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Gamma radiation effect on the optical linear and nonlinear properties of PVA with trypan blue film

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ABSTRACT

A film of polyvinyl alcohol (PVA) and trypan blue dye is prepared via the casting method. The characterization of the film is carried out using the microscope and Image J software, x-ray diffraction (XRD), UV–vis spectrophotometer and computational chemistry using density functional theory (DFT). The prepared film optical properties are studied under the irradiation withgammaradiation of doses that varied in the range 14.4–57.6 Gy. The crystallite size of the film is studied using the Scherrer method and the Williamson–Hall method. Numbers of linear and nonlinear (NLO) parameters of the prepared film are obtained via the measurement of its absorbance and transmittance spectra before and after irradiation with the gamma radiation.

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1. Introduction

Nonlinear optical (NLO) materials have attracted numerous investigations during the last three decades via studying the available ones, new synthesized and other's properties have been improved by many methods. These materials are so important for the use in potential applications, viz. index of refraction modulation (*1*), all-optical switching (*2*), optical limiters (*3*), phase controlled by light (*4*), optical phase conjugation (*5*), frequency conversion (*6*), image processing (*7*), optical telecommunication (*8*), optical data storage (*9*) and optical computing (*10*). The optical properties of matters of importance are absorption, transmission, optical band gap values, dielectric constant, crystal structure, index of refraction, reflectivity, grain size, etc.

The improvements of optical properties of various materials were the target of many researchers via the irradiation with gamma rays such as improving the natural fibers mechanical properties (*11*), control of conductivity and characterization of hydroxyl propyl methyl cellulose polymer (*12*), improving the PVA optical energy gap (*13*), effect on chitosan/mimosa tenuiflora and chitosan/mimosa tenuifloura /multiwalled carbon nanotubes (*14*), effect on nickel phthalocyanine films structural, electrical and optical properties (*15*), effect on volcanic basalt mineral mechanical and dielectric properties (*16*), effect on CdS thin film optical properties (*17*), effect on aluminum dihydrogen triphosphate properties

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