Radiation Vulcanization of Polymeric Blends Based on Ethylene Propylene Diene Monomer Rubber/ Waste Materials in Presence of Different Additives

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For
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In Chemistry
(Physical Chemistry)

By

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(M.Sc. 2011)

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AIM OF THE WORK

Blending of polymeric materials has proved to be a successful method for preparing new polymeric materials having not only the main properties of the blend components but also new modification as well as specific ones. Hence, the blending technique becomes a desirable one and of commercial interest. Rubbers as polymeric materials are usually solid and therefore the method of mechanical blending has been found to be the most suitable one for preparing blends of rubbers.

Recycling of waste materials (Rice Husk and Ground Tire Rubber) as technique for solving their environmental pollution and using them in various industrial applications, has shown to be an appreciable one.

Ionizing radiation offers possibilities for the process of recycling waste polymers, due to its ability to cause cross-linking and or scission to a wide range of polymeric materials.

This work aims at studying the effect of gamma radiation on polymeric blends based on ethylene propylene diene monomer (EPDM) rubber to produce stable polymeric blends. These blends (EPDM/NBR) are filled at first with waste materials such as rice husk (RH) or ground tire rubber (GTR) as an additive. Different properties of prepared filled blends are followed up, specifically, mechanical, physical, thermal and morphological ones. Improvement of these properties is then aimed by adding together materials of different functional characters such as maleic anhydride (MAH)as a compatibilizer ,HAF-carbon black or Hisil as a reinforcing filler and N,N- methylene diacrylamide (MDA) as enhancing polyfunctional monomer.

ABSTRACT

In this investigation, the mechanical blending technique was applied for preparation of elastomeric blend of ethylene propylene diene monomer rubber (EPDM)and nitrile butadiene rubber (NBR) having a fixed ratio of (50/50) by weight. The prepared blend of EPDM/NBR (50/50) was used as a rubber matrix to be loaded with waste materials, namely rice husk (RH) as a natural waste filler and then with ground tire rubber (GTR) as an artificial one. The degree of loading varied from 5phr to 20 phr. Ionizing radiation, namely ,gamma rays were applied for inducing vulcanization of prepared and loaded rubber blends, in the range from 5 kGy to 250 kGy. Different properties of prepared composites were followed up as a function of degree of loading with the waste material and dose of irradiation.

The mechanical properties, namely tensile strength and elongation at break percent of the composites slightly decreased as the filler loading increased over the whole range of irradiation .Tensile modulus and hardness, on the other hand, showed an opposite trend, i.e. the increased. Other properties, namely physical, thermal and morphological confirmed the mechanical ones. Obtained results were affiliated with lack of interface adhesion between the waste materials and the rubber matrix elastomers.

The lack of interface adhesion was improved by filling the composite with a limited content, up to 7 phr, of the compatibilizer, namely, maleic anhydride (MAH). Measurements of different properties was carried out for composite loaded with 10 phr of waste material.

It has been found that the tensile properties were significantly improved with addition of the compatibilizing agent.

Further and significant improvement was attained in properties of prepared later composite by its loading with 40 phr of either HAF-carbon black or Hisil as reinforcing fillers that participates in chemical as well as physical bonding.

Similarly and lastly 8 phr of N, N- methylene diacrylamide (MDA) were loaded as an enhancing polyfunctional monomer, i.e. co-agent

Properties obtained showed further improvement due to its participation in gel formation.

CONTENTS

page

CHAPTER I
INTRODUCTION

CHAPTER II
LITERATURE REVI EW

CHAPTER III
EXPERIMENTAL

CHAPTER IV
RESULTS AND DISCUSSIONS
PART ONE

PART TWO

LIST OF TABLES **Page**