

SYNOPSIS

DEVELOPMENT OF COMPOSITE USING RECYCLED PET REINFORCED WITH FIBREGLASS AND SAWDUST

DEVJI S PATEL(01FB16EME055) ANANYA MATHU(01FB16EME024) SYED ARHAM ASIF(01FB16EME201)

UNDER THE GUIDANCE OF PROF. CHANDRA R KINNAL

INTRODUCTION:

As population continues to rise, so does the consumption rate. Plastics are being widely used and hence the aim must be to minimize the waste generation. PET (Polyethylene terephthalate) plastic is used in plastic bottles all around the globe. This project deals the development of composites using recycled PET reinforced with fiber glass used for automotive body parts.

A majority of the plastic produced every year is mostly used to make disposable items used for

packaging or other products that are usually discarded in within a short interval of time after it’s

manufacture.. Recycling is advantageous as it helps in reducing the usage of oil and also carbon dioxide emissions.

At present a large amount of plastic bottles are being discarded without any proper procedure or being dumped. It is the objective of this paper to take care of such waste being produced and dispose of it both economically and productively.

The purpose of this project is to develop a composite using recycled PET plastic which can be moulded into automotive body parts and can be compared in terms of characteristics such as strength, rigidity and weight as compared to automotive parts made of different materials.

.

LITERATURE REVIEW:

1. Study on Mechanical and Physical Behaviour of Hybrid GFRP Nor Bahiyah Baba, Ahmad Syakirin Suhaimi, Muhamad Asyraf Mohd Amin, and Alias Mohd Department of Manufacturing Engineering Technology, TATI University College (TATIUC), 24000 Kemaman, Terengganu, Malaysia
2. Fiber-Reinforced Polymer Composites: Manufacturing, Properties, and Applications Dipen Kumar Rajak 1,2,\* , Durgesh D. Pagar 3 , Pradeep L. Menezes 4 and Emanoil Linul 5,6,
3. Processing of self-reinforced poly(ethylene terephthalate) composites for automotive applications; LARS JEDPAL , KTH School of Engineering sciences
4. Development of composites with recycled PET matrixy F. Ronkay and T. Cziga´ny\* Department of Polymer Engineering, Budapest University of Technology and Economics, Budapest, Hungary
5. A review on composite materials based on recycled thermoplastics and glass fibres L. Scelsi\*1 , A. Hodzic1 , C. Soutis1 , S. A. Hayes2 , S. Rajendran1 , M. A. AlMa’adeed3 and R. Kahraman4
6. Flat-pressed wood plastic composites from sawdust and recycled polyethylene terephthalate (PET): physical and mechanical properties Khandkar- Siddikur Rahman1 , Md Nazrul Islam1\*, Md Mushfiqur Rahman1 , Md Obaidullah Hannan1 , Rudi Dungani2,3 and HPS Abdul Khalil
7. A study of PP/PET composites: Factorial design, mechanical and thermal properties Renato Carajelescov Nonato\* , Baltus Cornelius Bonse

METHODOLOGY:

Testing of the specimen

Manufacturing the composite by adding matrix and reinforcement materials

Recycling of Pet plastic

We shall start with the recycling of PET to obtain the rPET

Post-consumer recycling of PET comprises of the following steps:

* COLLECTION: The first step is to collect the plastic material that is to be recycled. Hence, normal waste and plastic waste should be collected separately. This can be done by having local collection points for plastic with an easy access for people.
* SORTING: After plastics are collected and transported to a recycling facility/recovery center,the next step is sorting. Different types of plastics must be processed in different ways and hence sorting is an important step.
* WASHING: The plastic must be washed in order to remove any impurities and waste that is not made of plastic. Waste like labels, adhesives and food residue is removed by chemicals and steam.
* SIZE REDUCTION AND SEPARATION: After sorting, the PET is resized by shredding or granulating the plastic waste into small particles known as flakes. This helps in increasing the surface area of the plastic thereby making it easier to process and reshape. This is also useful in removing any non-plastic waste that has not been removed in the first three steps of processing. This can be done by magnets or metal detectors that remove any metal present in the mixture.

