Effect of Modification Technique on Properties of Blends of Natural Rubber and Modified Tyre Crumbs

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INTRODUCTION

Waste management practices

- ❖ Reuse
- ❖ Landfilling
- ❖ Incineration
- ❖ Recycling

Why recycling of rubber waste?

- ✓ Is an excellent way to dispose rubber product waste
- ✓ Cost is less than that of virgin natural and synthetic rubber
- ✓ Less energy is required in compounding than virgin rubber
- ✓ Exhibits some properties that are better than those of natural rubber
- ✓ Conserves non-renewable petroleum products
- ✓ Can generate job opportunities

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CONT. . .

- Tyre crumbs or ground rubber tyre (GRT) produced by size reduction of tyre waste is generally used as an inert filler in the manufacture of rubber composites
- Reclaimed rubber is a low cost material produced by modification of GRT according to physical or chemical reclaiming processes
- Mechanical, thermomechanical , cryomechanical, microwave and ultrasound methods have been used in the past as physical reclaiming processes
- Alkyl phenol sulphides and disulphides, aliphatic and aromatic mercaptans, amino compounds and unsaturated compounds are the four major types of chemical reclaiming agents

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CONT. . .

- Reclaimed rubber is used as a partial replacement for virgin rubber in the manufacture of dry rubber based articles
- It is used for the manufacture of passenger tyre carcass and tread, extruded and calendered products, tiles and mats, inner tubes and tyre inner liners

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OBJECTIVES

- The overall aim was to develop an environmentally friendly modification technique for GRT

SPECIFIC OBJECTIVES

- To modify GRT according to three different modification techniques using a natural product
- To evaluate cure characteristics, physico-mechanical properties and swelling behaviour of the virgin NR / modified GRT blend compounds

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EXPERIMENTAL PROCEDURE

Tyre crumbs (GRT)

Mixing with the juice of the natural product (Modifying agent)

Modifying according to three different techniques

Modified GRT

Blending with NR

NR/modified GRT blend compounds

Cure characteristics

Physico-mechanical properties

Swelling behaviour

Testing

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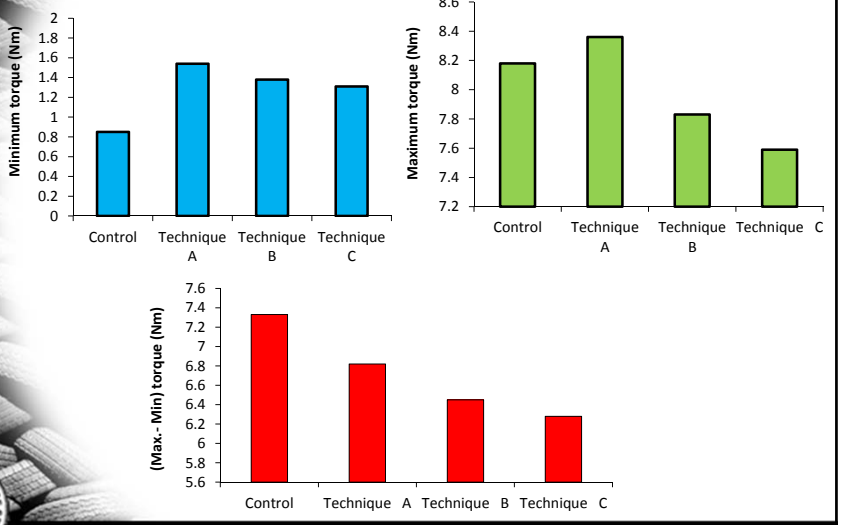
Technique A – **GRT was mixed with an equal weight of the liquid mass of the natural product and kept in an oven at 100°C for 24 hours**

Technique B – **GRT modified according to "Technique A" was milled for 5 minutes around ambient temperature using a laboratory two-roll mill (6" x 13") at a friction ratio of 1:1.1**

Technique C – **GRT modified according to "Technique A" was milled with processing oil (10 parts per hundred parts modified GRT) for 5 minutes in accordance with the milling conditions employed in "Technique B"**

RESULTS AND DISCUSSION

Cure characteristics of the rubber compounds



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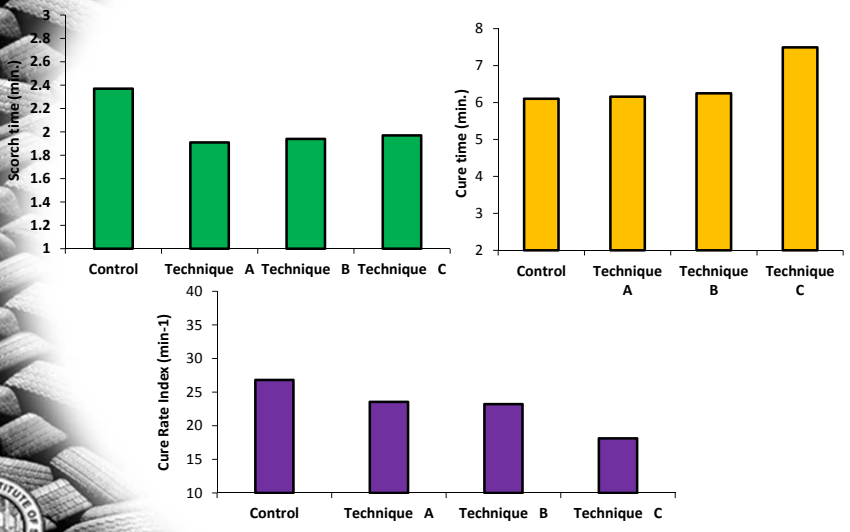
Cure characteristics of the rubber compounds



