

CENTRO ESCOLAR UNIVERSITY
GRADUATE SCHOOL

RECYCLING INNER TUBES OF USED RUBBER TIRES
INTO PAINT PIGMENT

871000

A Thesis
Presented to
the Faculty of the Graduate School
Centro Escolar University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science in Chemistry

by

Virginia B. Tanyag - *Medina*

March 1988

THE DLSU-EAC LIBRARY

ACKNOWLEDGMENTS

In presenting this work, the author wishes to acknowledge the help given by the following:

Mrs. Purificacion S. Suaco, Dean, College of Chemistry, Centro Escolar University, and Mrs. Aida P. Lacsamana, Dean, College of Arts and Sciences, De La Salle University, Emilio Aguinaldo College, Cavite; for their constant encouragements which made this work worth achievable;

Professor Betty Marges - Lontoc, Head of the Physical Sciences Department and the writer's adviser, for giving her thorough guidance and valuable suggestions;

Misses Edermina Campos and Cristina Sayoto of De La Salle University, E.A.C., Cavite Laboratory, for helping to make available the apparatus, materials and chemical reagents needed in the experiments;

Students and friends, who, in one way or another, helped in gathering the raw materials used in the research;

The writer's parents, for their moral support;

The family - Lito, Joselle Mendeleev Paulo and Chemist Christian who served as her inspiration in undertaking this study.

V. B. T.



TABLE OF CONTENTS

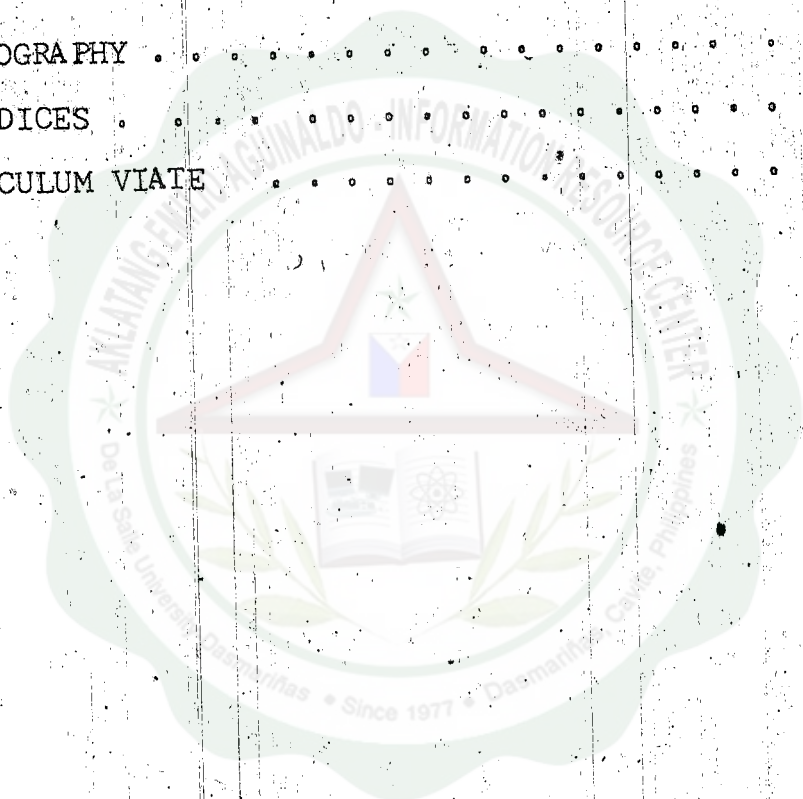
	Page
ACKNOWLEDGMENTS	ii
LIST OF TABLES	vi
LIST OF FIGURES	vii
Chapter	
1. THE PROBLEM	1
Introduction	1
Theoretical Framework	3
Statement of the Problem	4
Assumptions	5
Hypotheses	5
Significance of the Study	6
Scope and Delimitation of the Study	6
Definition of Terms	7
2. REVIEW OF LITERATURE AND RELATED STUDIES	9
Chemistry of Rubber	9
Sources of Rubbers	10
Physical and Chemical Properties .	10
Uses of Rubber	12
Carbon: Its Nature, Classification and Uses	13
Pigments	17
Uses of Pigments	19
Qualities of a Good Paint Pigment	19



Chapter	Page
Classification of Pigments	20
Testing of Pigments	24
Properties of Paint Pigments	28
Other Related Information	28
3. METHODS AND PROCEDURES	32
Collection and Preparation of the Sample	32
Isolation of Carbon Black	32
Determination of the Percent Recovery of Carbon	34
Moisture Determination	36
Specific Gravity Determination	36
Evaluation Tests for the Recovered Material	36
4. RESULTS AND INTERPRETATIONS	41
Collection and Preparation of the Sample	41
Isolation of Carbon Black	41
Percent Recovery of the Pigment Material	45
Moisture Determination	47
Determination of Specific Gravity	49
Evaluation Tests for the Recovered Material	50
Test of Applicability as a Paint Pigment	54

