

Morphological, Optical, Electrical Characterizations and Anti-Escherichia coli Bacterial Efficiency (AECBE) of PVA/PAAm/PEO Polymer Blend Doped with Silver NPs

Karar Abdali¹, Khalid Haneen Abass^{2✉}, Ehssan Al-Bermamy², Enas M. Al-robyai³, Ashraq M. Kadim⁴

¹Ministry of Education, Baghdad, Iraq.

²Physics Department, College of Education for Pure Sciences, University of Babylon, Iraq.

³Physics Department, College of Science, University of Babylon, Iraq.

⁴Medical Physics Department, Hilla University College, Iraq.

✉ Corresponding authors. E-mail: pure.khalid.haneen@uobabylon.edu.iq

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Abstract

In the current research, silver nanoparticles (AgNPs) were mixed with a polymer blend to enhance their optical and electrical properties and antibacterial efficiency. A novel approach via introducing AgNPs into the polymer blend could improve the physical and antibacterial characteristics of the nanocomposites (NCs). In the loading process, two different amounts of AgNPs were respectively encapsulated with polyvinyl alcohol (PVA), polyacrylamide (PAAm) and polyethylene oxide (PEO) polymeric blend via casting method. The prepared films were characterized by X-ray, optical microscope (OM), scanning electron microscopy (SEM), Fourier transformation infrared (FTIR) and UV/Visible. The OM and SEM images showed that the AgNPs were well diffused inside the polymer blend with some weak aggregations. The optical properties were enhanced after doping. The NCs films absorbed UV-ray at ($\lambda=220$ nm). The indirect energy gap decreased after loading from 3.80 to 3.10 eV but the direct energy gap decreased from 4.25 to 3.75 eV. The AC electrical properties were studied in the frequency range between 100 Hz to 5 MHz. The dielectric constant and loss of NC films were decreased with the increase of AgNPs, while the electrical conductivity increased. The inhibition zone diameters of Escherichia coli bacteria increased with the increasing of AgNPs contents.

Keywords: PEO, Silver NPs, AC conductivity, Antibacterial

Introduction

AgNPs has been famous as an antibacterial (ANB) factor for centuries. It has been reported that AgNPs and hybrid Ag NCs are efficient biocides versus various types of fungi, bacteria, and viruses via releasing Ag^+ which can inactivate the bacteria cells through damaging the membrane of cell and replication capability of DNA. Nanomaterials and nanotechnology are of much interest for the development of new ANB

approaches, based on either novel biomaterials or on enhancing the biological features of the existing ones [1]. Currently, in a sustainable and eco-friendly driven approach, many studies are directed to design both clinically and environmentally safe nanomaterials for ANB applications. Hybrid polymer NCs are a novel type of material with unique physical and chemical properties. These NCs have recently attracted serious research attention due to their tangible potential for a wide range of applications in environmental