounds of chicken feather are dumped as waste. This creates a major environmental pollution. Chicken feathers are collected and separated into barbs and quills Feathers are washed with soap solution .The jute fibre are cut into required size. Fibre manually mixed in the ratio of 75:25 : 100 respectively. Then the mixed fibre are feed into the miniature carding machine.

The prepared webs are used to produce composites using the compression moulding machine and composite specimens are produced at different process conditions. The mechanical properties of the prepared composites are tested.

Finally, the sound proof testing is carried out for the prepared specimens. In this project we have explained the new way of using the chicken feather into sound proof composites.In this regard we able to control one type of pollution(noise) using the chicken feathers which contributed another type of pollution (environmental pollution)

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CHAPTER I

1. INTRODUCTION

Natural fiber reinforced polymer composites have raised great attention and interest among materials scientists and engineers in recent years due to the considerations of developing an environmental friendly material and partly replacing currently used glass or carbon fibers in fiber reinforced composites. They are high specific strength and modulus materials, low priced, recyclable and are easily available. Some experimental techniques, from micro scale to macro scale have been employed to evaluate the interfacial performances of this kind of composites. It is known that natural fibers are non-uniform with irregular cross sections which make their structures quite unique and much different with man-made fibers such as glass fibers, carbon fibers etc. Many researches have been conducted to study the mechanical properties, especially interfacial performances of the composites based on natural fibers due to the poor interfacial bonding between the hydrophilic natural fibers such as sisal, jute and palm fibers and the hydrophobic polymer matrices. But reports on composites using bird feathers as reinforcing fibers are rare.

Materials derived from chicken feathers can be used advantageously as the reinforcing materials in polymer matrix composites. Such applications can potentially consume the huge quantity of feathers produced annually as a by-product of various poultry units worldwide. To aid the development of successful applications for chicken feather in composite making, this research work has been taken up. The objective of this investigation is to develop an eco-friendly, light weight sound proof composite from a cheap and easily available material at a lower cost.

Today much importance is given to the acoustical environment. Noise control and its principles play an important role in creating an acoustically pleasing environment. This can be achieved when the intensity of sound is brought down to a level that is not harmful to human ears. Achieving a pleasing environment can be obtained by using various techniques that employ different materials. One such technique is by absorbing the sound and converting it to thermal energy. Fibrous, porous and other kinds of materials have been widely accepted as sound absorptive materials. In this project we have attempted to produce sound proof board using chicken feather fibre reinforced composite which combines the advantages of natural fibre reinforcement and good thermal conductivity of chicken feather fibre.

CHAPTER II

2. LITERATURE REVIEW

This content show the structure and properties of Chicken feather fiber,jute and Polypropylene, Composite manufacturing technique and evaluation method of fibers.

2.1 CHICKEN FEATHER FIBER

2.1.1 STRUCTURES OF CHICKEN FEATHER

In chicken Feathers there are two portions the first portions is barb and second one is quills and these fibers are both made of the protein keratin, the stuff of hair, nails, and wool. But the quill is hard and has a disorganized microscopic structure, while the fibers are soft and possess a very orderly microstructure (fig2.1)(REF 1)

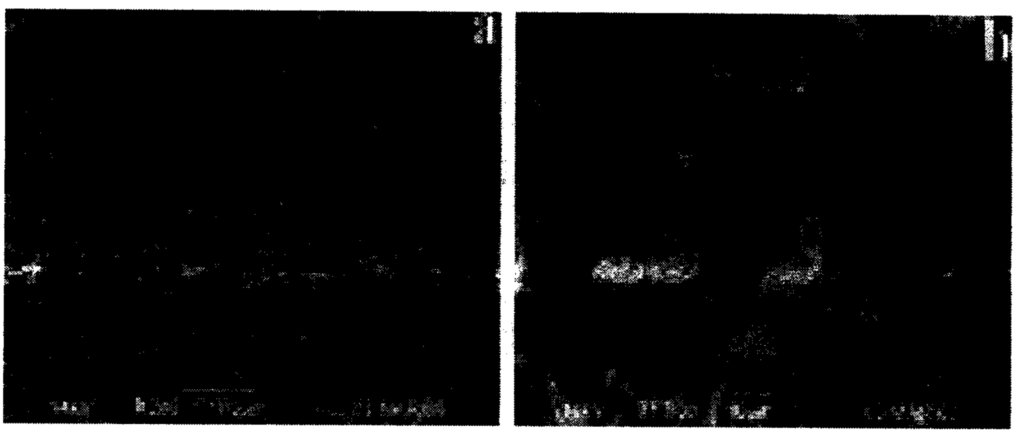


fig 2.1 STRUCTURE OF CHICKEN FEATHER

Feathers are light weighted, and they're hollow, yet very strong. That makes them standard." Feathers are made of the protein keratin, which in fiber form is both light and tough enough to withstand mechanical and thermal stresses. The hollow fiber is of very low density, providing strength without sacrificing weight.

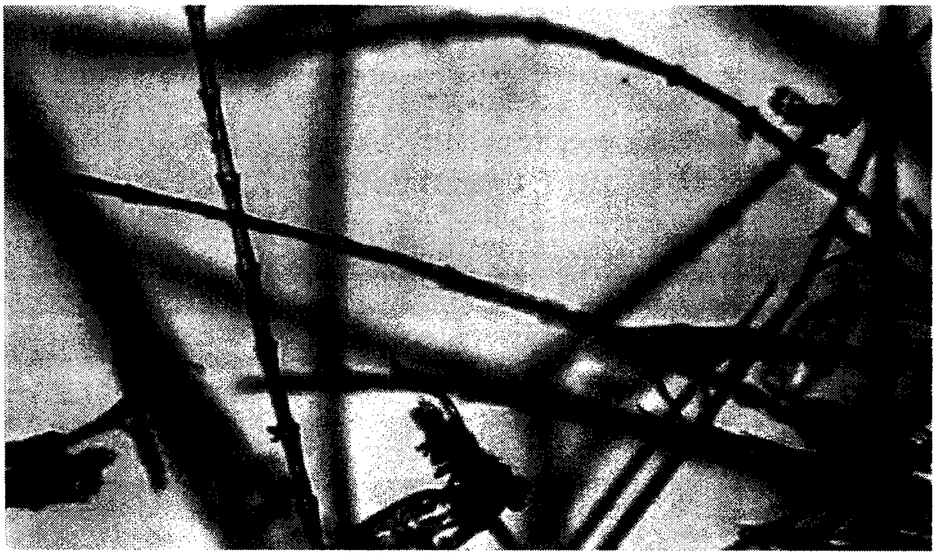


Fig 2.2 A micrograph of feathers (above) shows hollow keratin fibers, a light & tough material

2.1.2 CHICKEN FIBER FACTS

2.1.2.1 CHEMISTRY OF CHICKEN FEATHER FIBER

Chicken feather fiber primarily consists of α-helical conformations, and some β-sheet conformations are present. Chicken feather outer quill consists almost entirely of β-sheet conformations, and few α-helical conformations are present. Hard β-sheet keratins have a much higher cystine content than soft α-helix keratins and thus a much greater presence of disulfide (S-S) chemical bonds which link adjacent keratin proteins(Figure 2.3) These strong covalent bonds stabilize the three-dimensional protein structure and are very difficult to break. This suggests that chicken feather outer quill would be stronger than chicken feather fiber.(REF 14) However, a study of the thermal properties of chicken feather fractions suggests that outer quill is weaker than fiber and inner quill.

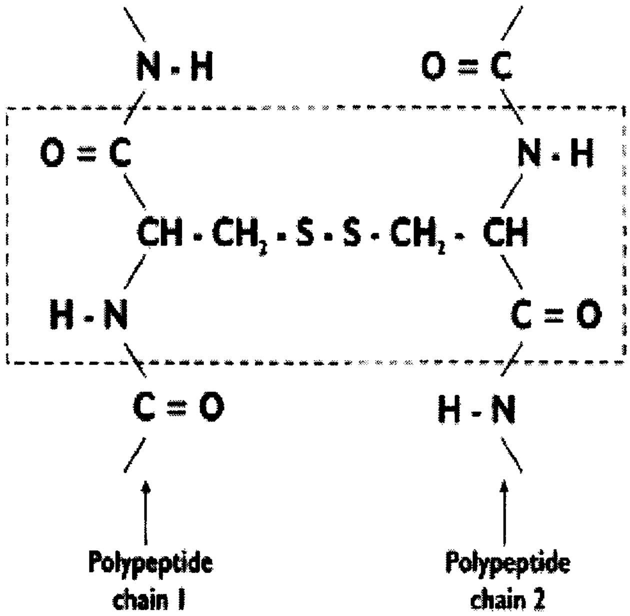


Figure 2.3 Diagrammatic representation of the diamino-acid cystine residue linking two polypeptide chains by covalent bonding(REF 12)

2.1.2.2 COMPOSITION OF CHICKEN FEATHER FIBER

Table 2.1 Component of chicken feather fiber

Component	%
Protein	91%
Lipids	1%
Water	8%

The amino acid sequence of a chicken feather is very similar to that of other feathers and also has a great deal in common with reptilian keratins from claws. The sequence is largely composed of cystine, glycine, proline, and serine, and contains almost no histidine, lysine, or methionine.(REF 2)

2.1.2.3 ANALYSING THE CHICKEN FEATHER FIBER

Table 2.2 Elemental Analysis of chicken feather fiber

Component	%
Carbon	47.83
Nitrogen	13.72
Hydrogen	6.48
Sulphur	2.16
Others	29.81

2.1.3 PROPERTIES OF CHICKEN FEATHER FIBRE

Physical properties

2.1.3.1 Moisture Content

Keratin can be considered to have both hydrophilic and hydrophobic properties. While 39 of the 95 amino acids in the keratin monomer are hydrophilic, serine, the most abundant amino acid, gives chicken feathers the ability to attract moisture from the air, because of the free OH^- group on the surface of each serine molecule. Thus, it may be considered to be hygroscopic(REF 15)

2.1.3.2 Aspect Ratio

Fiber diameters were found to be in the range of 5-50 μm by scanning electron microscopy.

The other examination of fibers were reported to have diameters of 6-8 μm and lengths of 3-13 mm. These values correspond to aspect ratios of 400-2200. It is found that fibers had a constant diameter of approximately 5 μm and lengths between 3.2 and 13 mm. These values correspond to aspect ratios of 600-2600.(REF 3)

2.1.3.3 Apparent Specific Gravity

The density of chicken feather fiber, obtained from Featherfiber Corporation, by displacing a known volume and weight of for the density of solid keratin. It is reported fiber lengths of 3.2-13 mm. ethanol with an equivalent amount of fiber. They reported a value of 0.89 g/cm^3 for the chicken feather fiber.