**Drying** is essential prior to molding. **PETs** are very sensitive to hydrolysis. Recommended **drying** conditions are 120 - 165 C for 4 hours. The moisture content should be less than 0.02%.

After the sorting, separation and cleaning process the rpet flakes are dried and then collected and melted at glass transition temperature which is then sandwiched between glass fiber rovings along with sawdust and then heated. It is then added layer by layer to make a composite using hand lay-up process.

**(Hand lay**-**up** is a molding **process** where fiber reinforcements are placed by **hand** then wet with resin. The manual nature of this **process** allows for almost any reinforcing material to be considered, chopped strand or mat.)

Finally the composite is ready and is sent to the next station for resting. After that the specimen is tested to find its durability, strength, toughness etc.,

Plastic Material Testing Goal:

Testing of plastic’s mechanical properties is carried out to determine whether it will meet the requirements of the application. The desired characteristics of plastic products are economic costs, less weight, high toughness, high elasticity and ductility, and high strength in tension, compression, flexure, torsion and shear. These properties are defined by the material components used to produce the plastic and are more dependent on their molecular weight, hardness, density etc.

**Mechanical Testing and Analysis:**

ASTM D4762 is the standard guide for testing fiber reinforced polymer matrix composite materials. ASTM D4762 covers composites testing in six categories: lmaina/laminate state properties, lamina/laminate dynamic properties, laminate/structural response, sandwich constructions, constituent/precursor/thermophysical properties, and environmental conditioning/resistance.

1)Tensile test:This test will be conducted on Universal testing machine(UTM) of 40KN capacity. Load is applied at constant rate,  and the specimen starts elongating until there is crack formation or when the specimen fails.

2) Impact test: The standard method to determine the impact strength of composites is usually done on an ASTM D256. This method is known as **Izod** impact **testing** and is an ASTM standard method of determining the impact resistance of materials.

3) Flexural test: **Flexural tests of composite** materials are useful as an alternative or supplementary method to determine tensile and compressive properties. Popular flexural test methods are ASTM D4762 for polymer matrix composites and ISO 3597-2 for glass roving reinforced plastics.

4) Fatigue test: can be conducted on ASTM D4762 and ASTM D3479 for tension-tension fatigue of polymer matrix composite materials.

5) shear test: can be conducted on ASTM D4762.

6)Freezing and Thawing Test:The specimen will be subjected to freezing and thawing test, to see the changes in weight loss and to study the behaviour of the specimen in extreme cold conditions.

7)Fire Resistance Test:A fire jet of high temperature will be used to heat the surface continuously for hours together, then temperature transferred to other face will be noted and the specimen will be checked for major or minor cracks on testing face. Hence we can check if the specimen is fire resistant or not.

TIMELINE

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Literature Review |  |  |  |  |  | | Selection of materials |  |  |  |  |  | | Procurement of materials |  |  |  |  |  | | Selecting suitable manufacturing process |  |  |  |  |  | | Manufacturing of composite |  |  |  |  |  | | Mechanical analysis and testing |  |  |  |  |  | | Validation of results and deducing applications |  |  |  |  |  | | Documentation and Report |  |  |  |  |  | |  | Dec 2019 | Jan 2020 | Feb 2020 | March 2020 | April 2020 | |  |  |  |  |  |

**EXPECTED OUTCOMES:**

1. To develop a suitable use for waste PET and thus reduce the amount of waste generated
2. To manufacture a composite using recycled PET reinforced with glass fibre and sawdust
3. Composite will have high strength and good impact resistance
4. The material will light in weight and more inert to chemical attacks
5. This composite can be used in automotive body parts like the bumpers, side skirt and bonnet