RADIATION-INDUCED GRAFTING OF ACRYLIC ACID ONTO POLYPROPYLENE AND SOME FLUORONATED POLYMERS

THESIS

Submitted to University College for Girls

Ain Shams University

In partial fulfilment of the requirements for the

Degree of M.Sc.
In
(Chemistry)

By
Fayza Hassan Khalil
(B.So)

National Centre For Radiation
Research and Technology
(Atomic Energy Authority)

Egypt

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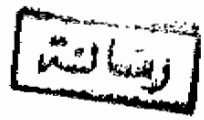

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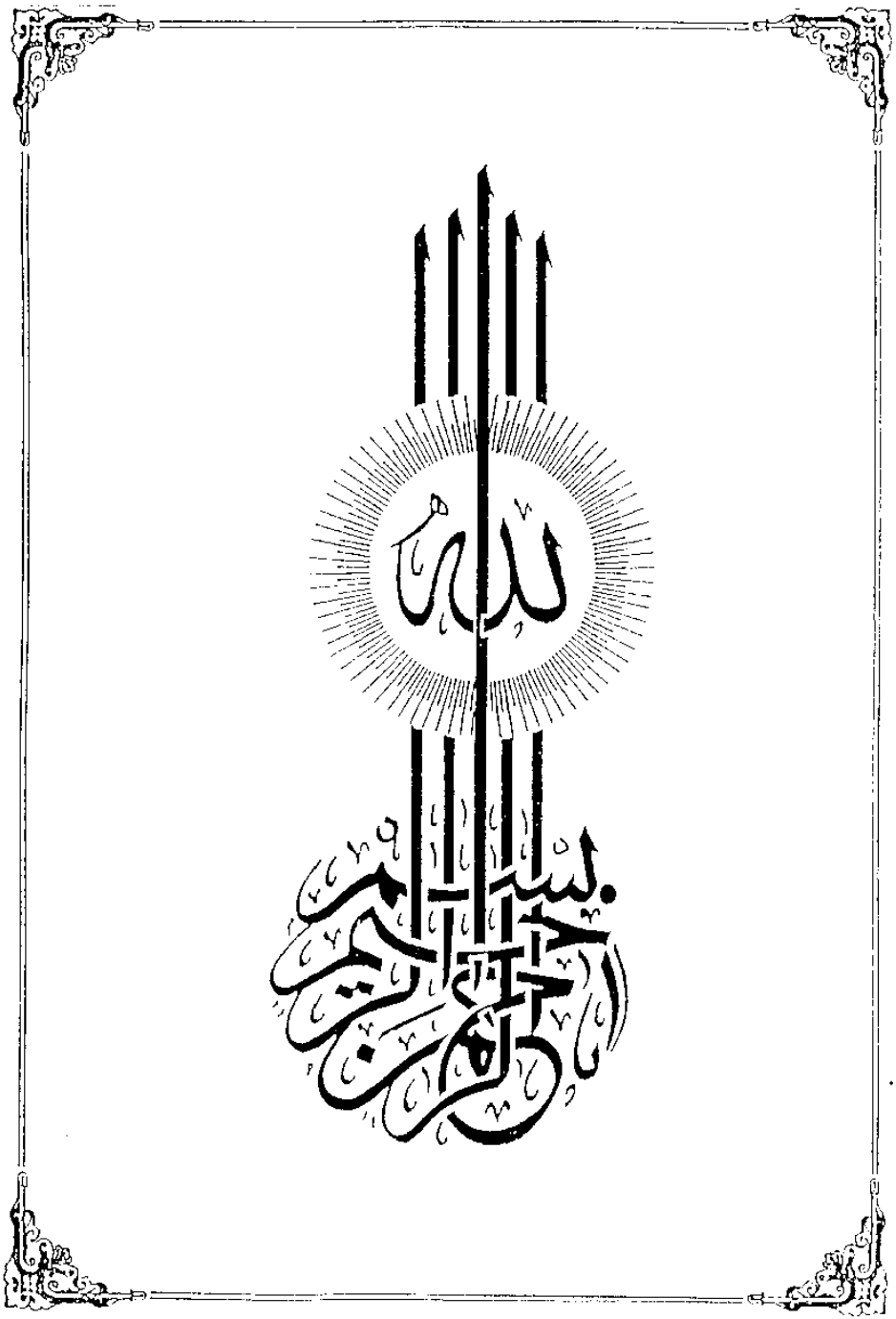

