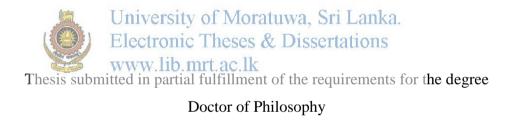
# CHEMICAL MODIFICATION OF RUBBER WASTE AND CHARACTERIZATION OF THEIR BLENDS WITH NATURAL RUBBER

## Dilhara Githanjali Edirisinghe

(8018)



Department of Chemical and Process Engineering

University of Moratuwa Sri Lanka

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### **ABSTRACT**

Ground rubber tyre (GRT) produced by recycling of tyre waste or rejects is used as a filler in the manufacture of tyre components, mainly to reduce the cost. Rubber matrix-GRT compositions generally exhibit poor mechanical properties due to poor matrix-filler adhesion and lack of reactive sites on GRT particle surfaces. Therefore, GRT is modified by employing various types of reclamation processes to enhance mechanical properties. The modified GRT known as reclaimed rubber is widely used as a component in rubber blends in many applications, especially in tyre manufacturing.

This study is focused on developing a cost effective, environmental friendly mechanochemical reclamation process for GRT to produce reclaim rubber using a readily available amino compound. Initially, influence of the amino compound on rubber compound properties was evaluated and results indicate that it acts as an activator for sulphur vulcanization. Properties of GRT modified with the amino compound indicate that the amino compound acts as a reclaiming agent as well. Comparison of properties of natural rubber (NR) / novel reclaimed rubber blend compounds and revulcanisates with those of the controls reveal that the former can be used as alternatives to the latter in the manufacture of tyre treads. Replacement of 30% of virgin NR in the vulcanisates with the novel reclaimed rubber retains about 65-85% of strength properties, elongation at break and resilience. Abrasion volume loss is at an acceptable level and ageing properties are comparable to those of the 100% virgin NR vulcanisate.

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Further, most of the properties of the wirens NR Disvellectained rubber composites are comparable to those of the corresponding composites prepared by blending NR with commercially available reclaimed rubbers. Accordingly, the novel reclaimed rubber could be a suitable component to blend with virgin NR in the manufacture of tyre treads with required properties.

**Keywords:** Ground rubber tyre, reclaiming, mechano-chemical reclamation, natural rubber, rubber blends, physico-mechanical properties

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# LIST OF ABBREVIATIONS

Abbreviation	Description
NR	Natural Rubber
MT	Metric Tons
BR	Polybutadiene Rubber
SBR	Styrene-Butadiene Rubber
TDF	Tyre Derived Fuel
GRT	Ground Rubber Tyre
GTR	Ground Tyre Rubber
ASTM	American Society for Testing and Materials
ARDL	Akron Rubber Development Laboratory
NBR	Acrylonitrile-Butadiene (Nitrile) Rubber
EPDM	Ethylene-Propylene-Diene Terpolymer
CR	UrPolychloroprene (Neoprene), Rubberanka.
CSIRO (	El Commonwealth Sesientifle and Industrial Research
	www.ahilamant.ac.lk
TMTD	Tetramethylthiuram Disulphide
TETD	Tetraethylthiuram Disulphide
ZDC	Zinc Diethyl Dithiocarbamate
MBT	2-Mercaptobenzothiazole
TCR	Trelleborg Cold Reclaiming
DMSO	Dimethyl Sulfoxide
SKS	Sekhar-Kormer-Sotnikova
IIR	Isobutylene-Isoprene (Butyl) Rubber
DPG	Diphenyl Guanidine
DVR	Devulcanised Rubber
RH	Rubber Hydrocarbon
TEM	Transmission Electron Microscopy
SEM	Scanning Electron Microscopy

RSS Ribbed Smoked Sheet Rubber

ISO International Standards Organisation

 $M_L$  Minimum Torque  $M_H$  Maximum torque

 $T_{S1}$  or  $T_{S2}$  Scorch Time

T<sub>90</sub> or T<sub>C90</sub> 90% Cure Time

N 330 High Abrasion Furnace Black

CRI Cure Rate Index

M100 Modulus at 100% Elongation
M300 Modulus at 300% Elongation

IRHD International Rubber Hardness Degrees

IR Infra-Red

FTIR Fourier Transform Infra-Red
ATR Attenuated Total Reflectance

MDR Moving Die Rheometer

RR Reclaimed Rubber

IPPD N-Isopropyl, N'-Phenyl Paraphenylene Diamine

TMQ Electronic Theses & Dissertations
2.2.4 Trimethyl-1.2-Dihydroquinoline

ZnO Zinc Oxide

CRT Cathode Ray Tube

BSE Back Scattered Electrons

TSR Technically Specified Rubber
TBTD Tetrabenzylthiuram disulphide

Ts Tensile strength

Eb Elongation at break

CB Carbon Black

MW Microwave

CT Conventional Thermal

CV Conventional Sulphur

EV Efficient Sulphur

MPI Ministry of Plantation Industries