Ain Shams University,
Women's College for Arts,
Science and Education,
Cairo, Egypt.

Radiation synthesis of polymeric materials and its possible application

A Thesis

Submitted to Chemistry Department,
Women's College, Ain Shams University
In Partial Fulfillment of The Requirements For The
Degree of Master of Science

Presented by
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(2012)

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بسم الله الرحمن الرحيم

الحمد لله الذي له ما في
السموات وما في الأرض
وله الحمد في الاخره
وهو الحكيم الخبير

صدق الله العظيم

سوره سبأ الأيه (١)

Ain Shams University
Women's College for
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NOTE

The candidate has attended post-graduate courses for one year in Physical Chemistry covering the following topics.

1- Quantum Chemistry

2- Advanced Reaction Mechanism

3- Thermodynamic Chemistry

4- Kinetics and Catalysis

5- Polymer Chemistry

6- Nuclear Chemistry

7- Photo Chemistry

8- Surface Chemistry

9- Electrochemical Analysis

10- Instrumental Analysis

11- Chemistry of Cement

12- Spectroscopy

13- English Language

He has successfully passed written examinations in these courses.

Head of Chemistry Department

ACKNOWLEGMENT

Praise and Thanks be to **ALLAH,** the most merciful for assisting and directing me the right way**.**

I greatly appreciate, **the Head of the National Center for Radiation and Technology**, Nasr City, Cairo, Egypt, for useful directions and valuable discussion throughout this work.

My deepest appreciation to ***Prof. Dr. Ahmed A. Taha,*** Prof. of Physical Chemistry, Women's College for Arts, Science and Education, Ain Shams University, for useful directions, valuable discussion and encouragement throughout the whole work .

I would like to submit my gratitude, sincere thanks and appreciation to ***Prof. Dr. Nafosa H. Taher***, Prof. of Physical Chemistry, National Center for Radiation and Technology, Egypt, for her deep concern in this work, and guiding and encouraging me.

My deepest gratitude and appreciation to ***Prof. Dr. Magda B. El-Arnaouty,*** Prof. of Physical Chemistry, National Center for Radiation and Technology, Egypt, for suggesting the point of research, continuous interest and fruitful discussion, direct supervision and valuable guidance throughout this work.

Thanks are also to ***Dr. Ashraf Maher,*** Ass. Prof. of Physical Chemistry, National Center for Radiation and Technology, Egypt, for this kind help, support and friendship.

My sincere thanks for my **colleagues** in the chemistry department, National Center for Radiation and Technology, for the team spirit and their ultimate support.

Maysara Aboulfotouh

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Radiation synthesis of polymeric materials and its possible application

Abstract

γ-Radiation-induced graft-copolymerization of the binary monomers system butylmethacrylate/acrylamide (BMA/AAm) comonomer into low density poly ethylene (LDPE) and polypropylene (PP) films and also the preparation of butylmethacrylate/acrylamide (BMA/AAm), poly (BMA) and poly (AAM) hydrogels using direct radiation technique have been investigated.

The appropriate reaction conditions such as solvent nature, comonomer composition and concentration, and the value of the irradiation dose at which the copolymerization process can be successfully achieved have been determined. The most suitable comonomer composition (BMA/AAm) was found to be (50: 50) for both LDPE and PP films. Also using DMF as a solvent at concentration (50:50) wt% enhanced the copolymerization process. The grafting (%) is increased with increasing the irradiation dose up to 30 kGy.

Poly (BMA/AAm), poly (BMA) and poly (AAm) hydrogels are obtained at (50:50) comonomer composition and

at different comonomer concentrations in the presence of DMF (50:50 wt%) as a solvent at ambient temperature.

Some properties of the grafted membranes such as water uptake and thermal stability have been investigated, where the improvement of such properties let these membranes very useful in some practical applications such as the removal of some heavy metals from wastewater.

Poly (BMA), poly (AAm) and poly (BMA/AAm) hydrogels have been prepared by gamma-irradiation at different irradiation doses and the hydrogels were identified by FTIR. The pore structure of the hydrogels was monitored using scanning electron microscopy and thermogravemetric analysis (TGA). The rate of the thermal decomposition of the hydrogels has been evaluated to give a better understanding of the thermal stability of the hydrogels. The X-ray data of the hydrogels have been discussed to inform about the degree of ordering and its crystallite size. The effect of comonomer concentration, dose rate and pH on the swelling behaviour has been examined. It was observed that the introduction of AAm monomer with BMA monomer increases the swelling extent and thus poly (BMA/AAm) hydrogel has a higher swelling tendency than poly (AAm) and poly (BMA). Consequently, the heparin-loading % of poly (BMA/AAm) hydrogel is much higher than the loading % of both poly (BMA) and poly

(AAm) hydrogels. Some unique characteristics of the reported poly (BMA) hydrogel such as its gelation %, biocompatibility and its low degradation rate makes its uses possible instead of the conventional drug delivery systems. Furthermore it could improve the biocompatibility of many materials.

Key Words: Radiation copolymerization – Metal uptake – Hydrogels – Thermal analysis – Heparin loading release – Drug delivery systems.

Aim of the work

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

In the present study, grafting of butylmethacrylate (BMA) and acrylamide (AAm) as a binary comonomer system into polyolefins such as low density polyethylene (LDPE) and polypropylene (PP) films using direct γ-irradiation has been investigated. The two monomers BMA and AAm are good biocompatible with blood and the human body, moreover they have no toxic effect.

The effect of some parameters such as the nature of the solvent, comonomer concentrations, comonomer composition and the value of the irradiation dose on the yield of the copolymerization process has been studied. Some selected