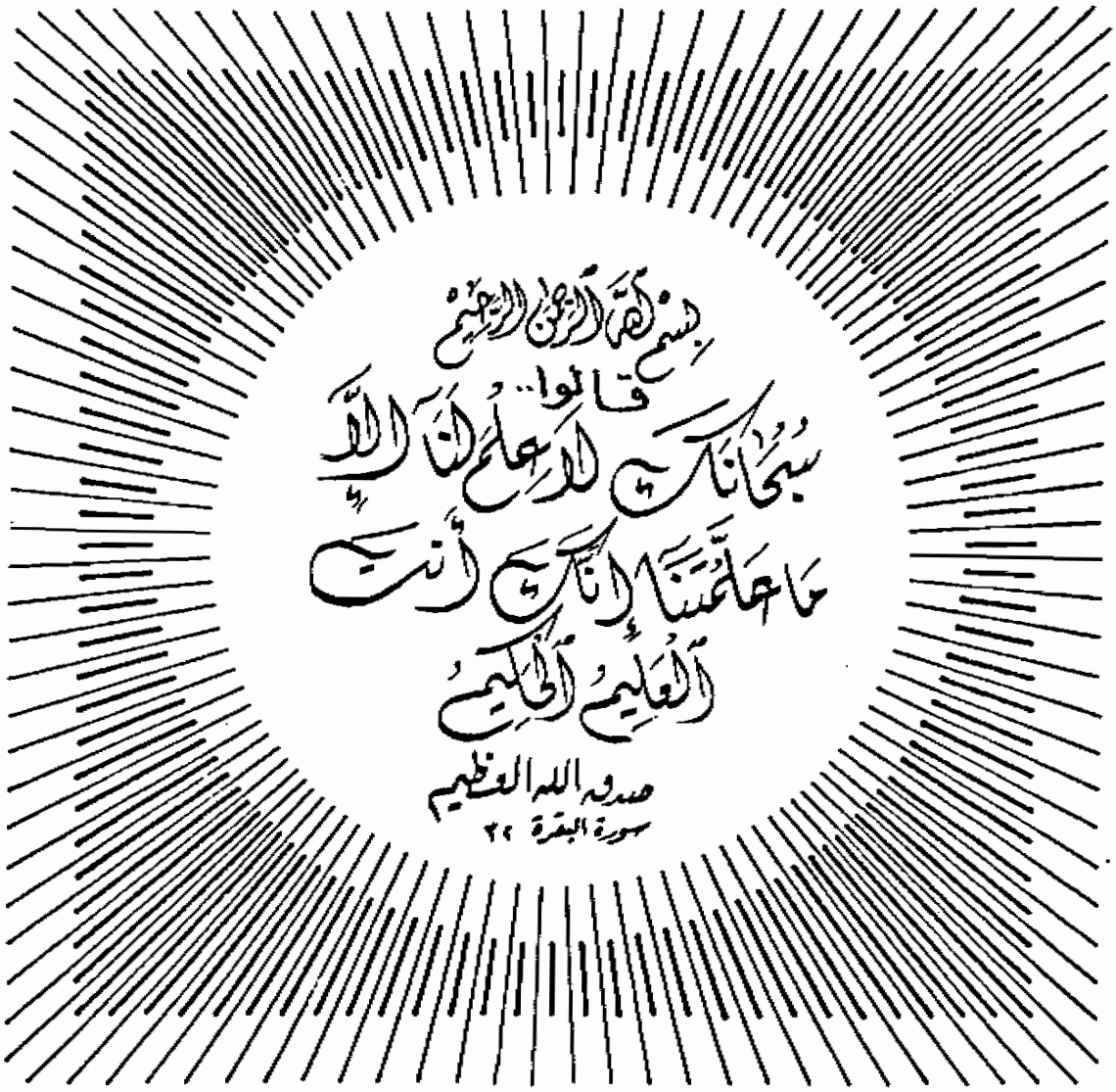

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TO MY FATHER

RADIATION-INDUCED GRAFTING OF ACRYLIC ACID ONTO POLYPROPYLENE AND SOME FLUORONATED POLYMERS

Thesis Advisors	Approved
1- Prof. Dr. Ahmed Abdel-Reheim Taha	
2- Prof. Dr. Ahmed M. Dessouki	
3- Assist. Prof. Dr. Nafossa Hafez Ahmed	

Prof. Dr. Marguerite Anis Wassef

Head Of Chemistry

Department

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.

She has successfully passed a written examination in these courses, partial fulfillment for the degree of Master of Science.

Approved.

Prof. Dr. **Marguerite Anis Wassef**

Head Of Chemistry

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AIM OF WORK

The aim of this work is to synthesize memberanes exhibiting good properties such as swelling, permselectivity, electrical conductivity, chemical and thermal stability and mechanical properties, for possible practical applications. Graft copolymerization is an attractive means for modifying base polymers because grafting results mostly in the superposition of properties relating to backbone and pendant chains. Among the various methods for initiating the grafting reaction is ionizing radiation which is the cleanest and versatile method of grafting available. In this method ionizing radiation creates active sites on an inert polymer suitable for polymerizing monomer to form grafts,a process which is very difficult to achieve through conventional chemical reactions. A complete hydrophobic polymer never allows water to pass under pressure and its electric resistance is high. Introducing hydrophilic groups to the hydrophobic polymer by radiation grafting produces permeable membranes, which may have low electric resistance and allow water to pass under high pressure.

The direct-initiated radiation grafting of acrylic acid onto polypropylene and some fluorine - containing polymers

