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"Development Of Sustainable Composite Form Recycled Polymers as Floor Sheets"

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Abstract:
The current developments with the emphasis on sustainable composite materials originating from recycled polymers for flooring systems have been reviewed. The major concern is to investigate and determine environmentally and economically sound alternatives to traditional flooring products whose environmental benefits through polymer recycling are not compromised on performance and durability. The literature survey comprises a wide range of polymer blends in terms of the addition of fillers and reinforcements with the intent of enhancing mechanical properties, especially tensile strength, impact resistance, thermal stability, wear and moisture resistance. Thus, this review will help to encourage sustainable construction practices and toward the circular economy by showing recycled polymer composites as potentially durable, high-quality solutions for flooring materials.
Keywords: *Recycled Polymers Sustainable Composites, Flooring Materials, Polymer Blends, Fillers and Reinforcement, Eco-friendly Materials, Circular Economy, Sustainable Building Practices\, Recycled Polymer Composites*

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I. INTRODUCTION

The current developments with the emphasis on sustainable composite materials originating from recycled polymers for flooring systems have been reviewed. The major concern is to investigate and determine environmentally and economically sound alternatives to traditional flooring products whose environmental benefits through polymer recycling are not compromised on performance and durability. The literature survey comprises a wide range of polymer blends in terms of the addition of fillers and reinforcements with the intent of enhancing mechanical properties, especially tensile strength, impact resistance, thermal stability, wear and moisture resistance. Thus, this review will help to encourage sustainable construction practices and toward the circular economy by showing recycled polymer composites as potentially durable, high-quality solutions for flooring materials.

II. Methodology

Vinyl ester resin as a matrix and plastic granules-and-powder as reinforcement in the formation of floor sheets involves a series of steps below is a general methodology for this process-

1. Material preparation vinyl ester resin prepare the resin as per the instructions of the manufacturers including mixing with hardeners or catalysts as needed plastic granules choose the type-a-size of plastic granules suitable for your application dry and clean are essential
2. Mold preparation select-or-prepare-a mold-for-floor-sheet ensure-mold-surface-is-smooth-and-treated-with-release-agent-so-floor-sheet-does-not-stick
3. Mixing mix vinyl ester resin with plastic granules the proportion of granules to resin depends on the required properties in the final product strength or flexibility
4. Application pouring induces the resin and granules mixture into the mold some tools or techniques should be used to bring about even distribution and the expulsion of air bubbles
5. Curing-the mixture must be allowed to cure as per the resins specification the curing time varies with the type of resin and environmental conditions

6. Finishing-with the curing process being done remove the sheet from the mold trim and finish the edges if need be and in the event that a smooth finish is required start sanding or polishing of the surface
7. Testing-possible tests should be carried out to check that the floor sheet fulfills durability load-bearing capacity and other relevant factors needed in specification

III. Fabrication Process

1.3.1 Material Selection

(i) Characteristics of the plastic material should be thermoplastic.

(ii) Collecting plastic like food container boxes, which is a type of plastic called as polypropylene.

(iii) Collecting high impact polystyrene granules.

1.3.2 Melting Process and Preparation of Reinforcement

(i) Firstly, break all the plastic food container box into small pieces and should be melted in a crucible with help of electrical resistance melting furnace (at a temperature of 395^0c).

(ii) After the melting process, the molten plastic will be poured on the plane surface or in a mold.

(iii) After the solidification of the molten plastic, it should be converted in to powder by grinding it, while converting into powder some plastic particle will be in crystal and some will be in powder form.

(iv) Separate the crystals to one side and separate the powder to one side.

Fig1.3.2: Electric furnace

1.3.3Mold preparation

Create the mold as shown in a fig on a plane surface plate with the help of double-sided tape to create a border in order to create a desired shape.

Fig 1.3.3: Mold preparation

1.3.4Preparation Of Matrix

Here vinyl ester used as resin, while preparing the matrix add promotor and cobalt to the vinyl ester in order to form like a gel (for ex: if we take 100ml of vinyl ester add 2or 3ml of promotor and cobalt should mixed with the vinyl ester)

Fig 1.3.4: preparation of matrix

IV. Preparation of Floor Sheet

(i) After the preparation of matrix, mix the powder or crystals (reinforcement) in the prepared matrix and stir it for few minutes in order to mix completely.

(ii) The mixture of reinforcement and matrix, add catalyst (at the amount of 2 or 3%) to acts as hardener.

(iii) Then the complete mixture will be poured in the mold.

