# Experimental analysis of mechanical behavior of Industrial waste filled polymer composite

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Abstract-This present study deals with the useful utilization of industrial wastes of leather industry and automotive glass industry. This study reports the preparation and characterization of composites with recycled poly vinyl Butyral (PVB),wet blue leather and buffing dust with leather contents of 50%. Both wastes are compounded using two roll mill at a temperature of 90°C. After milling the composite plates were compression molded at a temperature of 95°C less than 20 ton of pressure to improve surface finishing. A final thickness of 3 mm was obtained for the samples to be used in mechanical tests. After that, specimens were punched out as per ASTM standard for testing the various mechanical properties, and thermal conductivity. Thus different kinds of waste materials have been successfully utilized as filler in polymer composites with various applications. This not only reduces the production costs but also offers an opportunity for utilization of waste materials thereby reducing environmental pollution.

## Keywords – Industrial wastes, Leather waste, PVB, Compounding

## I. INTRODUCTION

Generation of solid and liquid wastes during manufacturing processes is unavoidable in major industries. India alone produces; more than 960MT of solid waste from various industrial and domestic operations and dumping of these wastes in wastelands pose severe environmental threat. Proper recycling of the wastes would certainly save the energy and conserve the resources. Residue management has become a major problem in modern society, especially solid residue with potential toxic effects. The search for innovative solutions for the reuse of solid residue increased in the late 20th century and has intensified with growing urgency for environmental preservation. Many residue management solutions aim to add value to residue through the development of new materials and processes.

#### II. MATERIALS AND METHODOLOGY

## A. Materials

Leather is wasted during each and every operation when leather is transformed from raw material to final product. Each operation we are getting different kinds of wastes. Tannery generates huge amount of solid wastes during each stage of processing. In fleshing 50 to 60%, during trimming 5 to 7% wastes are obtained. For this study we considered about buffing dust and trimming waste. Buffing dust from chrome tanned leather which is portentous, impregnated with chromium, synthetic fat, oil, tanning agents and dye chemicals is one of the difficult tannery wastes to manage. Trimming waste obtained from trimming operations during leather processing.

Laminated glass is a sandwich made of one piece of plastic Poly Vinyl Butyral between two or more glasses. The PVB sticks with the glass, forms chemical as well as mechanical bonds. When laminated with annealed glass, the layer maintains the geometric integrity of the pane in case of breakage. Also it gives acoustic insulation as well as gives protection against damage caused due to UV radiation because it cuts almost 99% of UV radiation present in the sunlight.

## B. Metodology -

In this present study two leather wastes are taken namely Trimming waste and buffing Dust. These two wastes are mixed with PVB with 50% formulation under certain temperature using two roll mill equipment.



Figure 1. Process Flowchart

. The first step for this process is drying. Both type of leather wastes are dried under direct sunlight. It was found that initial weight was reduced by 62% in trimming waste and 9% in buffing dust. Then Compounding is a process of mixture in which both wastes are mixed in proportionally. The two roll mill is used for mixing the component.

Generally it is used for rubber compounding. The two roll mill consists of two horizontal, parallel, heavy metal rolls which can be heated by electrical heater. Temperature is controlled by controller. The temperature is set as  $90\square$ C, because the PVB softening temperature is  $95\square$ C. The two rolls are turn towards each other with preset, adjustable nip or gap to allow the material to pass through to achieve high- shear mixing. The material is fed through from the top of the roll mill. The gap between the rollers is maintained at 1mm. The back roll usually turns at a faster surface speed than the front mill. Back roll is rotate at 15rpm and front roll rotates at 10 rpm. After compounding materials are placed on the lower die. The dies are heated up to  $95\square$ C. Then upper die is compressed against lower die at 20kN pressure. Then it is allowed to cool in the die itself for half an hour. The die size is 270x130x3mm.Using the ejector pin material is taken out from the die.

### III. EXPERIMENT AND RESULT

Tensile Test for the new material was conducted as per the ASTM D412 standard



Figure 2: Tensile test

The tensile strength of PVB and Leather is greater than in flexible composite sheet. So the strength is reduced in 50 wt% proportionality. But this value is almost similar with nitrile rubber whose value is 14MPa and greater than concrete whose value is 3 MPa.



Figure 2: Tear Test

Tear resistance plays a vital role in O- ring Applications. This composite material exhibits good tear resistance property. Trimming Waste Composite (94.2mg)has more abrasion resistance compare than Buffing Dust Composites. (172mg).So in future our composite material can replace all the rubber and costly materials using in liner and seal applications. If moisture is present in the composite sheet, easily fungal will be formed in the sheet. So the life time of composite sheet will be reduced. The result shows both wastes having less moisture content. The content of moisture is more in TWC than BDC. So drying time could be extended for trimming waste or alternative drying method could be chosen. Generally Reinforced Plastic composites has thermal conductivity in the range of 0.2 - 0.4 W/mk. Such that this composite also exhibits very low thermal conductivity. Hence we can use this flexible sheet for moderate temperature insulation, heat shields etc.,

s.no	Property	Standard	Unit	Sample1 (Trimming waste)	Sample2 (Buffing Dust)
1	Tensile strength	ASTM D412	MPa	7.32	8.0
2	Tear Resistance	ASTM D1004	N	92	84
3	Hardness(Shore A)	ASTM D2240	-	87.5	84.5
4	Abrasion Resistance	ASTM D1044	Mg	94.2	172
5	Moisture Content	-	%	6.07	3.47
6	Thermal Conductivity	ASTM E 1530	W/mk	0.232	0.22

#### Table 1: Comparison between two samples

# **IV.CONCLUSION**

Much of the energy is needed to make new things. But the energy is wasted when we send them throw away. The waste rate is proportional to the production rate. The current rate of waste production is very high, and now this is the time to we need to think about alternative way to disposal of waste in useful form. Leather wastes were converted into flexible composite sheets using automotive industrial waste. It has been found that it provides good mechanical and thermal properties. The tensile value 8MPa shows it can be replace with nitrile rubber and thermal conductivity 0.2 W/mK exhibits it can be used for insulation material. The shore-A hardness value 88 prove that it could be used as liner , gasket and O-ring applications. The industrial waste polymer composites thus produced have potential for numerous applications in different industry. The present work provides possible solution for the managing of two industrial wastes. Flexible composite sheets were prepared by a simple, efficient and scalable technique combining PVB and Leather wastes. The project will be useful one to reuse the industrial wastes, and the production of this PVB and leather waste composites, becoming a very interesting alternative for recycling of both wastes.

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