





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

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# Introduction

- ❖ **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**

## Introduction (2)

- ❖ **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.

Ingredient	Percentage (%) of 10 pphr					
Kaolin	15	15	15	15	15	15
Alkanolamide	0	0,5	1	1,5	2	2,5
Water	85	84,5	84	83,5	83	82,5

# Experimental (2)

## ❖ 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..

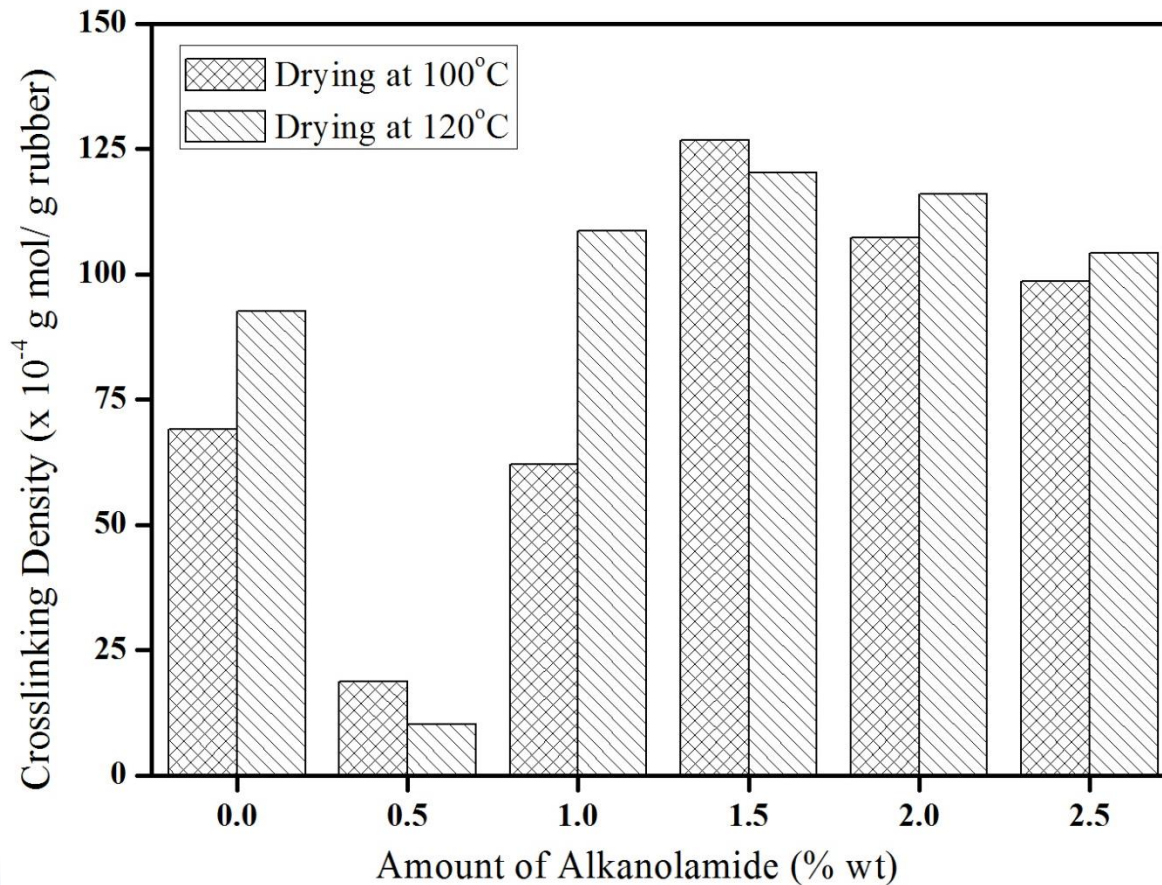
Ingredient	Composition (Grams)
60% High Ammonia Latex	167
50% Sulphur	3
50% ZDEC	3
30% ZnO	0.83
50% Antioxidant	2
10% KOH	3
10% Fillers	16,7