The value may be higher due to the presence of shorter fibers (as short as 3.2 mm in length). The hollows, or voids, inside chicken feather fibers may become more accessible to ethanol as fiber length decreases. For a fiber of some critical length, the void inside of this fiber acts as a part of its surface, and as a result only the solid matter of this fiber will be accounted for by a measurement of apparent density. Assuming a density of 1.3 g/cm^3 for the solid matter of chicken feather fiber (keratin), apparent density results will approach 1.3 g/cm^3 as fiber length decreases.

2.1.3.4 Chemical Durability

The structure of keratin, the primary constituent of chicken feathers, affects its chemical durability. Because of extensive cross-linking and strong covalent bonding
within its structure, keratin shows good durability and resistance to degradation. Efforts to extract keratin proteins from feathers illustrate this point. Extraction is a difficult task because it can only be achieved if the

disulfide and hydrogen bonds are broken. Schrooyen found keratin to be insoluble in polar solvents, such as water, as well as in nonpolar solvents.

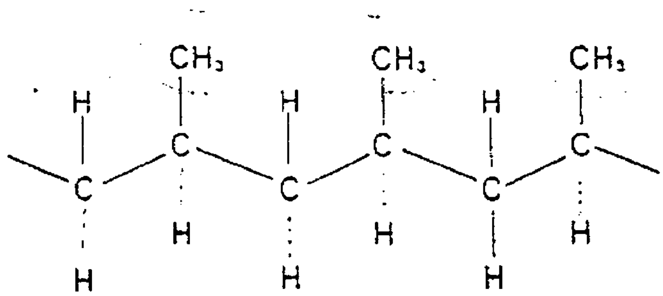
The most common method for dissolving feather keratins is solubilization with concomitant peptide bond scission via acid and alkali hydrolysis, reduction of disulfide bonds with alkaline sodium sulfide solutions, or a combination of enzymatic and chemical treatment. Although these techniques are effective for extracting keratin (75% yield), they require extremely high reagent concentrations that are much higher than keratin fibers would ever be exposed to in nature. One can deduce from this that keratin is a relatively sturdy, stable protein.(REF 4)

2.2 POLYPROPYLENE

Polypropylene (PP), a polymer prepared catalytically from propylene which differs from HDPE by having an isostatic replacement of a hydrogen atom by a methyl group on alternate carbon atoms in the main chain. Although largely unreactive chemically the presence of the methyl groups makes Polypropylene slightly more susceptible to attack by strong oxidizing agents than HDPE. A major advantage is Polypropylene's higher temperature resistance, this makes PP particularly suitable for items such as trays, funnels, pails, bottles, carboys and instrument jars that have to be sterilized frequently for use in a clinical environment. Polypropylene is a translucent material with excellent mechanical properties and it has gradually replaced the polyethylenes for many purposes(REF 16)

2.2.1 STRUCTURE

$$
-[\,CH_2-\underset{}{\overset{\displaystyle CH_3}{\overset{|}{C}}}H\,]-
$$



POLYPROPYLENE-REPEATING UNIT

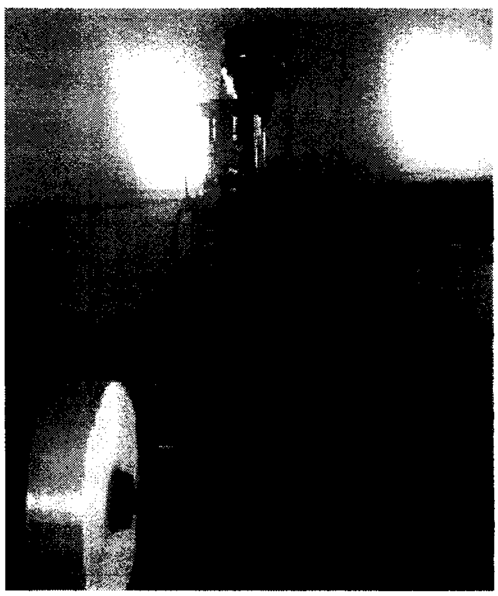


Fig 2.4 Polypropylene manufacturing machine

2.2.2 PROPERTIES

Homopolymer polypropylene is translucent, Colorless transparent, smooth and glossy with hard surface, strong, highly resistant to temperature changes and with electrical insulation properties· Water-resistant, water repellant and physiologically harmless.

Glass transition temperature:	10°C.
Melting temperature:	173°C.
Amorphous density at	25°C: 0.85 g/cm^3.
Crystalline density at	25°C: 0.95 g/cm^3.
Molecular weight of repeat unit:	42.08 g/mol.

TABLE 2.3 PROPERTIES OF POLYPROPYLENE

Physical properties

Density (g cm^{-3})	0.9
Flammability	HB
Limiting oxygen index (%)	18
Radiation resistance	Fair
Refractive index	1.49
Resistance to Ultra-violet	Poor

Mechanical Properties

Abrasive resistance - ASTM D1044	13-16 mg/1000 cycles
Coefficient of friction	0.1-0.3
Elongation at break (%)	150-300, for biax film >50
Hardness – Rockwell	R80-100
Izod impact strength (J m^{-1})	20-100
Tensile modulus (GPa)	0.9-1.5, for biax film 2.2-4.2,
Tensile strength (MPa)	25-40, for biax film 130-300,

Thermal Properties

Coefficient of thermal expansion (x10^{-6} K^{-1})	100-180

Heat-deflection temperature 0.45MPa (C)	100-105
Heat-deflection temperature - 1.8MPa (C)	60-65
Lower working temperature (C)	-10 to -60
Specific heat (J K^{-1} kg^{-1})	1700 – 1900
Thermal conductivity @23C (W m^{-1} K^{-1})	0.1-0.22
Upper working temperature (C)	90-120

Chemical Resistance

Acids – concentrated	Good-Fair
Acids – dilute	Good-Fair
Alcohols	Good
Alkalis	Good
Aromatic hydrocarbons	Fair
Greases and Oils	Good-Fair
Halogenated Hydrocarbons	Good-Poor
Halogens	Poor
Ketones	Good

Electrical properties

Dielectric constant @1MHz	2.2-2.6
Dielectric strength (kV mm^{-1})	30-40
Dissipation factor @ 1MHz	0.0003 - 0.0005
Surface resistivity (Ohm/sq)	10^{13}
Volume resistivity (Ohmcm)	10^{16}-10^{18}

(REF 5)

2.3JUTE FIBER

2.3 JUTE INTRODUCTION

Jute fiber is an important agricultural product. It is one of the most common natural fibers in Third World countries such as India, China, Bangladesh, etc. The jute industry has special importance in the economy of India and continues to be a major traditional earner of foreign exchange. However, it is facing tough competition from the synthetic fibers. Jute fibers find use in sophisticated fields like decorative and furnishing materials such as lamp shades, wall covers, curtains, upholsteries, etc. Today it is the least expensive fiber of mass consumption, at only a fraction of the cost of glass fibers; in terms of volume, jute is now the second most important fiber in the world, next to cotton. In the traditional applications in carpets, ropes, sacks, etc., jute fibers have been partially replaced by synthetic fibers which have some advantages compared to jute. In order to ensure a reasonable return to farmers, nontraditional outlets have to be explored for the fiber. One such avenue is in the area of fiber-reinforced composites. (REF16)

Jute is a long, soft, shiny plant fiber that can be spun into coarse, strong threads. It is produced from plants in the genus Corchorus.

Jute is one of the cheapest natural fibres, and is second only to cotton in amount produced and variety of uses. Jute fibres are composed primarily of the plant materials cellulose and lignin. Jute is a rainy season crop, growing best in warm, humid climates.

Worlds finest Jute is produced in Bengal Delta Plain, mostly in Bangladesh and India.China also produces large number of Jute while Pakistan grows relatively small number.

The industrial term for jute fibre is raw jute. The fibres are off-white to brown, and 1–4 meters (3–12 feet) long.(REF 6)

2.3.1 JUTE PLANTS (Corchorus olitor)

Jute is the common name given to the fiber extracted from the stems of plants belonging to the genus Corchorus, family Tiliaceae. whereas kenaf is the name given to a similar fiber obtained from the stems of plants belonging to the genus Hibiscus, family Malvaceae, especially the species H. cannabinus L. Only two species of Corchorus, namely C. capsular

L. and C. olitorius L., are grown commercially, although around 40 wild species are known, whereas other species of Hibiscus, particularly H. sabdariffa L. are sometimes also marketed as kenaf.

These plants are examples of a number of woody-stemmed berbaceous dicotyledons

Grown in the tropics and subtropics. Fibers can be extracted from the bast of stems of these plants. Most of the plants cultivated for fiber are grown from seeds annually, as are jute and kenaf, but a few are grown as perennials. Jute is the most important fiber of this type, and it is probable that, in the industrial and engineering uses of textiles. jute is used more than any other single fiber. Kenaf finds use in the domestic market in many countries, but its demand in the international market is much less than that of jute, and estimates of world kenaf production are liable to be erroneous. In many marketing statistics. the production or utilization of "jute and allied fibers" is given to include all the fibers in this group. "Allied fibers" are suitable for processing on jute spinning systems.

Favorable conditions for jute cultivation are found in the deltas of the great rivers of the tropics and subtropics such as the Ganges, the

Irrawaddy, the Amazon, and the Yangtze, where alluvial soils and irrigation, often by extensive flooding. are combined with long day lengths to provide an opportunity for considerable vegetative growth before flowering . Jute has an optimum growing temperature between 18 and 33°C with a minimum annual moisture requirement of 250 mm in a soil pH between 6.6 and 7.0. Kenaf has an optimum growing temperature between 22 and 30°C with a minimum annual moisture requirement of 150 mm in a soil pH between 6.0 and 6.8. Jute has a growing cycle of approximately 120-150 days with an average yield of 2200 kg/ha, while kenaf has a growing cycle of 150 to 180 days with an average yield of 1700 kg/ha. Since kenaf requires less water to grow than jute, it is now grown in several countries in Europe and South America. and in Mexico. United States, Japan, and China.

Both jute and kenaf grow to 2.5-3.5m in height at maturity. but kenaf, although it still requires a long day length for vegetative growth, flourishes in drier conditions than jute and can adapt to a wider variety of soils and climates. As a result, it is preferred to jute as a fiber

Fig2.5 cross sectional view for jute

jute and Corchorus capsularis)Jute fibre is often called hessian; jute fabrics are also called hessian cloth and jute sacks are called gunny bags in some European countries. The fabric made from jute is popularly known as burlap in North America (REF 7)

ADVANTAGES OF NATURAL FIBRE REINFORCED COMPOSITES

- Reduction in density of products.
- Acceptable specific strength, toughness and stiffness in comparison with glass fibre reinforced composites.
- Ease of shaping into complex shapes in a single manufacturing process.
- Lower energy consumption from fibre growing to finished composites

- The manufacturing processes are relatively safe when compared with glass based reinforced composites.
- Possibility of recycling the cuttings and wastage produced during manufacturing and moulding.
- The production of natural fibres can be started with a low capital investment and with a lower cost.
- Bast fibres exhibit good thermal and acoustic insulation properties.

