RADIATION GRAFTING OF METHACRYLIC ACID ONTO SOME POLYMERIC MATERIALS

THESIS

SUBMITTED TO

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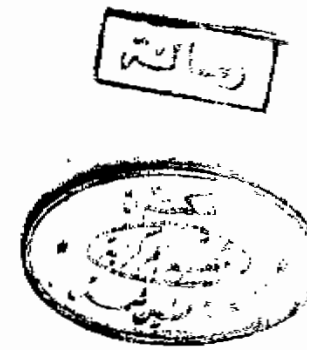
AIN SHAMS UNIVERSITY



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IN

(CHEMISTRY)

BY

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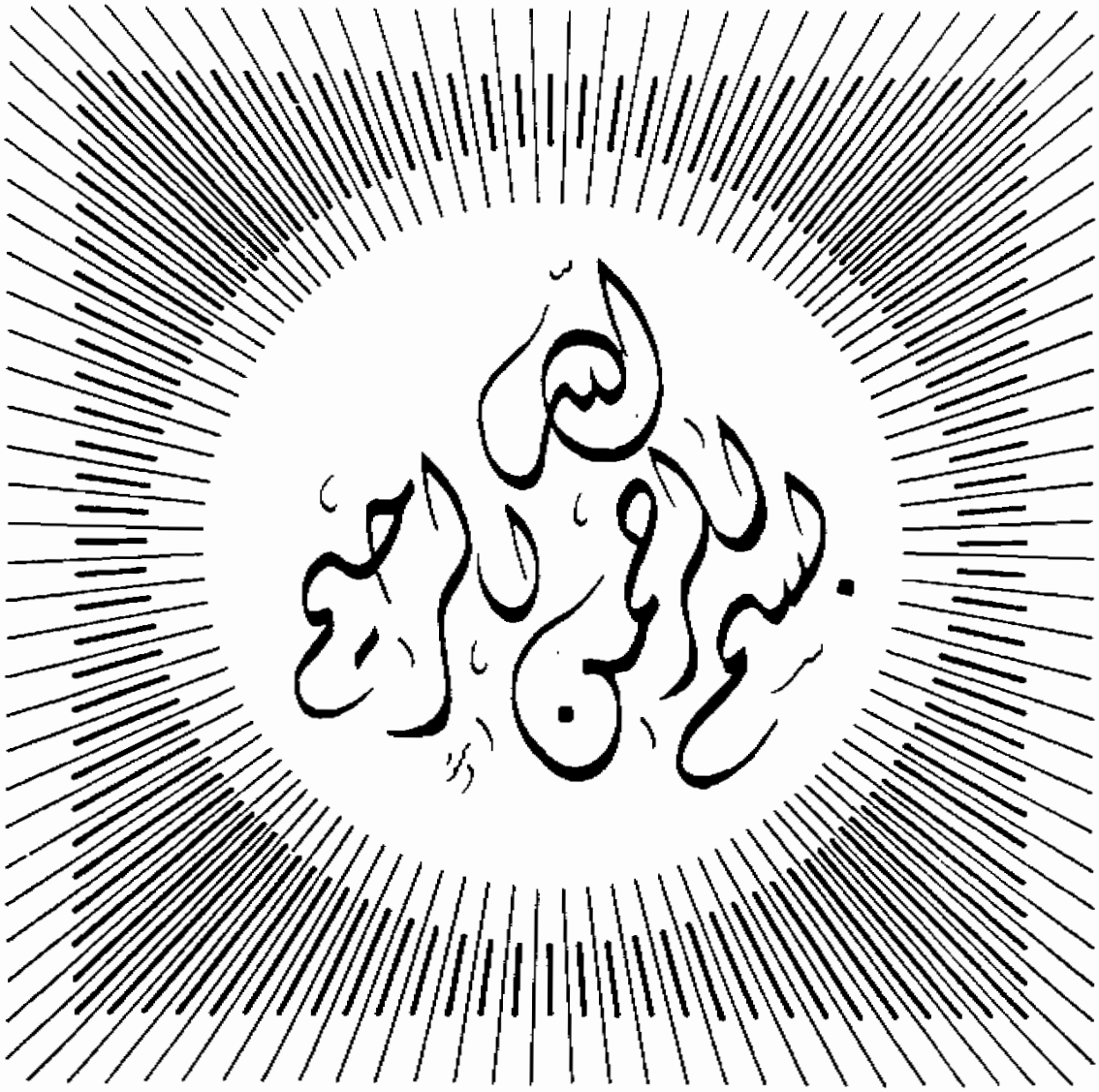