# Experimental (3)

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

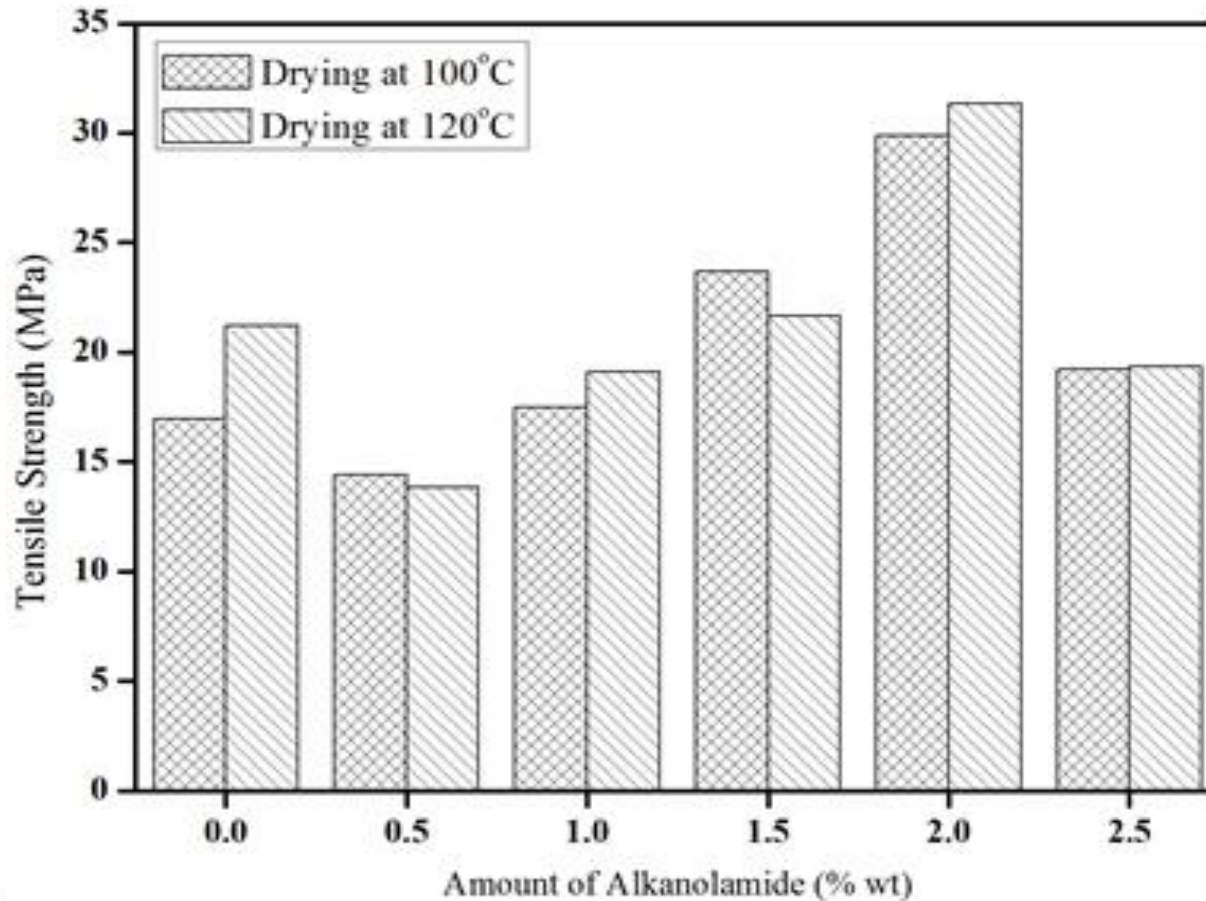
# Results

## ❖ Crosslink Density



