Effect of Gamma Irradiation on Blends Based on Thermoset or Thermoplast Polymers for Using in Some Useful Applications

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By

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In the name of Allah, most gracious, most merciful.

All praise and glory to Allah the almighty who alone made this small objective to be accomplished. I feel honored to glorify his name in the sincerest way through this small accomplishment and ask him to accept my efforts. Peace be upon the prophet, his companions and all who followed him until the day of judgment.

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Eman M. Shehata

DEDICATION

To

My lovely parents,

brother and sister

Thanks for being a part of my life

ABSTRACT

Modification of polymers via blending and gamma irradiation crosslinking opens the door for solving many industrial problems and broad the application and markets for the products of modified materials. From this point of view, the present work is divided into two main parts. **The first part** is dealing with the preparation and characterization of alkaline polymer electrolyte membrane based on polyethylene oxide and polyvinylpyrrolidone. The alkaline polymer electrolyte membranes were prepared by two different techniques: immersing the irradiated prepared membranes in different concentration of KOH solutions, and addition of various amounts of KOH to (PEO/PVP) mixture solution during the preparation step. Exposing the prepared membranes to different gamma irradiation doses causes an improvement in the membranes properties such as water solubility and thermal properties. The structure and morphology of the prepared polymer membranes were studied by FTIR spectroscopy and scanning electron microscope. Furthermore, the ionic conductivity of alkaline (PEO/PVP) electrolyte membranes was calculated from Ac impedance spectra. The results obtained showed that the membranes prepared by immersion

technique have better properties than the membranes prepared by addition technique.

Concerning **the second part**, urea formaldehyde (UF) as a thermoset amino resin, was modified by exposing to different gamma irradiation doses and blending with various amounts of vinyl acetate versatic ester latex (VAcVe). Gamma irradiation induced the crosslinking of pure UF and (UF/VAcVe) blends. The change in the structure of pure UF and (UF/VAcVe) blends before and after irradiation was investigated by FTIR spectroscopy. Moreover, physical properties such as insoluble fraction percent, water absorption behavior, and effect of dilute acid and alkali were studied. Thermal and mechanical properties were investigated in terms of thermogravimetric analysis and compacting strength measurement. The results obtained showed an improvement in the thermal stability and a decrease in compressive strength that is related to the amount of VAcVe added.

Keywords: Polyethylene oxide, polyvinylpyrrolidone, Urea formaldehyde, Radiation, thermal properties.

Aim of the work

This work is divided into two main parts:

The first part aims at:

- Preparation of a cost effective alkaline polymer electrolyte membrane using solution casting method.
- Improving the membrane properties via gamma irradiation.
- Evaluation of the prepared alkaline polymer electrolyte membrane as a carrier for hydroxyl transport, with high ionic conductivity and good thermal stability.

And the second part aims at:

- Studying the effect of gamma irradiation on urea formaldehyde (UF) resin.
- Improving the performance of UF film by the addition of vinyl acetate versatic ester (VAcVe).
- Evaluation of UF/VAcVe blends to ensure that it can be used as joint filler in the flooring.

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