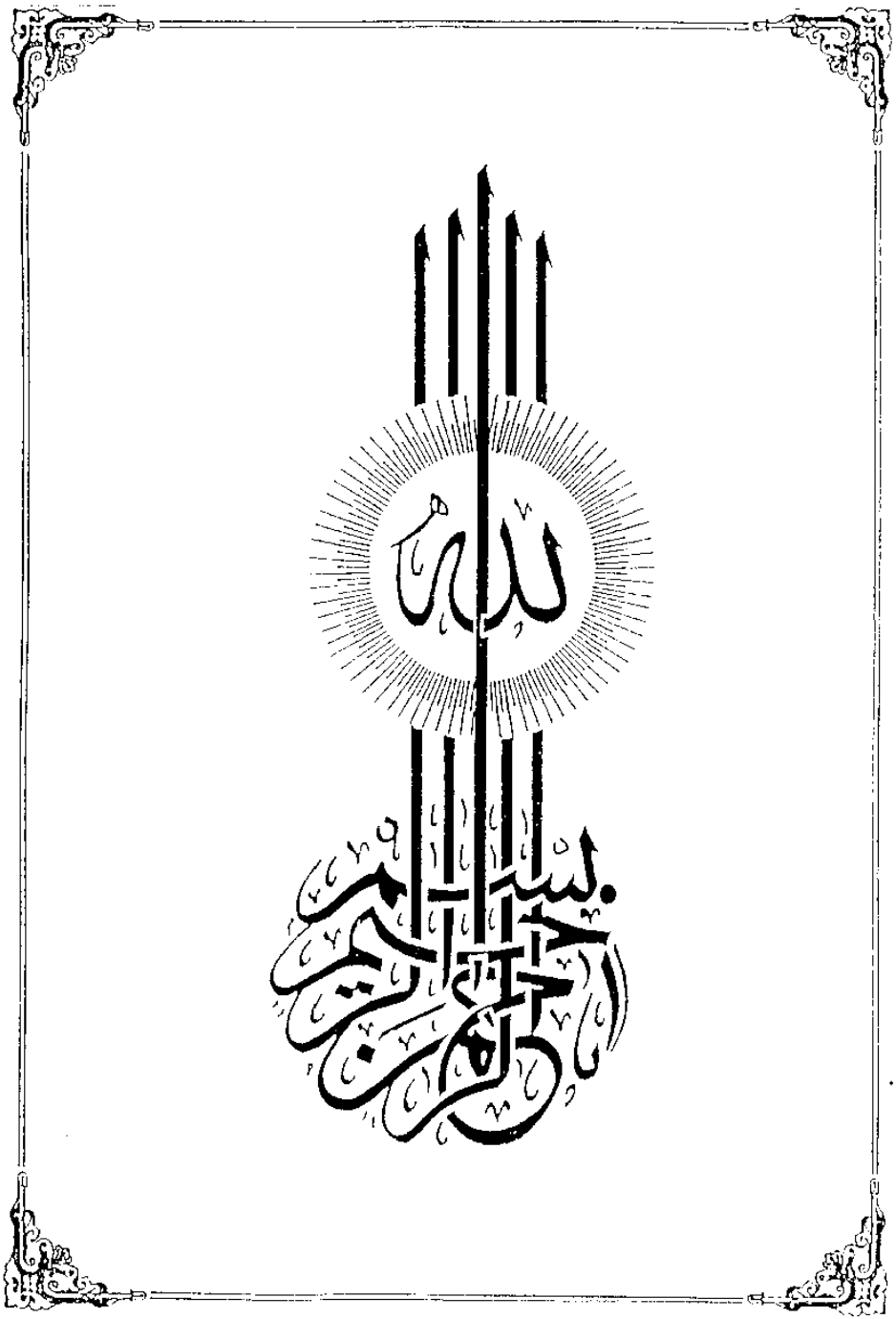

TO

MY CHILDREN

ACKNOWLEDGEMENT

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" RADIATION GRAFTING OF METHACRYLIC ACID ONTO SOME POLYMERIC MATERIALS "

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" NOTE "

Besides the work carried out in this thesis, the candidate has attended postgraduate courses in the following topics :-

1- Photochemistry.

