Manufacture and Characterization of Polymeric Tile Made From Natural Rubber Latex, Sand and Asphalt with Polypropylene as Adhesive

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ABSTRACT

Research has been undertaken for the manufacture of polymeric tiles made with natural rubber latex mix, Polypropylene, Asphalt, Sand and Epoxy. A study was conducted to determine the best mixture of natural rubber sand and latex as an independent variable with a variation of 30: 20, 32.5: 17.5, 35: 15, 37.5: 12.5, 40: 10, 42.5: 7.5, 45: 5, 47.5: 2.5 composition (all in % by weight). Then fixed variables are asphalt 5 g, Polypropylene 30 g and epoxy 15 g. Natural rubber latex is extracted and then mixed with asphalt, sand, polypropylene and then pressed with a press for 20 minutes at 200°C with 38 atm (38.5 x 10^5 Pa). The properties of polymeric tile tested were physical properties including water absorption and porosity, mechanical properties including impact test and flexure strength test. The result showed that the optimum mixture was a mixture of sand and natural rubber latex with addition of 5 g of asphalt as binder, and epoxy 14% and 1% catalyst.

Keywords: Natural Rubber Latex, Polypropylene, Polymeric Tile,

1. INTRODUCTION

Polymer tile is made of composite particles of first converting the fillers into particles, the particles are then mixed with the polymer matrix at the temperature of the melting point of the polymer (Murni, dkk. 2008).

Some researchers are doing a lot of research on polymer tile improvements, such as the results from Mulawarni (2012) that made polymer composite tiles from polypropylene, Resin mixtures, Asphalt, sand and Coconut husk. Suryati (2012) which makes polymer composite tiles from a mixture of Polyester resin, Asphalt, Styrofoam traces and fibers. Nemijuli Astutti (2014) which makes polymer tile using asphalt and polypropylene with variations of composition and pineapple oriented fiber. Tiopan Aruan (2017) which makes polymer tiles based on bagasse and pumice as aggregates with polyester and rubber sir 20 as matrices.

The purpose of this investigation thus was to manufacture polymer tile with asphalt mixture, natural rubber latex, polypropylene and sand. To determine the appropriate concentration of mixtures in polymer tile manufacture. To know its physical
properties and mechanical properties from the polymeric tile.

II. MATERIAL AND METHODS

The materials used is natural rubber latex, Polypropylene, sand, asphalt and epoxy. The mixed output from the internal mixer is fed into the mold and then printed with a regulated hot compressor of 200°C. Emphasis given when pressing the mold is done manually. The length of stress for one sample at the time of heating was 20 minutes and 20 minutes to cool the sample.

![Sample size of polymer tile](image)

**Figure 1. Sample size of polymer tile**

<table>
<thead>
<tr>
<th>Number of Samples</th>
<th>PPg (g)</th>
<th>sand (g)</th>
<th>Natural Latex (g)</th>
<th>rubber (g)</th>
<th>Asphalt (g)</th>
<th>Resin Epok (g)</th>
<th>Catalyst KMNO₄ (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample I</td>
<td>30</td>
<td>30</td>
<td>20</td>
<td>5</td>
<td>14</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sample II</td>
<td>30</td>
<td>32.5</td>
<td>17.5</td>
<td>5</td>
<td>14</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sample III</td>
<td>30</td>
<td>35</td>
<td>15</td>
<td>5</td>
<td>14</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sample IV</td>
<td>30</td>
<td>37.5</td>
<td>12.5</td>
<td>5</td>
<td>14</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sample V</td>
<td>30</td>
<td>40</td>
<td>10</td>
<td>5</td>
<td>14</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sample VI</td>
<td>30</td>
<td>42.5</td>
<td>7.5</td>
<td>5</td>
<td>14</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sample VII</td>
<td>30</td>
<td>45</td>
<td>5</td>
<td>5</td>
<td>14</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sample VIII</td>
<td>30</td>
<td>47.5</td>
<td>2.5</td>
<td>5</td>
<td>14</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

III. RESULT AND DISCUSSION

**Water Absorption Test Result**

Water absorption test refers to ASTM C-20-00-2005 on testing procedures, which aims to determine the percentage of water absorbed by the sample soaked for 24 hours.

\[
\text{Water Absorption} = \frac{M_b - M_k}{M_k} \times 100 \% \quad \ldots \ldots \ldots (1)
\]
From the graph above shows that the composition of 2.5 grams of natural rubber latex + 47.5 grams of sand has the smallest porosity. This is because with the large amount of soft sand that mixed will fill the voids so that porosity is reduced (Minimum).

**Impact Strength Testing**

The resulting impact strength is the ratio between the absorptive (Es) energy and the Cross-Sectional (A).

\[ I_s = \frac{E_s}{A} \]  \hspace{1cm} (3)

**Porosity Testing**

Porosity is the proportion of the void volume of the cavity. The export is also directly related to the density. Based on ASTM C 373-88, Porosity of the sample can be calculated using the following equation:

\[ \text{Porosity (\%) } = \frac{M_r - M_c}{V} \times \frac{1}{\text{pair}} \times 100 \% \ footsteps(2) \]

From the graph it can be seen that the maximum impact test value found on the composition of the mixture of sand and natural rubber latex is the variation (30; 20) of 15.8KJ/ m². While the minimum impact test value on the composition of the mixture on the composition of the mixture of sand and natural rubber latex in the variation (47.5; 2.5) was 3.48 KJ/ m².

**Flexural Strength Test**

Testing of bending strength is intended to determine the resistance of the polymer to loading. With the method used three bending point method. This test is intended to know the elasticity of a material.

\[ UFS = \frac{3}{2} \frac{PL}{bd^2} \]  \hspace{1cm} (4)
VI. REFERENCES


IV. CONCLUSIONS

In accordance with the quality requirements of Indonesian National Standard Tile (SNI) 0096: 2007 polymer tile sand composition and natural rubber latex with ratio (35:15) provide good density and strength and flexibility, and as much as 5 g of asphalt from the total weight of the sample which serves as a water barrier. The Physical properties of water absorption is 1.74 % and porosity 2.59 %. The mechanical properties that have impact strength value 12,2KJ/ m² and Strength of 12,25 Mpa.

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