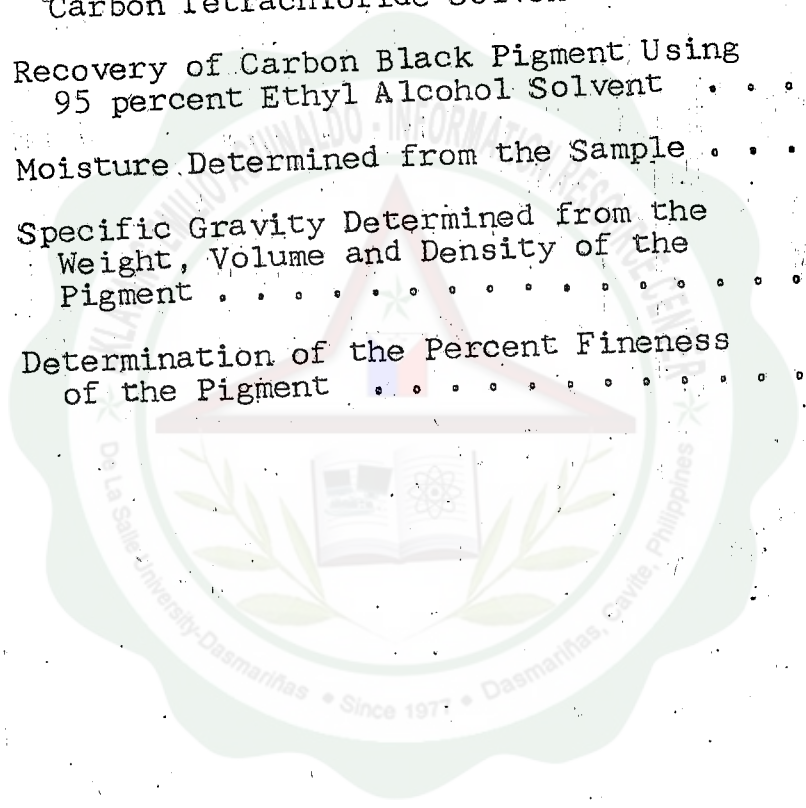


Chapter	Page
Cost of Production	55
5. SUMMARY, CONCLUSION AND RECOMMENDATION	58
Summary and Conclusions	58
Recommendations	59
BIBLIOGRAPHY	61
APPENDICES	66
CURRICULUM VIATE	74



LIST OF TABLES

Table	Page
1. Recovery of Carbon Black Pigment Using Acetone Solvent	46
2. Recovery of Carbon Black Pigment Using Carbon Tetrachloride Solvent	47
3. Recovery of Carbon Black Pigment Using 95 percent Ethyl Alcohol Solvent	48
4. Moisture Determined from the Sample	48
5. Specific Gravity Determined from the Weight, Volume and Density of the Pigment	50
6. Determination of the Percent Fineness of the Pigment	51





LIST OF FIGURES

Figure	Page
1. Digestion of the Sample by Steam Bathing	33
2. Flow Chart for the Extraction of Carbon Black	35
3. Collection of the Samples	42
4. Preparation of the Rubber Tire Samples	43
5. Screens Used in the Evaluation of the Fineness of the Pigment Particles Recovered	52
6. Photograph of Materials: Wood (1-B ₂), Iron Grill (2B ₂), and Concrete (3-B ₂) where the Pigment Paint Base Mixture was Applied	56
7. The Analytical Balance Used in Weighting the Sample and the Pigment Recovered	67
8. The Electric Oven Used in Moisture Determination	68

Chapter 5

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary and Conclusions

In this study the Carbon black was recovered from used rubber tires by digestion with concentrated Nitric acid over water bath and extraction with acetone.

The results show that more than 70 percent by weight of Carbon black can be recovered from the used rubber tires by the process employed. The specific gravity of the recovered material as determined in the study confirms the nature of the recovered material as Carbon black and the moisture content determination gave satisfactory results for its use as a pigment.

It further satisfied some tests employed such as the texture test, fineness test, bleeding tests in water, oil, and thinner.

Further tests on the applicability indicated that the best form for the isolated Carbon to be used as a tinting material for commercial paint base is as a fine solid after its complete extraction with Acetone and drying to remove such solvent.

Thus, in conclusion, the following statements are

offered in answer to the questions proposed at the beginning of the study:

1. Carbon black can be recovered from used rubber tires by digestion with concentrated HNO_3 over water bath and extraction with Acetone.

2. Appreciable amounts (more than 70 percent) of Carbon black can be recovered from these materials.

3. Carbon black extracted with Acetone as the solvent and expressed in a dry, solid form is a good pigment based on the physical properties shown. It gave satisfactory results with the tests employed which were: testure test, bleeding tests in water, oil, and thinner; moisture determination, and specific gravity determination.

4. The Carbon black recovered in the dry, solid form is suitable as a paint pigment, specifically as a tinting material for mixing with paint bases.

Recommendations

It is highly recommended that further studies be taken along the same line regarding a more extensive and detailed verification on the following aspects:

1. Possibility of using other solvents to recover the pigment from the same waste materials which could bring a more economical process;

2. Utilization of the recovered Carbon black as a pigment for black plastics, printing inks, typewriter ribbons, etc.;

3. Further use of this Carbon black in the actual paint formulations where it could find suitability for different applications such as in marine paints, automobile finishes, etc.; and

4. Economic viability of an industry on the actual production of Carbon black pigment from used rubber tires.