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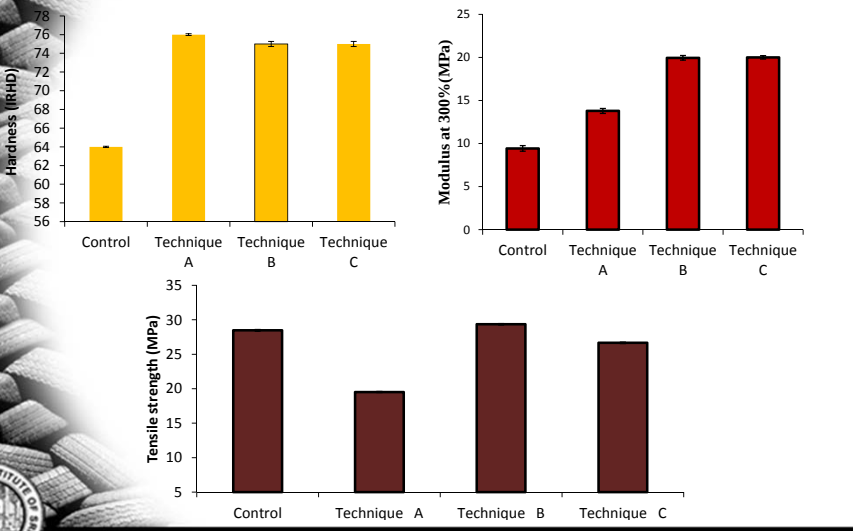
Mechanical properties of the rubber vulcanisates



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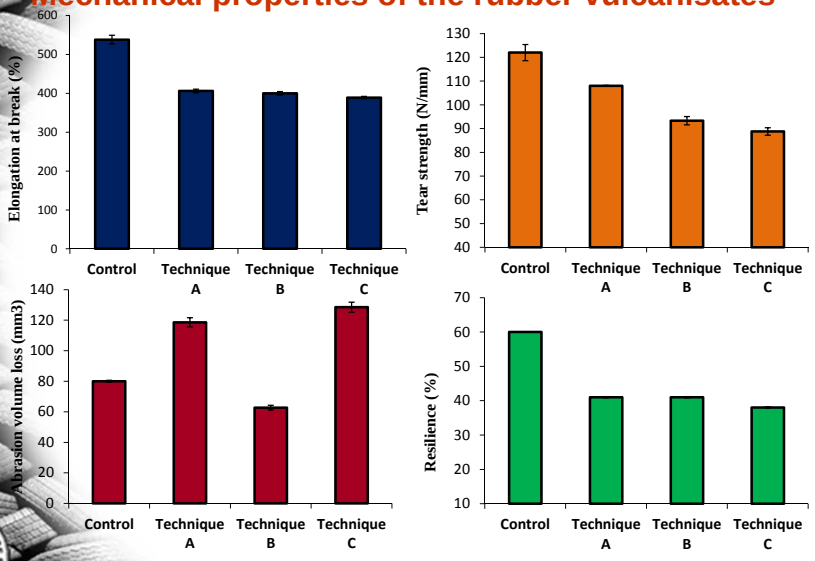
Mechanical properties of the rubber vulcanisates



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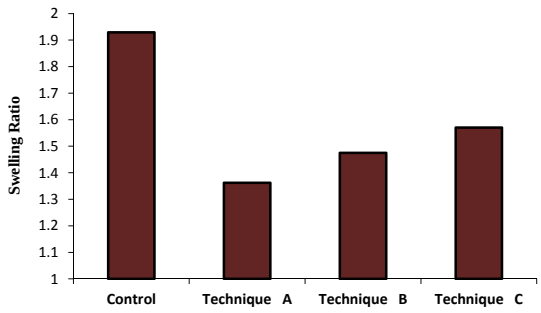
Swelling behaviour of the vulcanisates



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CONCLUSIONS

- Processing safety of the three virgin NR / modified GRT blend compounds is almost similar
- The blend compound of virgin NR and modified GRT prepared according to technique C is slower curing than other two blend compounds
- Hardness, modulus at 300%, elongation, abrasion resistance and swelling resistance of the blend of virgin NR and GRT modified according to technique B is superior to that of the virgin NR vulcanisate
- 85/30 blend compound of virgin NR and GRT modified according to technique B could be a suitable replacement for the virgin NR compound in tyre treads

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THANK YOU....
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