2- Instrumental Analysis.

3- Polymer Chemistry.

4- Quantum Chemistry.

5- Spectroscopy.

6- Chemical Kinetics and Catalysis.

7- Thermodynamics.

8- Surface Chemistry.

9- Advanced Electrochemistry.

10- Advanced Reaction Mechanism.

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CONTENTS

CHAPTER IV
RESULTS AND DISCUSSION

AIM OF WORK

Synthetic polymeric membranes play a very important role for practical application in various separation processes. In spite of their good filtration properties, these membranes have certain shortcomings as far as their selectivity, chemical and thermal stability are concerned. Considerable effort has therefore been spent in recent years to develop new membranes with better separation characteristics and better overall properties tailor-made for special application.

Fluoro polymers are appropriate materials in preparing membranes for separation processes because of their good thermal, mechanical and chemical resistance. The hydrophobic character of the fluoro polymers can be overcome by the radiation initiated grafting of hydrophilic monomers onto these polymers. The nature and morphological peculiarities of the trunk polymers as well as grafting reaction parameters affect the membrane properties of the grafted films. The most important applications of these synthetic membranes are in industrial mass separation processes such as micro, ultra-and hyperfiltration, electrodialysis and gas separations. However, a considerable amount of research is being conducted to develop membranes for many other uses such as enzyme reactors, electrochemical power sources, ion-selective electrodes and for the controlled release of active agents in the medical and biomedical field. The goal of all membrane research is to

develop structures with transport properties and chemical and mechanical stability tailor-made for their specific application

Radiation-induced graft copolymerization is a versatile technique which can be used to alter the surface and/or bulk characteristics of a polymeric substrate. This technique utilizes electron beam or gamma radiation to form radicals or ions in the polymer substrate, which then can attack monomers to initiate polymerization, which results in grafting.

The aim of the present study is to prepare membranes by the direct radiation grafting of methacrylic acid (MAA) onto some fluorinated polymers such as poly (tetrafluoroethylene - hexafluoropropylene vinylidene fluoride) (TFB), and poly (Tetrafluoroethylene - perfluoro vinylether) (TFA). Also, methacrylic acid was grafted onto polypropylene (PP) films, for the same purpose.

The effect of solvent, inhibitor and monomer concentration, dose rate and radiation dose on the rate and mode of the grafting process was studied. Some selected properties of the prepared grafted films such as swelling behaviour, dimensional change, electrical and mechanical were investigated.

Thermal and chemical stability of the grafted membranes were also studied at various elevated temperatures and in different acidic solutions. The gelled part in the graft copolymers was also determined. The practical uses of such grafted membranes were suggested.

CHAPTER I

INTRODUCTION

INTRODUCTION

POLYMER MODIFICATION

The modification of the properties of polymeric materials is one of the most important fields of research both in academic and applied science.

There are different ways used for such purposes in order to introduce some beneficial properties. General methods of modification can be summarized in the following :-

a. Copolymerization

It is the polymerization of more than one monomeric species at the same time under specific experimental conditions. The produced copolymer usually has properties of both monomers.

b. Graft and Block Copolymerization

Graft-copolymers in general and those of vinyl monomers on cellulose and cellulosic materials found many fields of technological exploitation.

Copolymerization reactions can be initiated by many means including γ-irradiation.

c. Vulcanization - Degradation and Cross-linking

Controlled reactions of these types are very useful especially in polymers having unsaturated double bonds. All these reactions can also be initiated by γ-radiations.

d. The Use of Additives

A lot of additives are usually added to the polymeric materials in order to make them suitable for processing and exploitation. Such additives are plasticizers, crosslinking agents, hardeners, dyes, fillers, ... etc.

There are many other methods of chemical modification of polymers such as oxidation, and halogenation ..... etc.

e. Modification by γ-radiation

The modification of plastics by high energy radiations has attracted considerable interest in the last 20 years[1-4]. The chemical and physical changes are gradually found when long chain polymers are subjected to such radiations. The effect of high energy (ionizing) radiations on a polymer material may result in an improvement in some physical properties and deterioration in others[5]. Accordingly, this opened up the possibility of commercial exploitation, improvement in the field of industrial dosimetry, packaging, medical purposes, coatings and sterilization.