Synthesis and Identification of Polymer Composite from Solid Waste Using TGA Method

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Abstract:
Impact of Plastic as solid waste is tremendous due to its slow degradation property. Out of 30 million tons of plastic waste generated, only 7 percent was recaptured for recycling in the U.S. in 2009. Vast industrialization and technological development promotes stone crushers business greatly. It tremendously disturbs the environmental balance. Any accumulation of stone dust is hazardous causes health issues. The finer, the dust particle the more danger is its effect. Plastic waste can be minimized by coupled with stonedust as filler. In the present work, composites of recycled polymer/stonedust particles (RPSDA-95/5/2% binder, RPSDB 95/5/5% binder, RPSDC 95/5/2% binder, RPSDD 95/5/5% binder) were prepared and analyzed for thermogravimetric analysis (TGA) to investigate weight loss of polymeric material under thermal behaviour obtained by plotting % of weight loss of material with temperature. The obtained results showed variations thermal peaks which are correspond with the different degrees of crystallinity and degradation with temperature. Degradation point and weight loss property decreases from sample A to D the % of binder increases it decreases the Tm value of polymer composite.

Keywords: degradation point, Recycled plastic/ stone-dust blend, Thermogravimetric Analysis (TGA)

I INTRODUCTION
The serious concern of environmental pollution, increase of plastic and stonedust discharge have been growing over the past 50 years. The environmental impact of polymers has had serious social issue on the industrial mentality. As an alternative, polymers and stonedust consumption represent nowadays one of the most interesting solutions in terms of sustainability. Properties like degradability or reutilization are one of the best solution in terms of polymers. Thermogravimetric analysis (TGA) examines the mass change of a sample as a function of temperature with respect to time. The temperature for accelerating degradation depends on chemical stability of the material in air atmosphere and found in the temperature range 0°C–600°C. Thermogravimetric analysis (TGA) is technique which measures the changes in the weight or mass of a material as a function of temperature or time in a controlled atmosphere. TGA measurements are used primarily to determine the degradation point of materials and to predict their thermal stability up to elevated temperatures.

II OBJECTIVE
The main objectives of the work are as follows:
1) Consuming solid waste.
2) By combining solid waste in different composition try to create new material with various social applications.
3) Changes in the mass of a sample are studied while the sample is subjected for analysis i.e. degradation point of new material.

III APPLICATIONS AND TRENDS
1. The new product has a better design freedom and safety by minimizing the breakage of sheet and corrosion resistant.
2. Wide variety of commercial products can be formed from films and sheets.
3. Represent the most effective way to save in both environment and money.

IV MATERIALS AND METHOD
Recycled polymer and stone dust was collected from ordinary dealer.

Sample preparation
Table 1:- Composition of constituent taken for experiment by volume fraction.

<table>
<thead>
<tr>
<th>Specimen code</th>
<th>RP/SD</th>
<th>Size of Stonedust in µm</th>
<th>Stearic Acid %</th>
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</thead>
<tbody>
<tr>
<td>BLANK</td>
<td>100/00</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>RPSDA</td>
<td>95/5%</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>RPSDB</td>
<td>95/5%</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>RPSDC</td>
<td>95/5%</td>
<td>45</td>
<td>2</td>
</tr>
<tr>
<td>RPSDD</td>
<td>95/5%</td>
<td>45</td>
<td>5</td>
</tr>
</tbody>
</table>

B. Sample analysis
Recycled polymer were mixed with filler stonedust in different composition as given in the table using steric acid as additive in a single screw extruder by melt extrusion method. Degradation of samples goes on decreasing from A to D analyzed by TGA Test were carried out in Pune University using Detector : DTG-60H between 0°C to 600°C in pure gas nitrogen atmosphere. Approximately 7.0 mg test specimens A,B,C and D was used for each measurement. The nitrogen flow rate was kept at 50 ml/min with the temperature rate 10°C/ min in aluminium cell to maintain a stable environment.

Figure 1 shows the TGA results generated on samples RPSDA. The plot shows the % weight as a function of temperature from 0°C to 600°C in pure nitrogen gas atmosphere.
Fig 2 Graph Showing TGA of RPSDB with Blank

Fig 3 Graph Showing TGA of RPSDC with Blank

Fig 4 Graph Showing TGA of RPSDD with Blank

Fig 5 Graph Showing TGA of RPSDA, RPSDB, RPSDC, RPSDD with Blank

V. GRAPH ANALYSIS
Sample is heated at a constant rate until a weight loss takes place. The degradation points start from 312°C it is observed that as the % of binding material increases the % of weight loss decreases.

VI. RESULT
1. The TGA results show that polymer undergoes thermal degradation beginning at 312°C and end at 552°C.
2. TGA analysis shows degradation point decreases from RPSDA, RPSDB, RPSDC to RPSDD
3. As the filler stone dust particle size and % of binder increases the degradation point increases.

### Specimens % weight loss Degradation starts Degradation end
<table>
<thead>
<tr>
<th>Specimens</th>
<th>% weight loss</th>
<th>Degradation starts</th>
<th>Degradation end</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLANK</td>
<td>100</td>
<td>312.98</td>
<td>535.15</td>
</tr>
<tr>
<td>RPSDA</td>
<td>79.03</td>
<td>245.73</td>
<td>800</td>
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<tr>
<td>RPSDB</td>
<td>92.811</td>
<td>332.11</td>
<td>499</td>
</tr>
<tr>
<td>RPSDC</td>
<td>83.702</td>
<td>317.82</td>
<td>491.29</td>
</tr>
<tr>
<td>RPSDD</td>
<td>73.635</td>
<td>258.29</td>
<td>552.26</td>
</tr>
</tbody>
</table>


VII. CONCLUSION
1. Consumption of solid waste definitely reduces solid pollution.
2. TGA analysis are carried out by plotting weight in % with temperature.
3. Graph analysis shows degradation point slightly increases with the % of binder increases.

References
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