(iv) Leave for few hours for solidification.

(v) After the solidification mold is removed and floor sheet is ready.

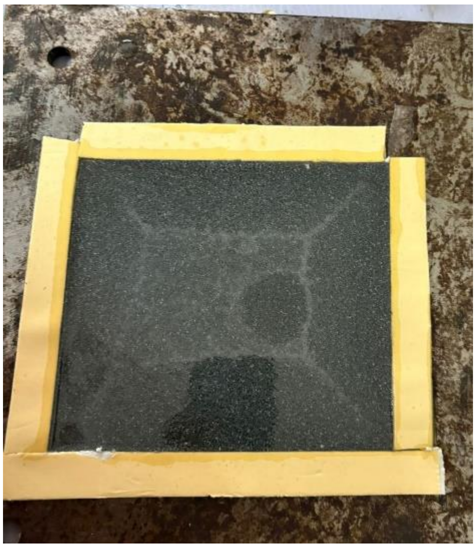
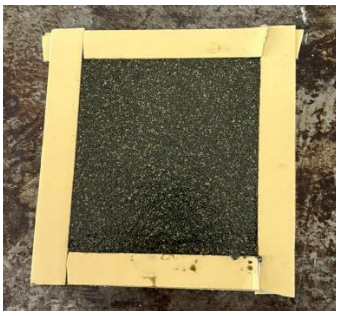


Fig 1.4.1: Floor sheet

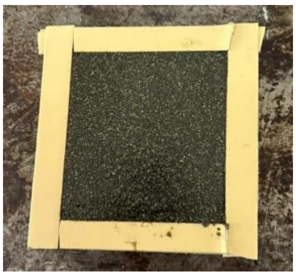
1.4.1 Polypropylene Crystal as Reinforcement.



Material Composition of trial 1:- 1:2

Composition of 1 is 60 grams of Polypropylene crystals.

Composition of 2 is 120 grams of Vinyl ester resin with addition of 5% of cobalt (acts as additive) and 5% of catalyst (acts as hardener)



Material Composition of trial 2:- 1:2

Composition of 1 is 300 grams of High impact polystyrene powder.

Composition of 2 is 600 grams of Vinyl ester resin with addition of 5% of cobalt (acts as additive) and 5% of catalyst (acts as hardener)

V.RESULT AND DISCUSSION

The results obtained are as discussed below

Tensile testing Specimen Dimensions

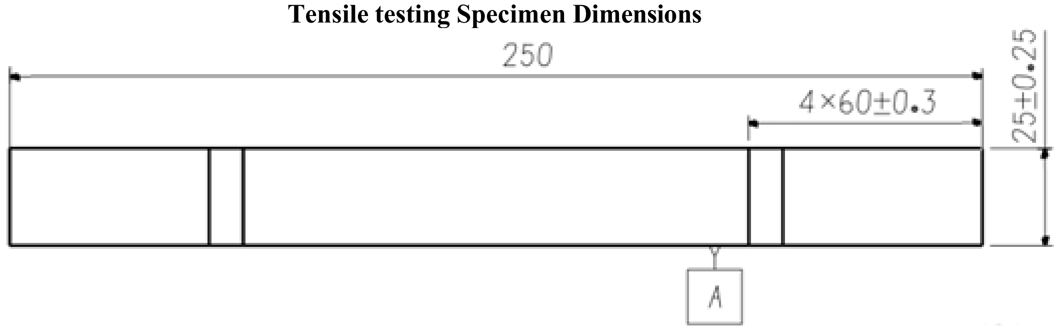


Figure 1.5.1 (tensile fatigue specimens)

Tensile test Procedure

5.1.2. Tensile test Procedure

In this study, we explored polypropylene crystal as reinforcement composite mold configured as shown in Figure 1. The specimens, designed following ASTM D3039 guidelines.

Test conducted	Normal specimen
Tensile test	3

Specimens in fixture for tensile testing

The tensile test for the carbon fiber cross-ply laminate specimen tests follows by applying a uniaxial load to the material until failure to obtain the strength and stiffness. In testing under room-temperature, the specimens are prepared based on ASTM D3039, clamped in the grips of a test machine, and pulled to failure at a constant load rate at room-temperature (20-25°C).

Force and elongation are monitored throughout the test.

