THE EFFECT OF DRYING TEMPERATURE ON MECHANICAL PROPERTIES OF THE NATURAL RUBBER LATEX PRODUCTS FILLED WITH KAOLIN MODIFIED ALKANOLAMIDE

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Natural Rubber Latex (NRL) is often filled by mineral or non mineral fillers in order to enhance its mechanical properties.

Kaolin as one of mineral clay can be used as fillers in NRL.
Kaolin offers strength, abrasion resistance, and rigidity to both natural and synthetic rubber products and relatively low cost.

Kaolin is hydrophilic and can be dispersed in water and in various other systems. Because of the properties of its surface, kaolin can be modified organically using alkanolamide; which is derived from Refined Bleached Deodorized Palm Stearin (RBDPS).
Introduction (3)

This study reports the effect of drying temperature on mechanical properties of NRL products filled with kaolin modified alkanolamide
Experimental

Kaolin Modified Alkanolamide Preparation

- The filler with 10 pphr (part per hundred rubber) is prepared by dispersing kaolin into a dispersion system which consists of water and alkanolamide.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage (%) of 10 pphr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaolin</td>
<td>15 15 15 15 15 15 15</td>
</tr>
<tr>
<td>Alkanolamide</td>
<td>0 0,5 1 1,5 2 2,5</td>
</tr>
<tr>
<td>Water</td>
<td>85 84,5 84 83,5 83 82,5</td>
</tr>
</tbody>
</table>
Pre-vulcanization and Vulcanization

- Latex was pre-vulcanized for 15 minutes at 70°C. Pre-vulcanized latex was mixed with 10 pphr filler dispersion system. After it has been mixed with fillers, the mixture was opened up for 24 hours in order to release the bubblecap inside it. After the bubblecap has been released, the latex compound was vulcanized by dry dipping method at 100°C and 120°C for 30 minutes.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Composition (Grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% High Ammonia Latex</td>
<td>167</td>
</tr>
<tr>
<td>50% Sulphur</td>
<td>3</td>
</tr>
<tr>
<td>50% ZDEC</td>
<td>3</td>
</tr>
<tr>
<td>30% ZnO</td>
<td>0.83</td>
</tr>
<tr>
<td>50% Antioxidant</td>
<td>2</td>
</tr>
<tr>
<td>10% KOH</td>
<td>3</td>
</tr>
<tr>
<td>10% Fillers</td>
<td>16.7</td>
</tr>
</tbody>
</table>
Experimental (3)

- Crosslink Density Measurement
- Mechanical Testing
- Characterization of Fourier Transform Infra-Red (FTIR)
- Morphology Analysis via SEM
Results

- **Crosslink Density**

![Graph showing crosslink density vs. amount of alkanolamide](image)
Results (2)

- Tensile Strength
Results (3)

- Elongation at Break

![Graph showing elongation at break](image)

- Drying at 100°C
- Drying at 120°C

Amount of Alkanolamide (% wt)

Elongation at Break (%)
Results (4)

- $M_{100}$ and $M_{300}$

![Graphs showing $M_{100}$ and $M_{300}$ for different amounts of alkanolamide and drying temperatures.]

Centara Duang Tawan Hotel, 11th November 2013
Results (5)

- Characterization of FTIR

(a) NRL Filled Kaolin
(b) NRL Filled Kaolin-Alkanolamide
Results (6)

- Morphology Analysis

(a) NRL Filled Kaolin-Alkanolamide (1 % wt) and (b) NRL Filled Kaolin-Alkanolamide (2 % wt) with Magnificent 5000x
Conclusions

- It is observed that utilization of alkanolamide as modifying agent can modify kaolin properties.
- It is proved from its physical cross-linking density where alkanolamide has important role to form strong cross-link network hence increasing its mechanical properties.
- The physical cross-link density can also increase by increasing its drying temperature of NRL products.
Thank You!