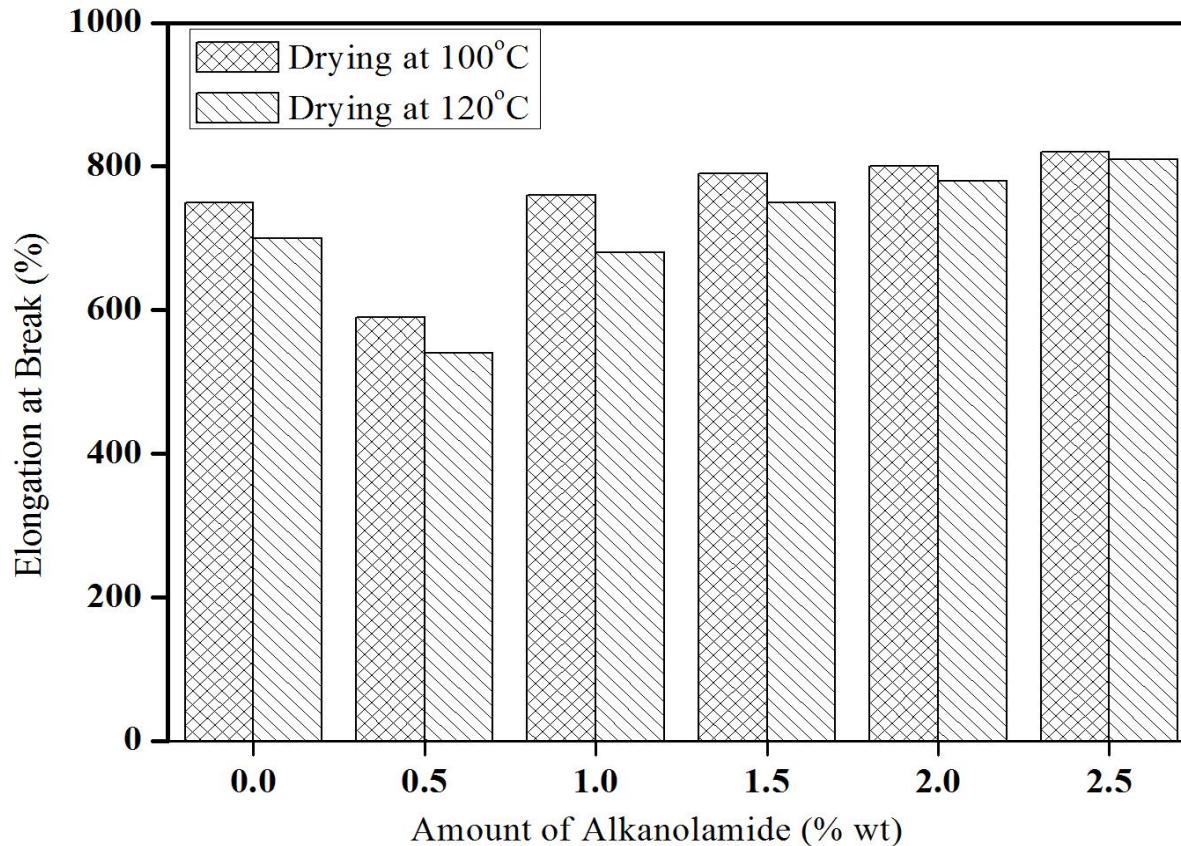
# Results (2)

## ❖ Tensile Strength



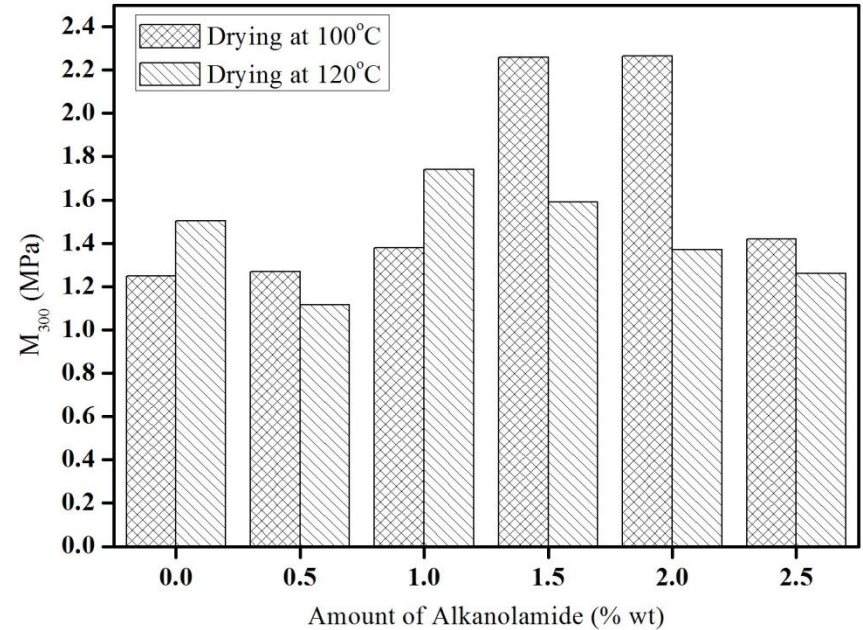
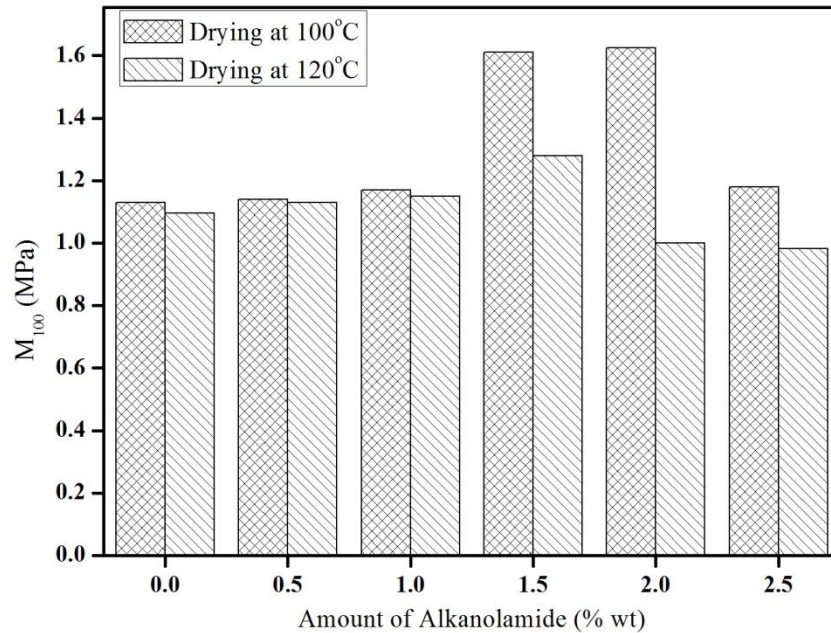
# Results (3)