Fig 1.5.3: (universal testing machine for tensile)

Tensile Test Specimens

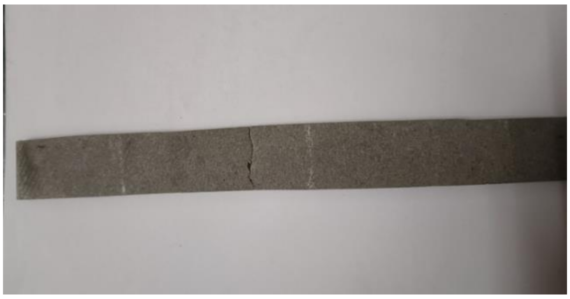


Fig 1.5.4 (Tensile Test Specimens)

Bending testing specimen dimensions

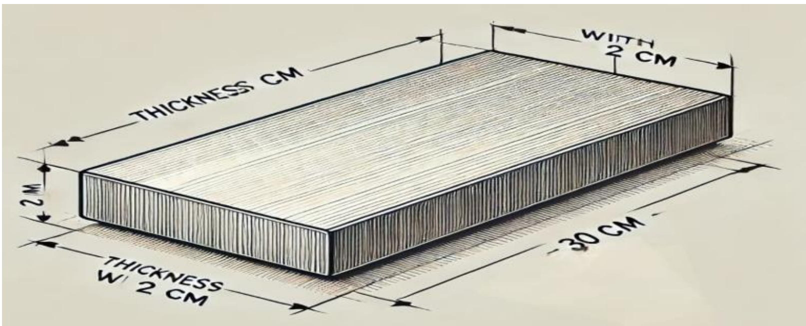


Fig 1.5.6: (bending specimen)

According to the ASTM D790 test procedure, specimen preparation is conducted according to standard dimensions with 300 mm in length, 20 mm in width, and 20 mm thick. Surfaces should be smooth and free from defects. Usually, specimens are conditioned for at least two days under the standard laboratory conditions of 23°C .

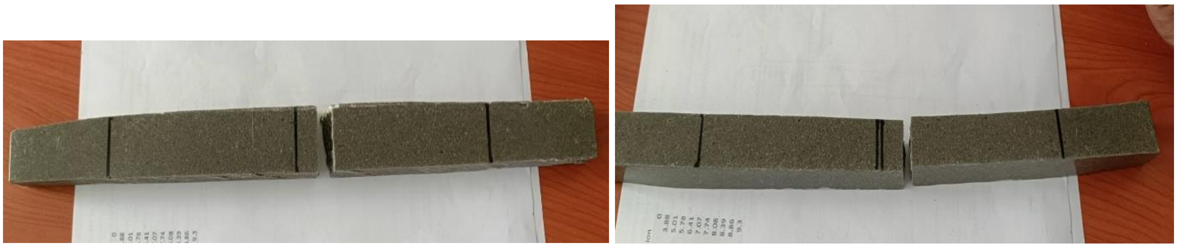
Test conducted	No of specimen
Bending test	3

Specimens in fixture for bending testing

The specimen is then placed onto the two supports of the three-point bending fixture. Set the span length as per the span-to-depth ratio of the specimen; the standard span-to-depth ratio is Then align the loading nose finely, so that the load is exactly at the center of the span. After final alignment, the machine is ready for testing. The speed at which the load is applied by the moving crosshead is set at a constant value, which depends on the specimen thickness (commonly 1.3 mm/min for standard specimens). During loading, continuous load and deflection readings are taken. The loading continues until fracture of the specimen or until a predetermined strain value is reached (generally 5%, if the specimen does not break). At this stage, the maximum load and deflections are recorded to calculate the flexural properties such as flexural strength and flexural modulus.

Fig 1.5.7:(universal machine for bending)

specimen for bending test



1.5.8: (specimen for bending test)

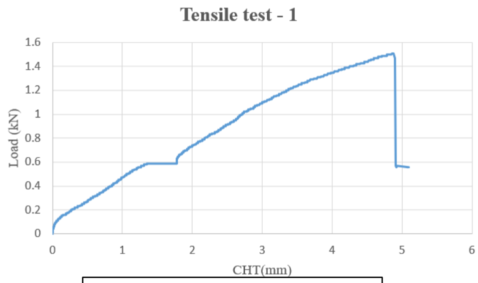


Fig 1.5.9 tensile test 1

Load AT Yield	: 1.2 KN
Elongation At yield:	3.370 mm
Yield stress	: 10.909n/mm^2
Load at peak	: 1.510KN
Elongation at peak	: 4.890mm
Tensile strength	: 13.727 N/mm^2
Load At Break	: 0.560KN