DISADVANTAGES OF NATURAL FIBRE REINFORCED COMPOSITES:

- Lack of consistency of fibre quality, high level of variability in fibre properties depending upon source and cultivars.
- Preparation of fibre is labour intensive and time consuming.
- Poor compatibility between fibres and matrix, which requires surface treatment of fibres.
- High moisture absorption, which brings about dimensional changes in composite materials.
- Low density of bast fibres can be disadvantageous during composites processing application because fibre tends to migrate to the surface rather then getting mixed with matrix.
- Fluctuation in price depending upon the global demand and production.
- Problem of storing raw material for extended time due to possibility of degradation, biological attack of fungi and mildew, loss in colour, and foul odour development.
- Lower resistance to ultra violet radiation, which causes the structural degradation of the composites. (REF 8)

Table: 2.4 PHYSICAL PROPERTIES OF DIFFERENT JUTE COMPOSITES

Sl. No.	Samples	Tensile strength (MPa)	Flexural strength (Dry) (MPa)	Flexural strength (After 2 hrs. boiling in water) (MPa)
1.	Untreated non-woven* + PF resin	42.10	68.24	22.17
2.	MF pretreated non-woven + PF resin	49.99	73.97	27.50
3.	PF pretreated non-woven + PF resin	47.70	72.32	26.13
4.	CNSL – PF pretreated non-woven + PF resin	62.21	90.03	58.27

TABLE: 2.5 PHYSICO-MECHANICAL PROPERTIES OF PULTRUDED JUTE PROFILE:

	PROPERTY	VALUE
A.	Physical properties	
	Bulk density (Kg/m3)	873
	Moisture content (%)	4.41
	Water absorption (%) I. 2 hrs. II. 24 hrs.	 3.61 12.31
	Surface water absorption (24 hrs., %)	1.52
	Change in swelling (%) I. Thickness II. Length III. Width	 0.37 0.013 0.041
	Due to surface absorption (%)	Negligible
B.	Mechanical properties	
	Flexural yield strength (MPa)	62.60
	Modulus of elasticity (GPa)	5.31
	Tensile strength (MPa)	33.0
	Elongation (%)	0.86
	Tensile modulus (GPa)	7.98
	Internal bond strength (MPa)	0.66
	Screw withdrawal strength (N), Face	1800

(REF 11)

TABLE 2.6 APPLICATION AREAS OF JUTE REINFORCED POLYMER COMPOSITES WITH TECHNICAL ADVANTAGES

Application areas	Advantages
Automobile industries ➢ door panels ➢ seat backs ➢ headliners, ➢ dash boards ➢ trunk liners	▪ Lighter in weight ▪ Lesser raw material ▪ Cost economic ▪ Serviceable mechanical properties ▪ Use of renewable resource
Building Component ➢ Door ➢ Window ➢ Wall partition ➢ Ceiling ➢ Floor	▪ Better physical properties ▪ Fire, termite & better moisture resistance properties ▪ Available at semi finished / finished state i.e. reduced labour & finishing cost
Transport Sector (railway coach & vehicle) ➢ Flooring ➢ Ceiling ➢ Seat & Backrest	▪ Better physical properties ▪ Fire, termite & better moisture resistance properties ▪ Available at semi finished / finished state i.e. reduced labour & finishing cost
Furniture ➢ Table ➢ Chair ➢ Kitchen cabinet etc.	▪ Better physical properties ▪ Fire, termite & better moisture resistance properties ▪ Available at semi finished / finished state i.e. reduced labour & finishing cost

2.3.2 SOME FEATURES OF JUTE:

Jute is 100% bio-degradable & recyclable and thus environment friendly.

Jute is a natural fibre with golden & silky shine, and hence nicknamed as The Golden Fibre.

Jute is the cheapest vegetable fibre procured from bast of the Jute plant and it falls into the category of bast fibres (other bast fibres are Flax, Hemp, Ramie, etc.).

Jute is the second most important vegetable fibre after cotton.

Jute has high tensile strength, and low extensibility.

Jute is one of the most versatile natural fibres that has been used in raw materials for packaging, textiles, non-textile, and agricultural sectors.

Jute stem has very high volume of cellulose that can be procured within 4-6 months, and hence it also can save the forest and meet cellulose and wood requirement of the world.

The best varieties of Jute are Bangla Tosha - Corchorus olitorius (Golden shine) & Bangla White - Corchorus capsularis (Whitish Shine), and Mesta or Kenaf (Hibiscus cannabinus) is another species with fibre similar to Jute with medium quality.

Raw Jute & Jute goods are interpreted as Burlap, Industrial Hemp, and Kenaf in some parts of the world.

The best source of Jute in the world is the Bengal Delta Plain, which is occupied by Bangladesh and India.(REF 9)

2.3.3 ENVIRONMENTAL IMPACT

Jute is 100% bio-degradable and is often considered to be one of the most environmentally friendly crops as it has so many uses, thus reducing the impact on other, less sustainable natural resources.(REF 10)

2.4 SOUND PROOFING MATERIALS

SOUND WAVE:

A sound wave is a longitudinal wave where particles of the medium are temporarily displaced in a direction parallel to energy transport and then return to their original position [REF 22]. The vibration in a medium produces alternating waves of relatively dense and sparse particles – compression and rarefaction respectively.(fig 2.6)

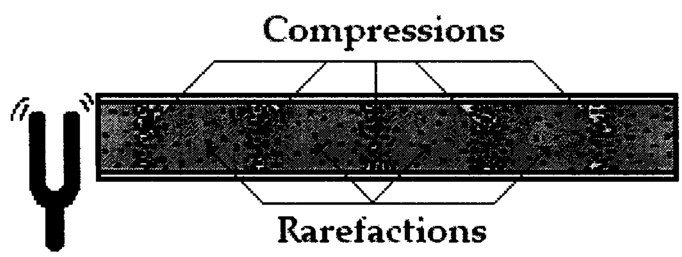


Fig 2.6 Alternative patterns of dense and sparse particles

The resultant variation to normal ambient pressure is translated by the ear and perceived as sound. A simple sound wave is illustrated in Figure 2.7 and may be described in terms of variables like: Amplitude, Frequency, Wavelength, Period and Intensity.

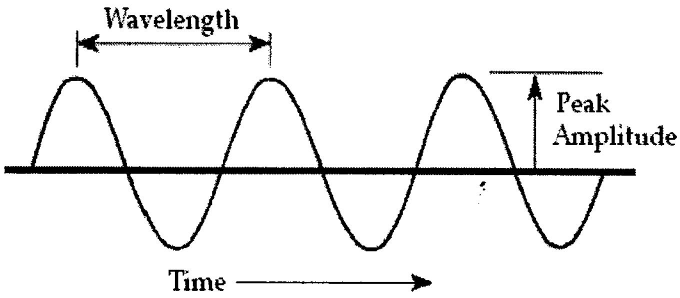


Fig 2.7 Illustration of simple sound wave

Amplitude refers to the difference between maxima and minima pressure. **Frequency** of a wave is measured as the number of complete back-and-forth vibrations of a particle of the medium per unit of time. A commonly used unit for frequency (f) is the Hertz (abbreviated Hz). The **wavelength** (λ) of a wave is the distance which a disturbance travels along the medium in one complete wave cycle .since a wave repeats its pattern once every wave cycle, the wavelength is sometimes referred to as the length of the repeating patterns.

The term '**period**' can be defined as the time required for the completion of one cycle of wave motion . The **intensity** of a sound wave is defined as the average rate at which sound energy is transmitted through a unit area.

Frequency and wavelength are related as follows :

Wavelength [ft] = Speed of sound [ft/sec]/ Frequency [Hz]

Like any wave, the speed of sound (v) refers to how fast the disturbance is passed from particle to particle. Under normal condition of pressure and humidity at sea level, sound waves travel at approximately 344 m/s through air. As explained earlier frequency refers to the number of vibrations, which an individual particle makes per unit of time, while speed refers to the distance, which the disturbance travels per unit of time.

2.4.1 NOISE CONTROL

"Noise is an unwanted sound and unfortunately most of the machines that have been developed for industrial purposes, for high speed transportation, or to make life more enjoyable are accompanied by noise" . A noise system can be broken down into three elements :

- Noise Source – The element which disturbs the air
- Noise Path – The medium through which the acoustical energy propagates from one point to another
- Noise Receiver – The person who could potentially complain about the quantity or level of noise as perceived at same point

It is necessary to treat at least one element in the noise system if the perceived level of the noise is to be reduced. By reducing the noise level at the source or along the path, the noise level at the receiver is accordingly reduced. Treating the receiver individually in such a way to minimize the sensitivity to high noise levels is another option. But this method is not often followed because of cost of redesign, develop and retool. Treatment of noise receiver is the least desirable approach since each receiver must be treated individually. Treatment of the noise path is conceptually the simplest and therefore the most common approach to a localized noise problem. The approach is to place the material in the path of the noise (generally between the noise source and the noise receiver) so that the level of noise at the receiver is reduced. In general four basic principles are employed to reduce noise isolation, absorption, vibration isolation and vibration damping. The study here is focused only on the absorption phenomenon of sound, where sound energy is converted into thermal energy(REF 21)

2.4. 1.1PRINCIPLES OF SOUND ISOLATION

1. MASS

Firstly there's mass. Mass impedes the transmission of sound in a simple way - its harder for sound to shake a very heavy thing. If your were to rely solely upon mass for sound reduction then you would need to make very large changes in mass to make large changes in performance. Typically doubling the mass of a panel without an air cavity will improve the sound isolation by 6dB.

The most common mistake made by many is to add an extra layer of plasterboard to a wall. Although this shows an improvement without looking and addressing the other principles here there will not be a great deal of improvement. In fact on a common single stud timber wall, doubling the number of plasterboard layers will yield an improvement of 3-4dB.(REF 17)

2. MECHANICAL ISOLATION OR DE-COUPLING

Mechanical Isolation is probably the most used method of improving sound isolation but probably one of the least understood. The most common was to achieve this is using SoundBreaker Bars, staggered studs, double studs, etc. These are all doing the same thing which is to inhibit the movement of sound from one side of the construction to the other through mechanical paths such as studs or joists. Creating an air cavity in the wall will ensure the vibration has to pass through it where some of it will be lost.

This method of isolation is frequency dependant. When you decouple you create a resonance, and only above that resonance does it help you.

3. ABSORPTION

Typically sound insulation material in a wall or ceiling cavity will increase the sound isolation by eliminating/removing/destroying some of the sound. In this situation it can also benefit by lowering the resonant frequency of decoupled walls, less so at very low frequencies.

Absorption won't be much use if you don't have a decoupled construction however. In a stud wall for example sound can easily pass through the timber without the need to go through the sound insulation if not decoupling is present.

