

Abstract

This study focuses on the spectral characteristics, the nonlinear optical properties, and optical limiters properties of mixture dyes (R6G, RC, and RB). Liquid and solid sample doped with polymer (poly methyl methacrylate) (PMMA) are studied for different concentrations (1.00E-5, 2.00E-5, 5.00E-5, 7.00E-5, and 1.00E-4 g/L) and for various thicknesses (95.44, 125.3, 167.6, 206.8, 247.5 μm), where these solid samples of thin films are prepared by casting method.

In order to identify the characteristics of the samples several optical tests are done, such as UV-VIS absorption spectra, transmission spectra, and fluorescence spectra to measure linear refractive index and linear absorption coefficient. Several calculations are done to measure the fluorescence lifetime, the radiative lifetime, quantum efficiency, and the probability of the radiative transition of both samples (solid and liquid).

The nonlinear optical properties such as nonlinear refractive index (NLR), nonlinear absorption coefficient (NLA), and nonlinear susceptibility (χ^3) are studied by using two sensitive techniques Z-Scan and Eclipse Z-Scan (EZ-scan). The results show that the sign of the NLR for liquid and solid samples that measured by (Z-Scan) are changed between positive and negative depending on dyes concentration and thickness while the sign of NLR measured by (EZ-Scan) technique are always positive (self –focusing) for the liquid samples and are negative (self – defocusing) for solid samples. In the case of (Open aperture), the results of (NLA) coefficient (measured by Z and EZ-scan techniques) in liquid samples show the behavior of two photons absorption while in solid samples behave like saturation absorption. The results show that there is a potential for liquid and solid samples to be used as effective optical limiters at this study wavelength (532nm).