such as, poly (tetrafluoroethylene - perfluoro vinylether) TFA, poly (tetrafluoro ethylene - hexafluoropropylene vinylidene flouride) TFB, and (Teflon/Polyethylene) ET, films was studied. These materials are known to have excellent thermal and chemical stability and good mechanical properties. It is also important to recognize the considerable array of system parameters which effects the characteristics of the graft copolymer and in turn the ultimate properties of the bulk graft copolymer. In this connection, the properties of the grafted films such as dimensional change by grafting, water uptake, electrical conductivity, mechanical properties, thermal and chemical stability were investigated.

The possiblity of the practical applications of these membranes were proposed. On the other hand, the effect of gamma radiation on the trunk polymers has been studied.

CHAPTER I

INTRODUCTION

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Interaction of High Energy Radiation with Polymers:

The modification of Polymers by high energy ionizing rediation 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 radiation. The effect of high energy ionizing radiations on a polymeric material may result in an improvement in some physical properties and deterioration in others [5].

Two reaction processes occur when electromagnetic radiation passes through matter, it may interact either with the atomic nucleus or with orbital electrons. In the case of polymeric materials, reaction with orbital electrons are more frequent. The removal of the orbital electrons disrupts the stability of the macromolecules, given rise to a positive ion :

$$\text{—CH}_2\text{—R} \xrightarrow{\sim\sim} \text{CH}^+_2\text{—R} + e \quad (1)$$

When the ionized molecules are discharged by the thermal electrons, highly excited molecules are formed

$$\text{—CH}^+_2\text{—R} + \bar{e} \longrightarrow \text{—CH}^*_2\text{—R} \quad (2)$$

These excited molecules are decomposed into free radicals

$$\text{—CH}_2\text{—R} \longrightarrow \text{—CH}^{\cdot}\text{—R} + H^{\cdot} \quad (3)$$