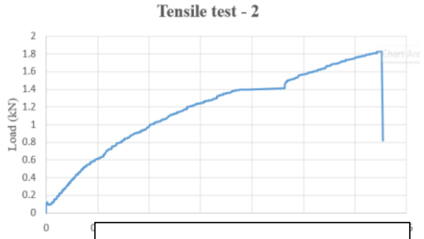


Fig 1.5.10 tensile test 2

Load AT Yield	: 0.00KN
Elongation At yield	: 0.00 mm
Yield stress	: 0.00n/mm^2
Load at peak	: 1.830KN
Elongation at peak	: 3.270mm
Tensile strength	: 14.640N/mm^2
Load At Break	: 0.820KN

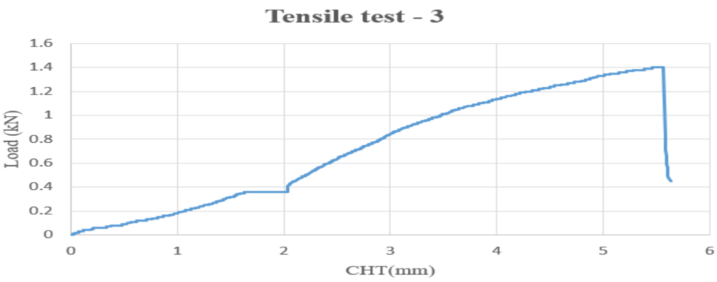


Fig 1.5.11 tensile test 3

Load AT Yield	: 1.11 KN
Elongation At yield	: 3.920 mm
Yield stress	: 8.88 N/mm^2
Load at peak	: 1.400 KN
Elongation at peak	: 5.570 mm
Tensile strength	: 11.200 N/mm^2
Load At Break	: 0.450 KN
Elongation at break	: 5.640 mm

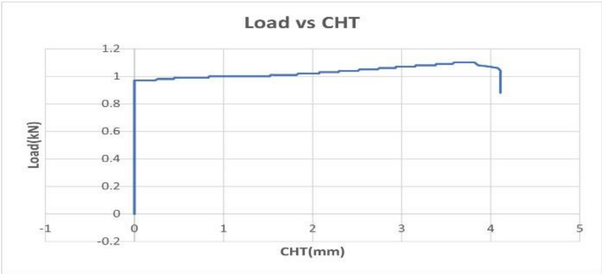


Fig 1.5.12: bending test 1

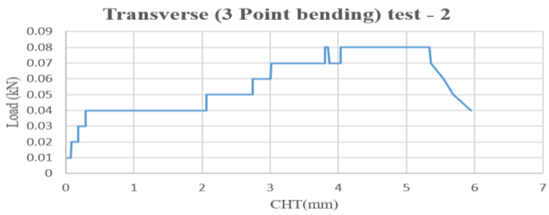


Fig 1.5.13: bending test 2

Load at peak : 1.100KN

C.H.Travel at peak : 3.384 mm

Transverse strength : 46.4N/mm^2

Load at peak : 0.80KN

C.H.Travel at peak : 5.350 mm

Transverse strength : 19.75N/mm^2

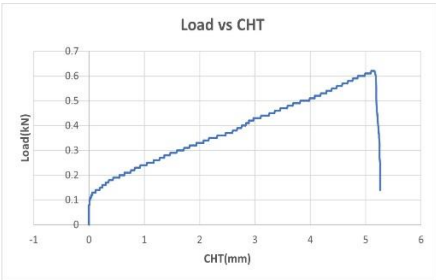


Fig 1.5.14: bending test3

Load at peak : 0.620KN

C.H.Travel at peak : 5.170mm

Transverse strength : 17..438N/mm^2

VI.CONCLUSION

The successful development of recycled composites from Vinyl Ester and Thermoplastic materials demonstrates a significant advancement in sustainable manufacturing .These eco-friendly panels exhibit excellent mechanical and thermal properties .The combination of Vinyl Ester's chemical resistance and Thermoplastic's toughness enhances overall performance .Recycled content reduces waste and conserves raw materials .The composite panels show promising applications in various industries .Their lightweight and corrosion-resistant nature makes them ideal for marine and automotive uses. The recycling process reduces environmental impact and supports a circular economy. Mechanical testing confirms the panels' suitability for structural applications. This innovative material offers a viable alternative to traditional composites. By leveraging recycled materials, we can mitigate waste and promote sustainable practices in manufacturing**.**

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