## ❖ Elongation at Break



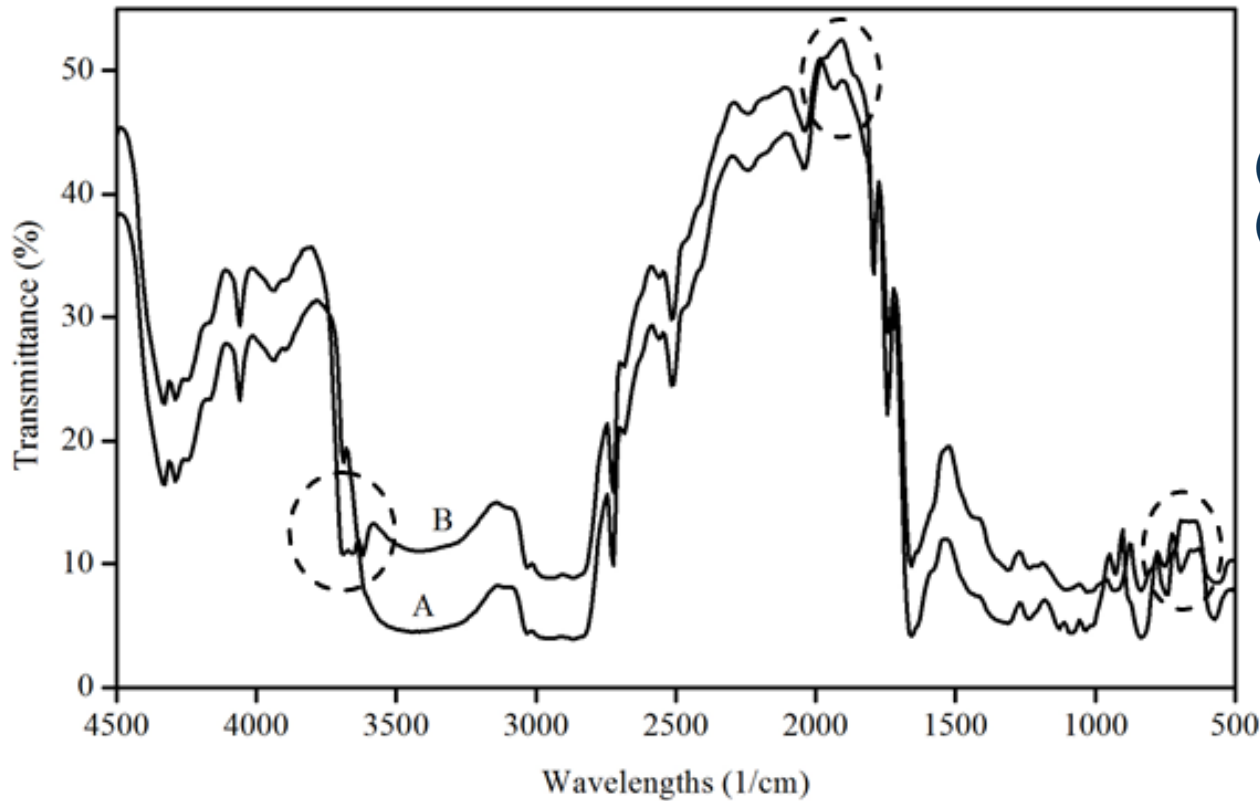
# Results (4)