4. RESONANCE

Resonance makes it easy for sound to vibrate a construction such as a wall. Even if you took a good, decoupled, insulated wall at a resonant frequency it will still vibrate very easily. A vibrating wall will vibrate the air on the other side, thus resonance will increase the ease for the sound to be transmitted.

Mechanical Damping can help reduce the magnitude of the resonance and therefore reducing the sound exiting the wall on the other side. The best method for dealing with this is to apply an visco-elastic layer within the construction to create the damping effect.

5. CONDUCTION

The last of the 5 principles. Conduction will stop a non de-coupled construction from attaining a high level of performance. Conduction plays a big role in Flanking Noise by allowing the solid materials to allow vibrations to transmit directly through unopposed.

To reduce conduction you need to mechanically isolate to separate out the solid masses and/or dampen the structure which will dissipate the energy as it travels through, both ultimately lowering the conduction significantly to a point where its not an important factor.

2.4.1.2 SOUND ABSORPTIVE MATERIALS

Materials that reduce the acoustic energy of a sound wave as the wave passes through it by the phenomenon of absorption are called sound absorptive materials [14]. They are commonly used to soften the acoustic environment of a closed volume by reducing the amplitude of the reflected waves. Absorptive materials are generally resistive in nature, either fibrous, porous or in rather special cases reactive resonators [7, 38]. Classic examples of resistive material are nonwovens, fibrous glass, mineral wools, felt and foams. Resonators include hollow core masonry blocks, sintered metal and so on. Most of these products provide some degree of absorption at nearly all frequencies and performance at low frequencies typically increases with increasing material thickness [38]. Porous materials used for noise control are generally categorized as fibrous medium or porous foam. A particular interest of this research is to conduct a systematic study on fibrous sound absorbing materials. Fibrous media usually consists of glass, rock wool or polyester fibers and have high acoustic absorption. Sometimes fire resistant fibers are also used in making acoustical products [10]. Often sound barriers are confused with sound absorbing materials. Generally materials that provide good absorption are poor barriers. Unlike, barriers and damping materials, the mass of the material has no direct effect on the performance of the absorptive materials . The performance of absorptive materials depends on many parameters, which are explained in the latter part of this chapter. Absorptive materials are almost always used in conjunction with barriers of some type since their porous construction permits some noise to pass through relatively unaffected . An absorber, when backed by a barrier, reduces the energy in a sound wave by converting the mechanical motion of the air particles into low-grade heat. This action prevents a buildup of sound in enclosed spaces and reduces the strength of reflected noise . The porous nature of absorptive materials renders them susceptible to contamination, moisture retention and deterioration due to physical abuse. To avoid these problems, facings may be attached to at least one side of the absorber. The addition of a facing to acoustical foam has the effect of increasing the lower frequency absorption at the expense of the higher frequencies .

2.4.1.3 MECHANISM OF SOUND ABSORPTION IN FIBROUS MATERIALS

The absorption of sound results from the dissipation of acoustic energy to heat. Many authors have explained this dissipation mechanism in the past Fridolin et al. describe the mechanism of sound dissipation as: when sound enters porous materials, owing to sound pressure, air molecules oscillate in the interstices of the porous material with the frequency of the exciting sound wave. This oscillation results in frictional losses. A change in the flow direction of sound waves, together with expansion and contraction phenomenon of flow through irregular pores, results in a loss of momentum. Owing to exciting of sound, air molecules in the pores undergo periodic compression and relaxation. This results in change of temperature. Because of long time, large surface to volume ratios and high heat conductivity of fibers,(REF 20) heat exchange takes place isothermally at low frequencies. At the same time in the high frequency region compression takes place adiabatically. In the

frequency region between these isothermal and adiabatic compression, the heat exchange results in loss of sound energy. This loss is high in fibrous materials if the sound propagates parallel to the plane of fibers and may account up to 40% sound attenuation. So, altogether the reasons for the acoustic energy loss when sound passes through sound absorbing materials are due to:

- Frictional losses
- Momentum losses
- Temperature fluctuations

2.4.1.4 APPLICATION OF SOUND ABSORPTIVE MATERIALS

Acoustical material plays a number of roles that are important in acoustic

Engineering such as the control of room acoustics, industrial noise control, studio acoustics and automotive acoustics. Sound absorptive materials are generally used to counteract the undesirable effects of sound reflection by hard, rigid and interior surfaces and thus help to reduce the reverberant noise levels . They are used as interior lining for apartments, automotives, aircrafts, ducts, enclosures for noise equipments and insulations for appliances . Sound absorptive materials may also be used to control the response of artistic performance spaces to steady and transient sound sources, thereby affecting the character of the aural environment, the intelligibility of unreinforced speech and the quality of unreinforced musical sound. Combining absorptive materials with barriers produces composite products that can be used to lag pipe or provide absorptive curtain assemblies.

Note: All noise control problem starts with the spectra of the emitting source. Therefore, sound absorbing materials are chosen in terms of material types and dimension, and also based on the frequency of sound to be controlled.

2.4.1.5 PERFORMANCE OF SOUND ABSORPTIVE MATERIALS

For porous and fibrous materials, acoustic performance is defined by a set of

Experimentally determined constants namely: absorption co-efficient, reflection co-efficient, acoustic impedance, propagation constant, normal reduction coefficient and transmission loss. There are different methods available to determine these acoustical parameters but all of these methods mainly involve exposing materials to known sound fields and measuring the effect of their presence on the sound field.

The performance of sound absorbing materials in particularly is evaluated by the sound absorption co-efficient (α) [35, 38]. Alpha (α) is defined as the measure of the acoustical energy absorbed by the material upon incidence and is usually expressed as a decimal varying between 0 and 1.0. If 55 percent of the incident sound energy is absorbed, the absorption coefficient of that material is said to be 0.55. A material that absorbs all incident sound waves will have a sound absorption coefficient of 1. The sound absorption coefficient (α) depends on the angle at which the sound wave impinges upon the material and the sound frequency. Values are usually provided in the literature at the standard frequencies of 125, 250, 500, 1000 and 2000.(REF 19)

The acoustic parameters that need to be considered while studying the acoustical absorptive properties are:

- Sound Reflection Coefficient: Ratio of the amount of total reflected sound intensity to the total incident sound intensity.
- Acoustic Impedance: Ratio of sound pressure acting on the surface of the specimen to the associated particle velocity normal to the surface.

In comparing sound absorbing materials for noise control purposes, the noise reduction co-efficient (NRC) is commonly used. NRC is the average usually stated to the nearest multiple of 0.05, of the co-efficient at four frequencies 250, 500, 1000 and 2000 HZ. It is intended for use as a single number index of the sound absorbing efficiency of a material. This NRC values provides a decent and simple quantification of how well the particular surface will absorb the human voice

The sound absorption for a sample of material or an object is measured sometimes in sabins or metric sabins. One sabin may be thought of as the absorption of unit area (1 m2 or 1 ft2) of a surface that has an absorption coefficient of 1.0 (100 per cent). When areas are measured in square meters, the term metric sabin is used. The absorption for a surface can be found by multiplying its area by its absorption coefficient. Thus for a material with 24 absorption coefficient of 0.5, 10 sq. ft has a sound absorption of 5 sabins and 100m2 is 50 metric sabins. Harris gives four factors that affect the sound absorption co-efficient. They are:

- Nature of the material itself
- Frequency of the sound
- The angle at which the sound wave strikes the surface of the material
- Air gap

More fundamentally, all sound absorptive materials can be characterized by two basic parameters namely: Characteristic Impedance and Complex Propagation Constant. Characteristic impedance is the measure of wave resistance of air. It is the ratio of sound pressure to particle velocity. Attenuation and phase constant which are included in the propagation constant are the measure of how much sound energy is reduced and the speed of propagation of sound respectively. Even other parameters were tried by researchers in order to include various effects like material internal structure, viscous and thermal loss, which are not discussed here.

2.4.1.6 MEASUREMENT OF SOUND ABSOPTION COEFFICIENT

A number of measurement techniques can be used to quantify the sound

absorbing behavior of porous materials. In general one is interested in one of the following properties: sound absorption coefficient (α), reflection coefficient (R), or surface impedance (Z). Detailed description of the measurement technique used in this research is given below.

ACOUSTIC MEASUREMENTS

Measurement techniques used to characterize the sound absorptive properties of a material are

- Reverberant Field Methods

Reverberant Field Method

For measuring sound absorption is concerned with the performance of a material exposed to a randomly incident sound wave, which technically occurs when the material is in diffusive field. However creation of a diffusive sound field requires a large and costly reverberation room.A completely diffuse sound field can be achieved only rarely. Moreover, anaccurate value of complex impedance cannot be derived from the absorption coefficient alone Since sound is allowed to strike the material from all directions, the absorption coefficient determined is called random incidence sound absorption coefficient, RAC. This method is clearly explained in ASTM C 423 – 72.

2.5. VARIOUS MOULDING TECHNIQUES

Some of the most common industrial manufacturing processes for polymers include:

Spray-up moulding
Compression moulding
Transfer moulding
Rotational moulding
Injection moulding
Blow moulding
Vaccum forming
Extrusion
Pultrusion

2.5.1. Spray-up moulding

Chopped fibers and resins are simultaneously deposited on a mould using spraying equipment. Gel coat is applied by spray gun. Curing takes place at room or elevated temperatures. Polyester and epoxy resins are used.

2.5.2. Compression moulding

Compression moulding is the process by which thermosetting polymers are usually formed .

The compression moulding process involves placing the polymer 'dough' into the die cavity. This 'dough' is carefully measured to avoid waste and minimise the amount of 'flashing' (fine, thin webs attached to the moulding) around the finished article.

With the dies apart, the prepared polymer 'dough' is placed into the cavity.

