

## الآية

قال تعالى

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

{قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ}

صدق الله العظيم

سورة البقرة الآية (32)

# Dedication

*To My*

*Parents, brothers and sisters*

*Teachers*

*Friends*

## **Acknowledgement**

All thanks for Allah who helped me in this research. I would be thankful to Dr. Amal Abdallah for helping and supporting; nothing could be done without her. Thanks also to Dr. Ali Suliman and Sudan University of Science and Technology college of science department of physics.

## **Abstract**

This research aims to define the swelling property in terms of weight change and evaluate its effect on polymer. The experimental work has been conducted in solid state physics laboratory at Sudan University of science and Technology College of science, swelling property was studied on two types of polymers rubber and plastic where two different rubber samples were used sample one containing high carbon black (external car tire), other sample lower percentage of carbon black (internal car tire). Two samples were taken from plastic bags, one containing carbon black and other does not. The above samples were placed in gasoline, acetone and benzene at room temperature for different period's time as well as water at different temperature. Found the swelling property was higher in benzene from rubber containing carbon black either plastic was found high swelling in acetone at room temperature. In water found the percentage of swelling high in both rubber and plastic at different temperature.

## المستخلص

في هذا البحث تم التعرف على خاصية التشرب و تقييم اثرها على البوليمرات. و قد تم اجراء التجارب العملية بمعمل فيزياء الجوامد كلية العلوم جامعة السودان للعلوم و التكنولوجيا. دُرست خاصية التشرب على نوعين من البوليمرات المطاط و البلاستيك حيث أُستخدمت عينتين مختلفتين من المطاط الاولى تحتوي الكربون الاسود بنسبة عالية (اطار سيارة خارجي) و الثانية بنسبة اقل (اطار سيارة داخلي). تم اخذ عينتين من الاكياس البلاستيكية واحدة تحتوي على الكربون الاسود و الاخرى لا تحتوي عليه. وضعت العينات اعلاه في الجازولين والاسيتون و البنزين في درجة حرارة الغرفة لفترات زمنية مختلفة و كذلك الماء عند درجات حرارة مختلفة. وجد ان خاصية التشرب كانت اعلى في البنزين بالنسبة للمطاط المحتوي على الكربون الاسود اما البلاستيك وُجد ان التشرب اعلى في الاسيتون و ذلك عند درجة حرارة الغرفة. اما عند درجات الحرارة المختلفة بالنسبة للماء وجد ان نسبة التشرب عالية في كلا من المطاط و البلاستيك المحتوي على الكربون الاسود.

## Table of Contents

NO of address	Contents	NO of Pages
	Holly Verse	I
	Dedication	II
	Acknowledgement	III
	Abstract	IV
	Arabic Abstract	V
	Table of Contents	VI
	List of Figures	IX
	List of Tables	X
<b>Chapter One: Introduction</b>		
1.1	Introduction	1
1.2	The objective of Research	1
1.3	The problem of Research	1
1.4	Literature Review	2
1.5	Layout of Research	2
<b>Chapter Two: Material and Properties</b>		
2.1	Introduction	3
2.2	Classification of Material	3
2.3	Properties of Materials	4
2.3.1	The optical Properties	4

2.3.2	The electrical Properties	4
2.3.3	The magnetic Properties	5
2.3.4	The thermal Properties	5
2.3.5	The mechanical Properties	6
<b>Chapter Three: Polymers</b>		
3.1	Introduction	9
3.2	The structures of Polymers	9
3.3	Classification of Polymers	10
3.4	Types of Polymers	10
3.4.1	Plastics	11
3.4.2	Elastomers	12
<b>Chapter Four: Results and Discussion</b>		
4.1	Introduction	14
4.2	Materials and Devices	14
4.3	Theorem	17
4.4	Methods	18
4.4.1	Different Temperature	18
4.4.2	Room Temperature	18
4.5	Results	19
4.6	Discussion	25
4.6.1	Different Temperature	25
4.6.2	Room Temperature	25
4.7	Conclusion	25
4.8	Recommendation	26
	References	27

## List of Figures

<b>No of Address</b>	<b>Title</b>	<b>No of Page</b>
4.1	Rubbers Samples	14
4.2	Plastics Samples	15
4.3	Sensitive Balance	16
4.4	Electric Heater	17
4.5	Different polymer samples in container	19
4.6	Result of rubber high carbon black	20
4.7	Result of rubber low carbon black	20
4.8	Result of plastic contain carbon black	21
4.9	Result of plastic does not contain carbon black	22
4.10	Result of rubber high carbon black	22
4.11	Result of rubber low carbon black	23
4.12	Result of plastic contain carbon black	24
4.13	Result of rubber does not contain carbon black	24



## List of Table

<b>No of Address</b>	<b>Title</b>	<b>No of page</b>
4.1	Result of rubber high carbon black	19
4.2	Result of rubber low carbon black	20
4.3	Result of plastic contain carbon black	21
4.4	Result of plastic does not contain carbon black	21
4.5	Result of rubber high carbon black	22
4.6	Result of rubber low carbon black	23
4.7	Result of plastic contain carbon black	23
4.8	Result of rubber does not contain carbon black	24