Cairo University
Faculty of Science
Chemistry Department

Improving the Compatibility of Natural and Synthetic Polymer Blends by Radiation Treatments for Using in Practical Application

Thesis
Submitted In Partial Fulfillment of the Requirements
For the PhD Degree in Chemistry

To

Chemistry Department
Faculty of Science
Cairo University

By

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M.Sc. Organic Chemistry (2006)

2010

ACKNOWLEDGMENTS

Deepest thanks to Prof. Dr. Abdel Wahab M. El-Naggar, Radiation Chemistry Department, National Center for Radiation Research and Technology, for suggesting the topic of this work, his keen enthusiasm, sincere guidance and continuous supervision.

High appreciation is due to Prof. Dr. Horia M. Nizam El-Din Polymer Chemistry Department, National Center for Radiation Research and Technology for suggesting the topic of this work, her continuous supervision, her keen enthusiasm and sincere guidance.

I would like to thank Prof. Dr. Fawzy A. Attaby, and Dr. Rasha M. Faty Chemistry Department, Faculty of Science, Cairo University for their continuous supervision.

I would like to thank, Chemistry Department, Faculty of Science, Cairo University for her sincere guidance.

Special thanks to collogues and Head of Polymer Chemistry Department, National Center for Radiation Research and Technology for their help and continuous encourage.

Finally, I would like to thank my friends and family for their encouragement, love and support throughout these years.

Dedication

To my Parents may God bless their souls?

Aim of the Work

Recently, polymer blends and composites provided an economical way to produce new materials with wide properties and applications. However, the especially most important blends are those based on natural and synthetic polymers, which they are immiscible in most cases. The incompatibility in polymer blends so far has a great influence on the entire physical and chemical properties. Thus, the present work was undertaken to prepare three hydrophilic blends based on natural and synthetic polymer. These blends are based on: (1) carboxymethyl cellulose (CMC) and polyethylene glycol (PEG), (2) carboxymethyl cellulose (CMC) and polyethylene oxide (PEO) and (3) Polyacrylamide and sodium alginate (AG). These blends are miscible in water. Also, the present work was aimed at studying the effect of gamma radiation on the compatibility and the physical and chemical properties of these blends. The different polymer blends of different compositions were evaluated for different industrial and pharmaceutical applications such as removal of heavy metals from wastewater, removal of dyes from wastewater and as drug delivery systems.

Abstract

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Title of the thesis: **Improving the compatibility of natural and synthetic polymer blends by radiation treatment for using in practical applications**

Degree: PhD

Different polymer blends based on the natural polymers carboxymethyl cellulose (CMC) and sodium alginate as well as the synthetic polymers poly(ethylene glycol) (PEG), poly(ethylene oxide) (PEO) and poly acrylamide (PAM) were prepared by solution casting in the form of films. The common solvent used was water. The different blends prepared in this study were subjected to gamma radiation. The compatibility and structure-property behaviour of these blends was studied by differential scanning calorimetry (DSC), Fourier-Transform Infrared (FTIR) analysis, thermogravimetric analysis (TGA), scanning electron microscopy (SEM), and tensile mechanical testing before and after irradiation. In addition, the swelling properties of different polymer blends were studied at different conditions of temperature and pH. The controlled release characters of the different blends of different drugs were investigated. In addition, the different polymer blends were used for the removal of heavy metals and dyes waste.

Keywords: Carboxymethyl cellulose, Polyethylene glycol; Polyethylene oxide, Sodium alginate, Polyacrylamide, FTIR, DSC, TGA, SEM.

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List of Abbreviations

Symbol	Scientific Meaning
FTIR	**Fourier-Transform Infrared Analysis**
DSC	**Deferential Scanning Calorimetry**
TGA	**Thermogravimetric Analysis**
SEM	**Scanning Electron Microscopy**
CMC	**Carboxymethyl Cellulose**
PEG	**Poly(Ethylene Glycol)**
PEO	**Poly(Ethylene Oxide)**
PAM	**Poly(Acrylamide)**
DDS	**Drug Delivery System**

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