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GAMMA IRRADIATION EFFECT ON THE NONLINEAR REFRACTIVE INDEX AND OPTICAL LIMITING BEHAVIOR OF PYRONINE Y DYE SOLUTION

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ABSTRACT

In this work, the influence of gamma irradiation on the structural, third-order nonlinearities and optical limiting properties of Pyronine Y ($C_{17}H_{10}ClN_2O$) solution has been reported. The samples have been investigated via a typical absorbance spectra, and characterized in the wavelength range 300–700 nm. The nonlinear optical coefficient (nonlinear refractive index and nonlinear absorption) showed clear changes with different irradiation time. Also, the optical limiting property of the sample has been investigated using 532 nm continuous wave (cw) laser (SDL-532-100T). At the same time, the optical limiting behavior was found to increase with increasing dose. Gamma ray irradiation was performed by using ^{137} Cs source with an exposure rate of 0.56 Gy/min. This study also suggests that the gamma irradiation can be considered as a tool for the enhancement of the device properties amongst the other applications.

keywords: *gamma irradiation, pyronine y, nonlinear refractive index, optical limiting, optical device.*

1 INTRODUCTION

In recent years, owing to a number of practical applications in the field of micro-electronics and optoelectronics, a great deal of attention has been paid to the study of the properties of various materials. Recent years have witnessed a great demand for the organic materials for non-linear optical (NLO) applications because of their usage in devices such as second harmonic generators, electro-optic modulators, frequency conversion, etc [1,2]. The NLO phenomena take place when the optical properties of molecules change in the presence of strong external electric fields, i.e., high energy laser beams. They exhibit other additional advantages such as their broadband spectral responses, high thermal and chemical stability, along with their simple structures, low cost and ease of preparation in solution and thin polymer film [3,4]. Due to these advantages, the organic nonlinear materials
have been extensively investigated for useful optical applications, such as all-optical signal