## ❖ $M_{100}$ and $M_{300}$



# Results (5)

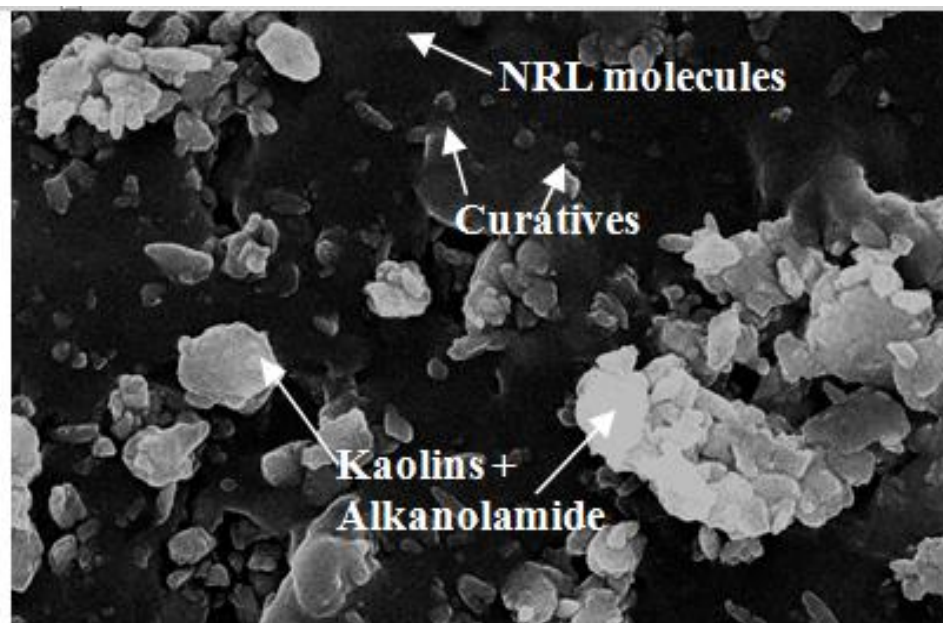
## ❖ Characterization of FTIR



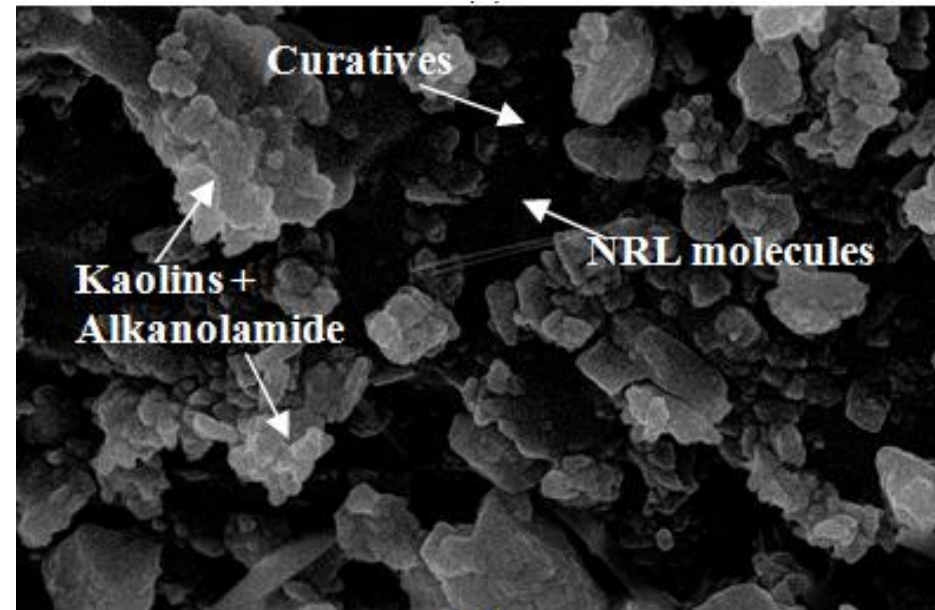
(a) NRL Filled Kaolin  
(b) NRL Filled Kaolin-Alkanolamide

# Results (6)

## ❖ Morphology Analysis



(a)



(b)

**(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 !

Centara Duang Tawan Hotel, 11<sup>th</sup> November 2013

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