With the die closed, the article is formed and the small amount of flashing on each side will be removed later.(fig 2.8)

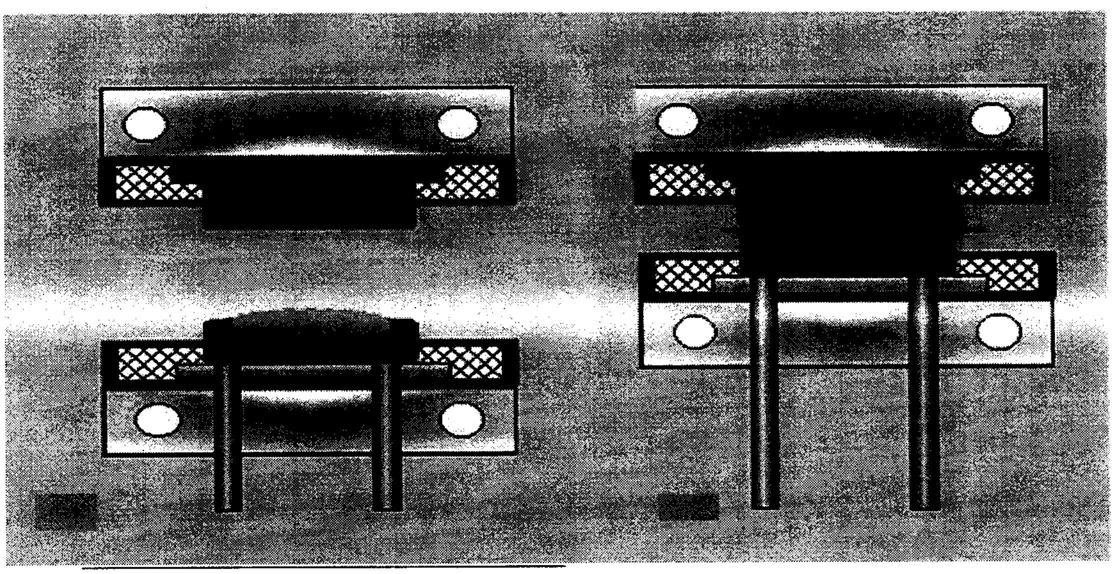


Fig 2.8 COMPRESSION MOULDING

When the die is closed, heat and pressure is maintained until the condensation polymerisation process is completed.

The hot compression moulding process is used to form components from phenolic, urea and melamine thermosetting polymers, as well as alkyd resins.

2.5.3 Transfer moulding

Transfer moulding is different to compression moulding because the plastic is not fed directly into the die cavity. Instead it is fed into a chamber outside the die. Here it is preheated before a piston forces it through a system of runners and gates that allow it into the die cavity. When the polymer is cured through heat and pressure it is ejected from the mould. The advantage of this process is that the runner system allows the simultaneous production of many small, intricate parts and there is no 'flashing' around the finished article.

2.5.4 Rotational moulding

Rotational moulding is a unique process for manufacturing thermosoftening polymers as it produces hollow items eg. Lawnmower grass-catchers, balls and some types of children's toys. A split mould is filled with exactly the right quantity of polymer which is then tumbled in the mould once it is bolted together. The die is rotated in a heated chamber until the polymer is completely melted. The die is removed from the chamber and continues to rotate until the polymer is set. The die halves are separated and the article removed.

2.5.5 Injection moulding

In this process thermosoftening polymer powder, or granules, are placed into a feed hopper connected to a heating chamber. When the fluid state is attained, due to the heat, a piston or 'screw type' mechanism forces the plastic through a nozzle and into the die. These are often water-cooled to hasten setting such that when the plastic becomes solid again the die is opened and the component is ejected. Any flashing is then removed.
Modern technology and sophisticated metal machining and finishing techniques means that large objects with fine tolerances are easily produced.

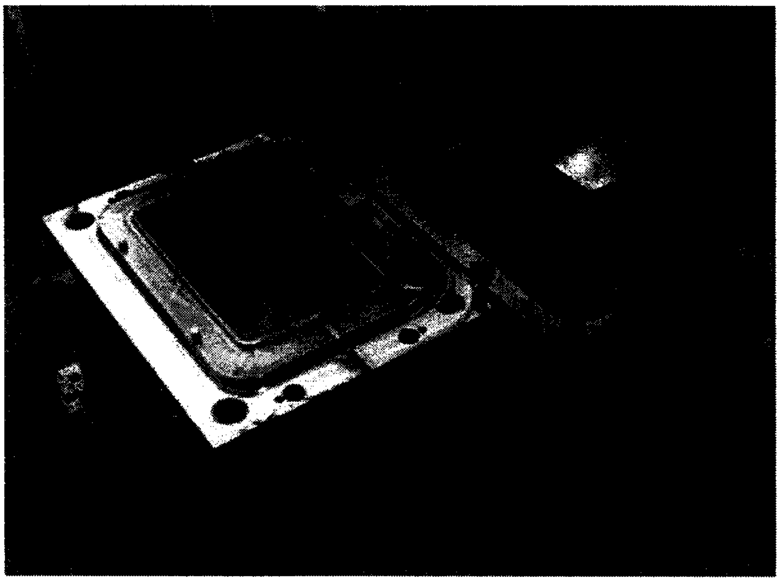


Fig 2.9 This complete die weighs in excess of 1.5 tonnes. Note the 4 alignment pins and the ejector pins.

2.5.6 Blow moulding

Thermoplastic polymer articles, such a soft drink bottles made from PET (polyethyleneteraphthalate), are formed by blow moulding. A hot, thin extruded tube of the polymer is gripped in a die as an internal blast of air forces it out against the sides of the mould . It is held in the die until it cools and is then released . The polymer assumes the shape of the die .

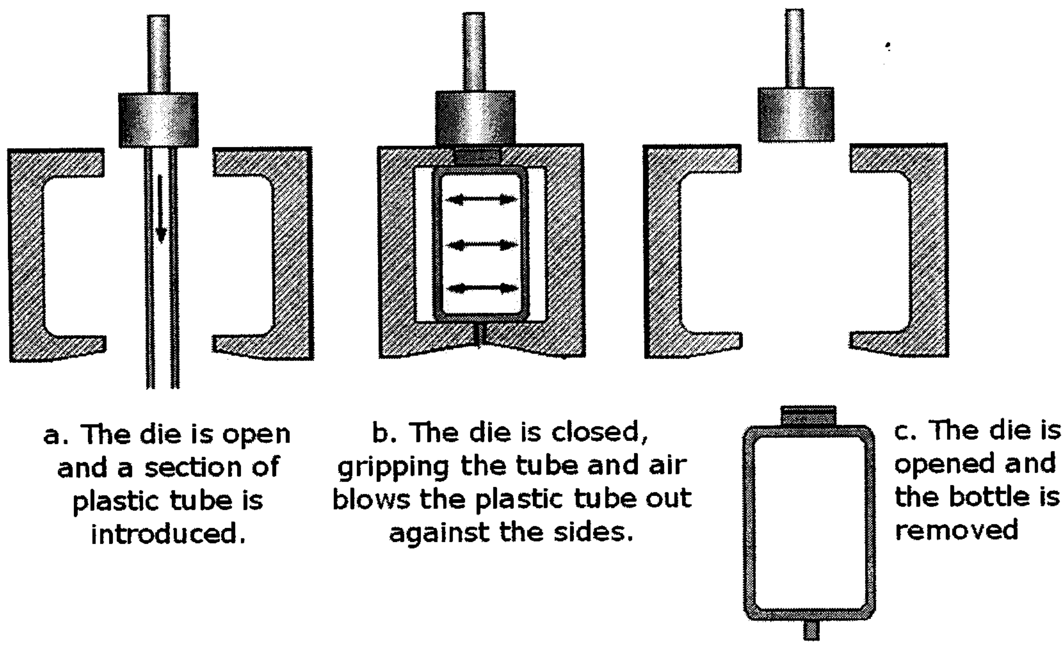


Fig 2.10 BLOW MOULDING

With the die closed and the tube pinched, the air pressure, which has blown the bottle to shape, is maintained until the plastic is cooled to room temperature.

2.5.7. Vacuum forming

Vacuum forming relies upon air pressure to form a shape. A heated sheet of polymer is clamped above a mould and the air in the mould is evacuated leaving a partial vacuum. The air pressure above the mould forces the plastic sheet down into the mould to form the shape which is removed when cooled. This process is often used for transparent canopies and covers over lit signs such as those seen in service stations or fast food outlets.

2.5.8 Extrusion

Extrusion involves the use of powder or granules, mixed with dyes as required, which are placed into a feed hopper connected to a heating chamber.When the fluid state is attained due to the heat, a piston or 'screw type' mechanism forces the plastic through a nozzle and into the mould or die. The dies are often water-cooled to hasten setting such that when the plastic becomes solid again the die is opened and the component is ejected. Any flashing is then removed.

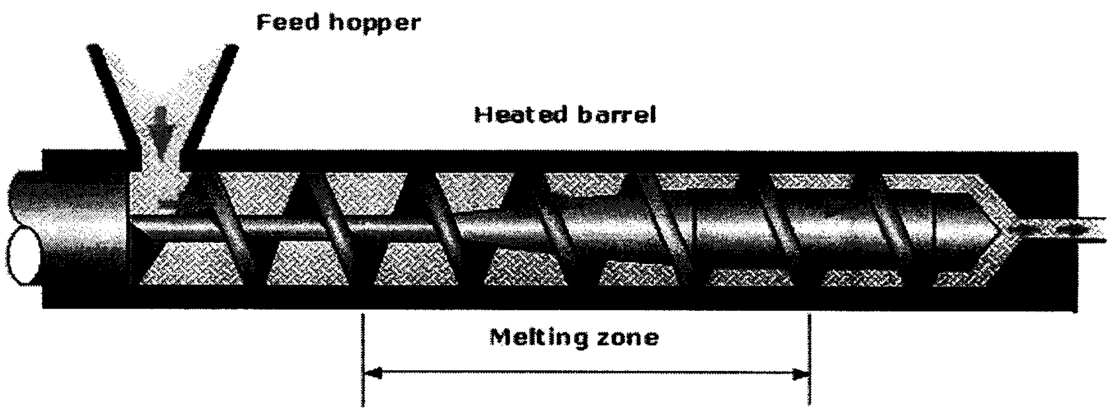


Fig 2.11 EXTRUSIONS

2.5.9 Pultrusion

Pultrusion is similar to extrusion except that thermosetting polymers are used and the composition of the composite polymer requires a greater force to move it through the die. For this reason, a pulling force is incorporated into the forming process to overcome resistance during manufacture of the article.

2.6 COMPRESSION MOULDING MACHINE

The compression-moulding machine which was used has the following features:

1. Insulated from all four sides for effective heat insulation.
2. Six heating coils at uniform distance to have a uniform heat distribution on both platens.
3 .Sensitive PID controllers with K type sensors at different places averaging out the temperatures on the platens.
4. A timer to accurately control the timings.
5. Three sets of brass heaters on the upper and lower platens at a uniform distance, ensures that the distribution of heat on the platens is proper and uniform.

2.6.1 WORKING OF COMPRESSION MOULDING MACHINE

The compression-moulding machine with hydraulic system of loading was employed in this work, which comprises of six heating coils, three on top plate and three on the bottom plate. The moulding process is explained with help of a flow chart.

The cool mould is taken

↓

Web is placed on the mould

↓

Set the temperature in the compression moulding machine

↓

Keep the two heating tables in contact in the machine by lifting the lever

↓

After the set temperature is reached , the lever is pulled up

↓

Now the mould is placed on the heating table and the heating tables are again closed

↓

Set the require pressure and allow the mould inside for test time

↓

Extraction of Composite sample from the mould

Fig 2.12 Compression Moulding Machine

CHAPTER III

3. MATERIALSAND METHODS

3.1 INTRODUCTION

This chapter explains the methodologies, materials, evaluation techniques used to study the mechanical properties and sound absorption properties of chicken feather and jute reinforced composites.

3.1.1 OBJECTIVES

The objectives of our project are :

- To collect the chicken feather, separate the fiber and purify them
- To produce the chicken feather fibre, jute and polypropylene blended web.
- To develop the sound proof boards using chicken feather and jute reinforced composites
- To study the mechanical and sound absorption properties of chicken feather fibre reinforced composites

3.1.1.1 FIBER COLLECTION, SEPERATION AND PURIFICATION

The chicken feathers from the poultry units are collected and cleaned.the stiff central core of the feather (the quill) must be stripped of the flexible, interconnected strands of material that emerge from it (the barbs).it is only this soft barb material that is useful as feather fiber.

Although the whole feather is made up of keratin, the crystal structure of the protein in the brittle central quill is different from that in the soft but durable barbs; only the barbs have the desirable properties. Then the fibres are strelized in autoclave at high temperature. The jute from the manufacturing units is collected and the required lengths are cut and do the softening treatment.

3.1.2 WEB PREPARATION

In this project, we have planned to produce the composites using compression moulding technique. In order to produce the composites there is different type of laying technique available.we have selected card laid technique.

MIXING

Before the production of web,the first step is mixing where chicken feather fibre (reinforcement) jute and polypropylene (matrix) are mixed in the ratio of (75:25:100) respectively vice-versa (25:75:100)

CARDING

After the mixing of fibres (chicken feather fibre, jute and polypropylene), they are fed into the miniature carding machine and the web is produced

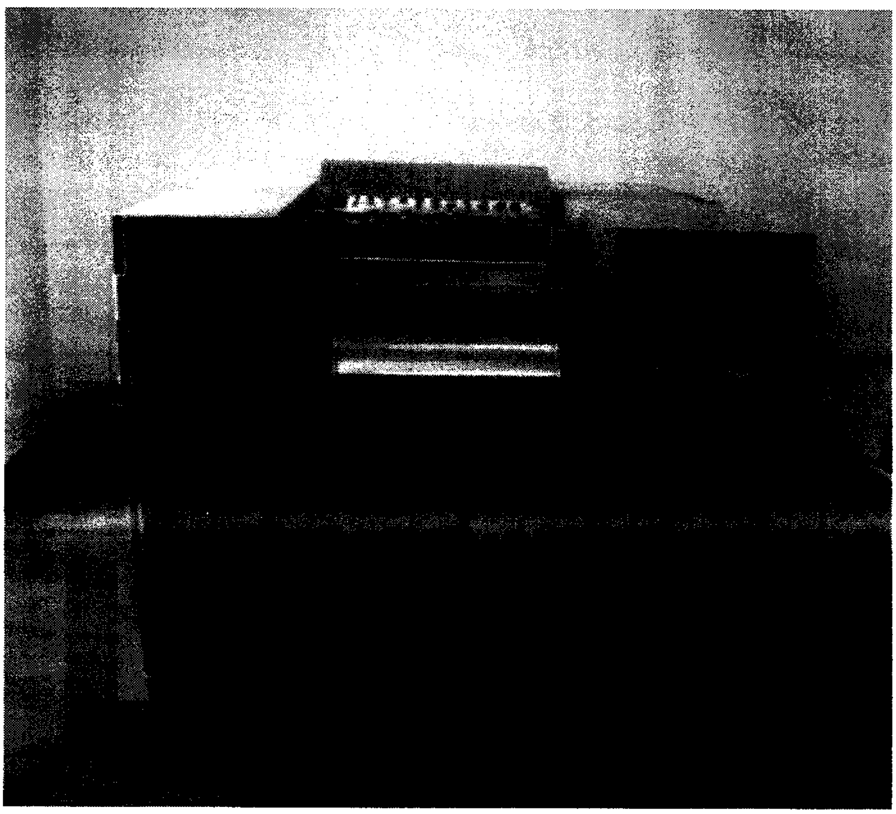
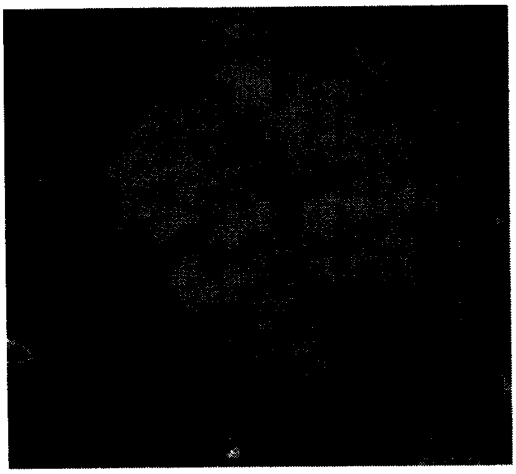
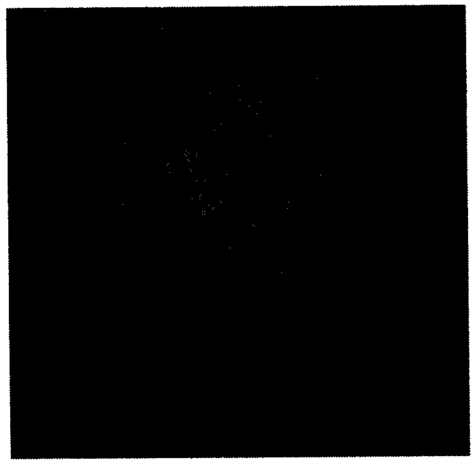


Fig 2.13 MINIATURE CARDING MACHINE



Polypropylene Fibre



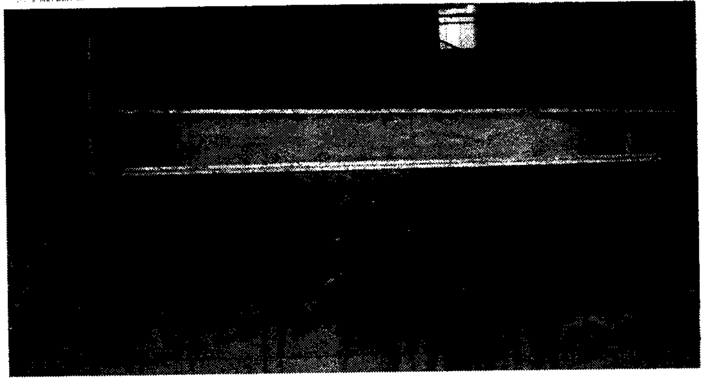
Chicken feather fiber

JUTE FIBRE

Fig 2.14 FIBRE'S

3.1.1.3 MANUFACTURE OF CHICKEN FEATHER FIBRE REINFORCED COMPOSITE

Composites are made in the compression moulding machine. The mould was made up of steel of dimensions 15 * 15 * 4 cm and also the samples as well. The chicken feather jute and polypropylene blended web is cut according to the dimensions of mould and kept on the mould. Then the mould is kept on the compression moulding machine and the composites are produced.



WEB PLACED ON MOULD

Fig 2.15 Manufacture Of Chicken Feather reinforced composite

MOULD KEPT ON COMPRESSION MOULDING MACHINE

2.6.2. TECHNICAL SPECIFICATIONS OF COMPRESSION MOULDING MACHINE

Maximum capacity	-	20 Tons
Type	-	4 Pillars and Plates
Acting	-	Single acting
Movement	-	Upward stroke
Platen size	-	300300 mm
No of day light	-	Single
Day light gap	-	150 mm
Stroke length	-	150 mm
Piston diameter	-	120 mm

No of heaters - 3 nos, 500 watts in each plate

Maximum temperature - 300

Temperature accuracy - +/- 5

Heaters - Cartridge type Electrical Heater dia 25 mm

Heater Controls - Digital temperature Controllers "J" type

Timer - Digital type

Oil tank capacity - 15 liters

Maximum Operating Pressure - 500 bar

3.1.1.4 EXPERIMENTAL PLAN

The composites are prepared by the process parameters such as

- Temperature
- Pressure
- Time

Experimental Plan

The composite samples are produced as per the parameters mention the below

SAMPLE A-Chicken feather 75,jute 25 and polypropylene100

SAMPLE B- Chicken feather 25,jute 75 and polypropylene100

S NO	SAMPLE	TEMPERATURE	PRESSURE	TIME
1	A1	175∘C	15 BAR	3 MIN
2	A2	175 ∘C	15 BAR	3 MIN
3	A3	175 ∘C	15 BAR	3MIN
4	B1	175 ∘C	15 BAR	3 MIN
5	B2	175 ∘C	15 BAR	3 MIN
6	B3	175 ∘C	15 BAR	3 MIN

3.2 EVALAUATION TECHNIQUES OF CHICKEN FEATHER FIBER REINFORCED AND JUTE COMPOSITE CHARACTERISTICS

3.2.1. CHARACTERIZATION OF COMPOSITES

The composites fabricated were characterized in terms of the mechanical and sound absorption composites. In order to undergo such processes the following test methods procures the resultant values with respect to the test principles.

3.2.2 MECHANICAL PROPERTIES

FLEXURAL STRENGTH TEST
IMPACT STRENGTH TEST
TENSILE STRENGTH TEST

3.2.2.1 FLEXURAL STRENGTH TEST

SCOPE:

- Flexural tests provide the strength of material in bending expressed as the stress on the outermost fibres of a bent test specimen at the instant of failure.
- Flexural test produce a Load(N)
- The test is performed based on the ISO 14 125 1998-03.

To design parts to withstand application load and as a quality check of materials.

SAMPLE PREPARATION:

The required sample size for performing flexural strength using UNIVERSAL testing machine is as follows:

- Length =100 mm
- Width=10 mm

TEST PROCEDURE

The test is performed based on the ISO 14 125 1998-03 According to the procedure, the test speed is 50 mm/min.

The specimen is placed on the clamps and load will be applied on the specimen.

The load will be applied until the sample breaks under bending.

In the computer interface, the graph showing the relation between load and length of the specimen will be displayed.

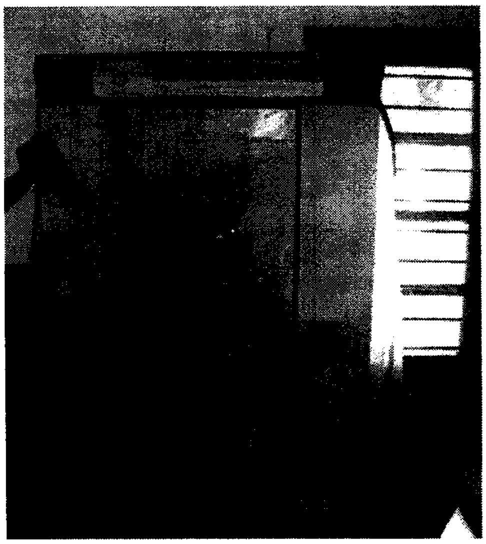


Fig 2.16 UNIVERSAL FLEXURAL STRENGTH TESTER

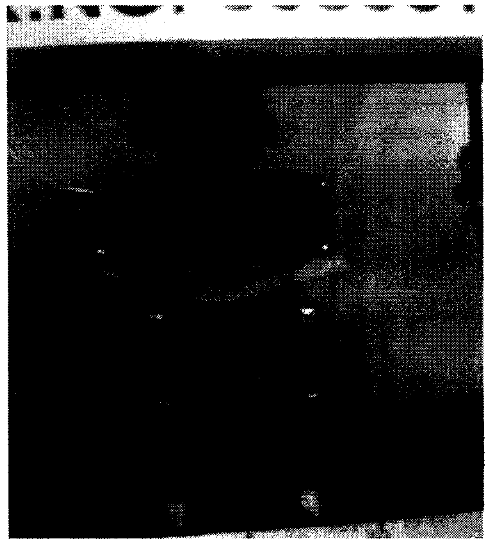


Fig 2.16 SAMPLE UNDER TEST

3.2.2.2 IMPACT STRENGTH TEST

Impact strength is an ability of material to withstand shock loading.

The test is performed based on the ASTM STP 936 1985-08 Std.

SAMPLE PREPARATION:

The samples required for performing impact strength must have the following dimensions :

- Length = 65 mm
- Width = 13 mm

TEST PROCEDURE:

The test is performed based on the ASTM STP 936 1985-08 in the charpy impact strength tester .According to the procedure, the sample is placed on the sample holder and hammer will be swinged by our hand.

The hammer strikes and breaks the specimen and the amount of energy required to break the sample is read from the dial in the instrument.

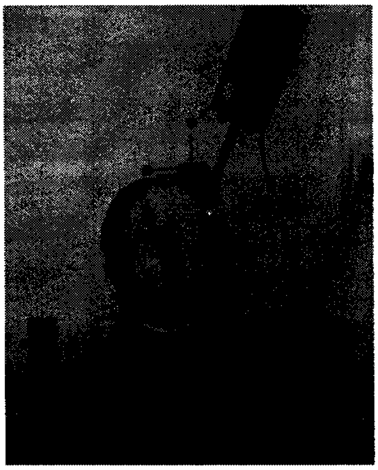


Fig 2.17 CHARPY IMPACT STRENGTH TESTER

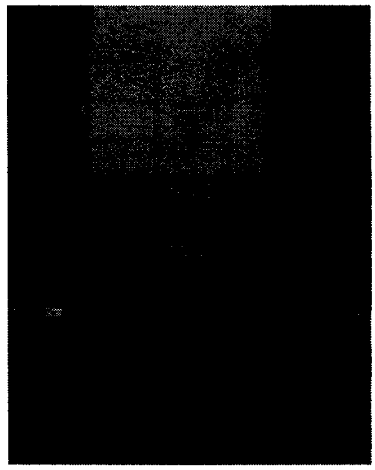


Fig 2.17 SAMPLE FIXED ON SAMPLE HOLDER

3.2.2.3 TENSILE STRENGTH

The Breaking strength is a measure of the resistance of the material to a tensile load.

SAMPLE PREPARATION

Gauge Length – 150mm

Sample Size – 280mmX25mm

TEST PROCEDURE

Fix the Sample in between two jaws and bottom jaw is movable one(CRL)

Breaking strength is noted in terms of Newton(N) and Elongation at break.

The test is performed based on the ASTM D7205-06 Std.

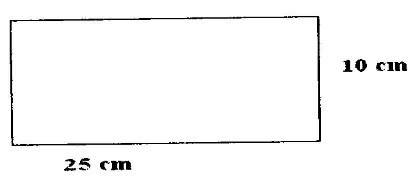
3.2.3 SOUND ABSORPTION PROPERTY

There are many methods available to test the sound absorption properties of composites. But we have developed our own method of testing the sound absorption property of chicken feather reinforced composites.

TEST PROCEDURE:

To test the sound absorption property, the following method is followed.

Step 1: Construct a rectangular box with dimensions as shown in figure



Step 2: Remove one side of rectangular box to place the source

Step 3: Remove the part which is just opposite to the already removed part to place the specimen

Step 4: Place the rectangular box in the anechoic chamber with non-parallel diffracting material

Step 5: Using the decibel meter measure the ambient sound (without any sound from source)

Step 6: Now place the SOURCE at one side and measure the sound using the decibel meter from the opposite side where the source has been placed. This is noted as **input sound.**

Step 7: now place the specimen and switch on the source and measure the **sound output** from the specimen using decibel meter.

Fig 2.18

Source placed at one end

(Sound input measurement)

Fig 2.18

Sound output measured using decibel meter

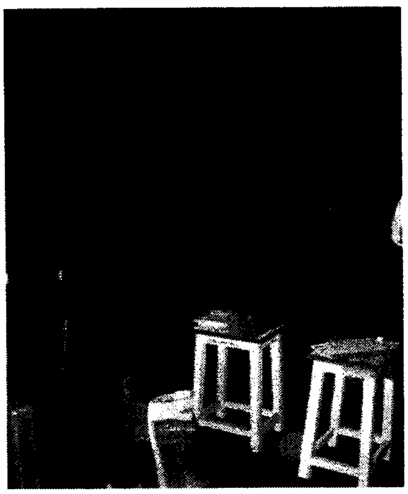


Fig 2.18
Experimental set-up in anechoic Chamber

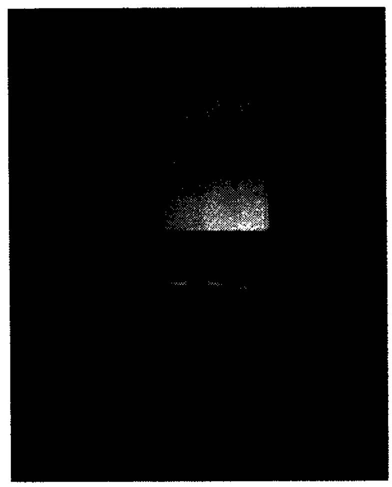


Fig 2.18
Lutron decibel meter

CHAPTER IV

4. RESULTS AND DISCUSSION

4.1 MECHANICAL PROPERTIES OF COMPOSITE

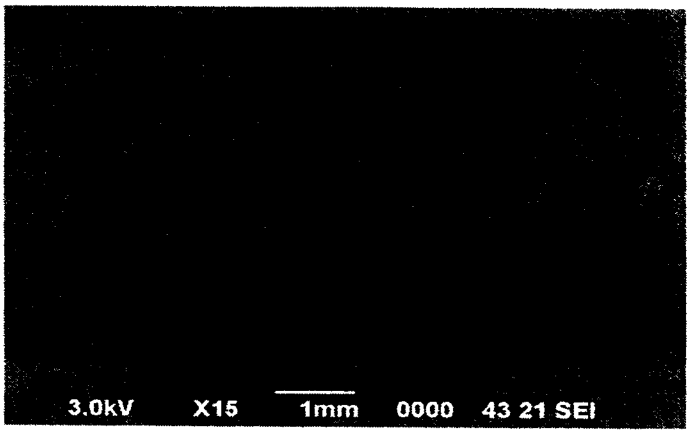
4.1.1 EVALUATION OF FLEXURAL STRENGTH OF COMPOSITE

The composites were subjected to a Universal flexural strength tester to determine its flexural strength. Results of the study of flexural properties of chicken feather fiber reinforced composite are given in table

In the present investigation the reinforcement of chicken feather fiber into Polypropylene has shown good results in terms of mechanical properties and its Percentage Elongation at break is determined as 1.66N and 1.4 N

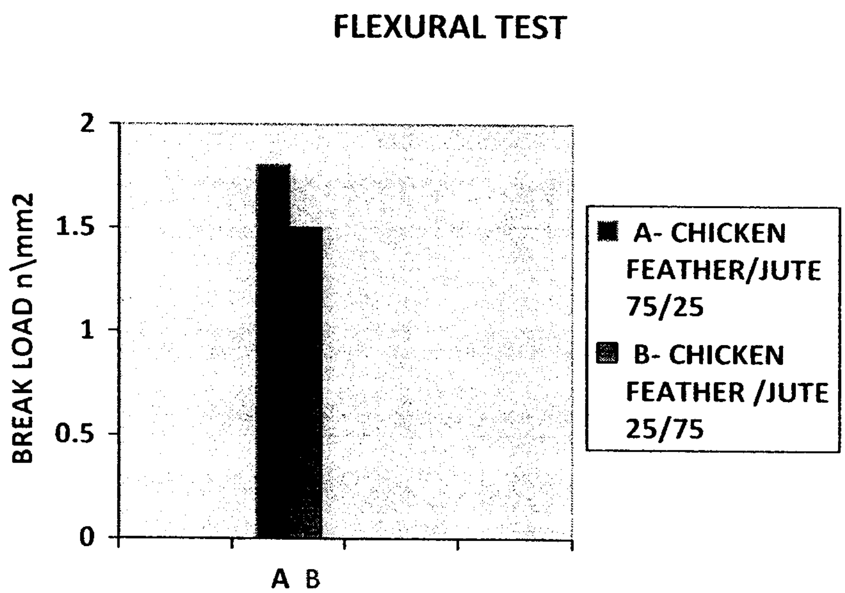
Flexural Strength

S.NO	ISO STD	IMPACT STRENGTH NEWTON	
		SAMPLE A	SAMPLE B
1	ISO 14 125 1998-03	**1.8**	**1.5**
2	ISO 14 125 1998-03	**1.6**	**1.5**
3	ISO 14 125 1998-03	**1.6**	**1.2**
		MEAN= 1.66 N	**1.4 N**



SEM Photograph of flexural strength tested sample

Fig 2.19 Show the Flexural Test graph



In this flexural test graph show that chicken feathers has high flexible property than jute.

4.1.2 EVALUATION OF IMPACT STRENGTH OF COMPOSITE

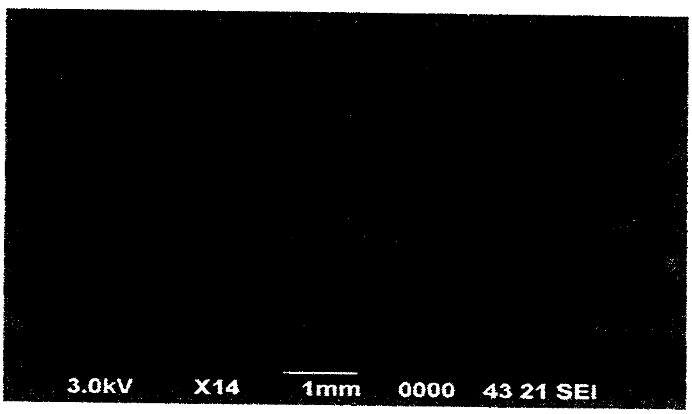
The composites are subjected to Charpy Impact Strength tester to determine the impact strength. Results of the study of impact strength properties of chicken feather reinforced composites are given in the table

In the present investigation, the reinforcement of chicken feather fibres into polypropylene has shown good results in terms of mechanical properties. The impact strength of composite is found to be **0.2 Joule.**

Impact Strength

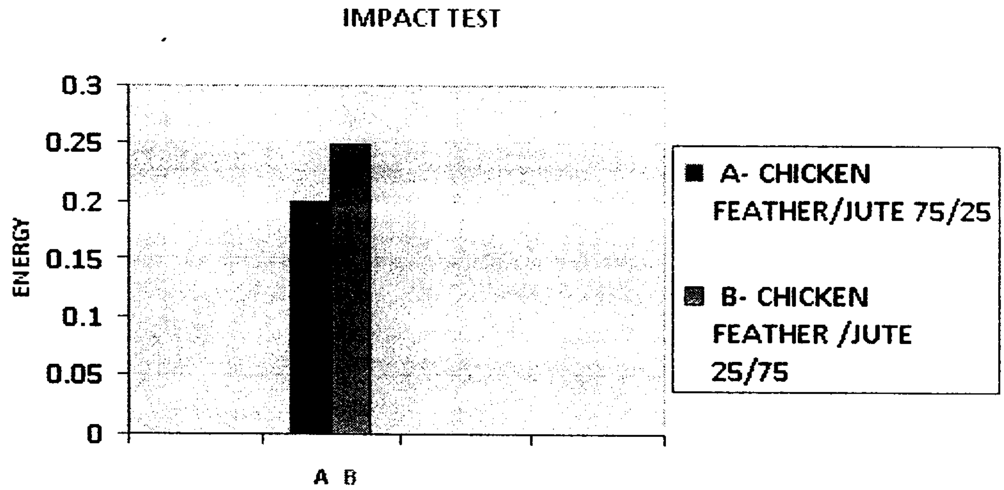
S.NO	ASTM STD	IMPACT STRENGTH JOULES	
		SAMPLE A	SAMPLE B
1	ASTM STP 936 1985-08	0.2	0.25
2	ASTM STP 936 1985-08	0.2	0.25
3	ASTM STP 936 1985-08	0.2	0.25

MEAN= 0.2 J **0.25 J**



SEM Photograph of flexural strength tested sample

Fig 2.19 Show the Impact Test grap

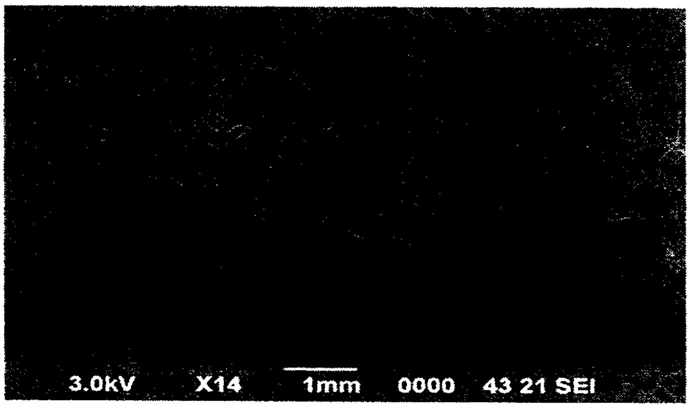


In this impact test graph show that jute has low break strength when force act on it. But chicken feather has high break strength force act on it.

4.1.3 EVALUATION OF TENSILE STRENGTH OF COMPOSITE

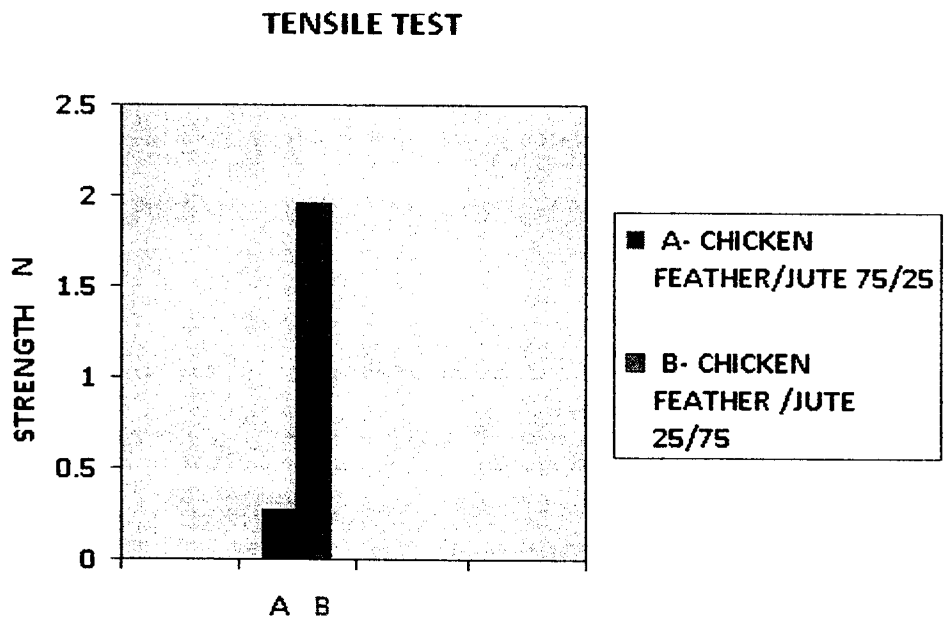
S.NO	ASTM STD	TENSILE STRENGTH NEWTON	
		SAMPLE A	SAMPLE B
1	ASTM D7205-06	0.23	1.12
2	ASTM D7205-06	0.21	2.25
3	ASTM D7205-06	0.39	2.52

MEAN= 0.27 N 1.96 N



SEM Photograph of Tensile strength tested sample

Fig 2.19 Show the Tensile Test graph



In this tensile strength test graph show that the chicken feather has a low tensile property than jute

4.2 EVALUATION OF SOUND ABSORPTION PROPERTY

The composites are subjected to sound absorption test in anechoic chamber with non-parallel sound defracting material. The sound absorbed by the samples is measured using Lutron sound level meter.

The results of sound absorption of composites is tabulated below

SOUND ABSORPTION PROPERTY

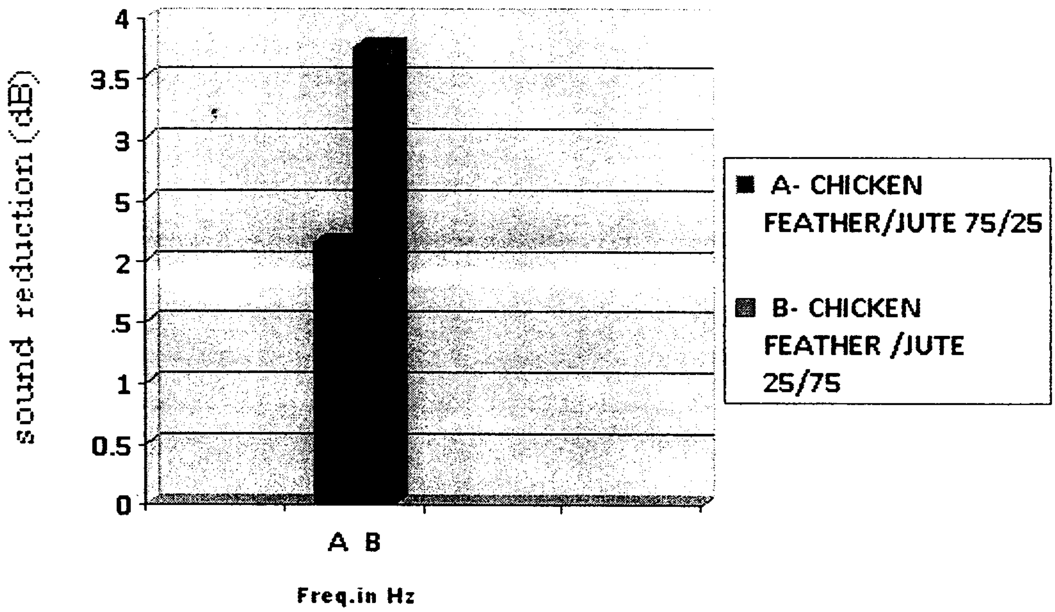
75:25Chicken Feather /jute(43.6dBAmbient Condition)

Sound Input		**Sound Output**	
Hz	**With Sample (dB)**	**Without Sample (dB)**	**Sound Reduction (dB)**
400	71.3	72.5	1.2
800	74.3	74.9	0.6
1200	64.1	68.2	4.1
1600	57.7	62.3	4.6
2000	67.3	64.3	3.0
3000	58.0	64.9	6.9
4000	61.0	65.3	3.3
5000	65.3	71.6	6.3

25:75Chicken Feather /jute(44.2dBAmbient Condition)

Sound Input		**Sound Output**	
Hz	**With Sample (dB)**	**Without Sample (dB)**	**Sound Reduction (dB)**
400	71.4	73.8	2.4
800	75.1	74.6	0.5
1200	66.8	67.1	0.3
1600	60.0	62.1	2.1
2000	64.6	61.2	3.4
3000	60.5	64.3	3.8
4000	56.4	60.3	3.9
5000	75.8	76.7	0.9

Fig 2.19 Show the Sound absorbtionTest graph



In this sound absorption test property chicken feather has high thermal conductivity than jute to absorb the sound

NOISE REDUTION CO-EFFICIENT (NRC)

The NRC rating of 75/25 chicken feather / jute composite is 1.21. This reading show the good sound abosorbtion property.

The NRC rating of 25/75 chicken feather/ jute composite 0.69.It show is the sound abosorption property 25/75 chicken feather/jute fibre composite is less than of 75/25 chicken feather/jute fibre composite.

CHAPTER V

5. CONCLUSION

- The chicken feather fiber and jute reinforced composite were successfully manufactured. The mechanical and sound absorption properties of the chicken feather fiber reinforced composites were determined.

- The Tensile and flexural strength of the 75:25 (chicken feather/jute fiber) composite is more than 25:75 (chicken feather/jute fiber). Impact strength of both composite is same.

- The sound absorption property of the chicken feather reinforced composite is higher than the jute fiber composite. Because it has good thermal insulation property(Due to honeycomb cross section)

- The chicken feather composite reduce the noise level upto6.3dB.where jute fiber composite reduce maximum. of 1dB

- There by we concluded sound absorption property of chicken feather/jute (75:25) possess a good sound absorption property. when compare to chicken feather/jute (25:75)

- Noise Reduction Co-efficient (NRC) value of chicken feather/jute (75:25) is 1.21.

- Noise Reduction Co-efficient (NRC) value of chicken feather/jute (25:75) is 0.69.

CHAPTER VI

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7.FUTURE SCOPE OF PROJECT

- Instead of jute ,other kind of textile fibre can be blend
- composite board can also produced by nonwovens
- Fabric can also used to produced composite board
- Other composite technology can be used
- It can be studied other technical purpose (Insulation board)