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Thermooptic coefficient and Transmitted beam profile of Rifampin

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Abstract— **The nonlinear optical properties of 3-[[(4-methyl -1-piperazinyl) imino]-methyl] –rifamycin VS (rifampin) in Tetrahydrofuran (THF) are studied by using z-scan and diffraction ring technique with continuous wave (CW) laser at a wavelength of 532 nm. The sample showed negative and large nonlinear refractive index values of the order of 10-7 cm2/W and reverse saturable absorption with high values of the nonlinear absorption coefficient of the order of 10-3 cm/W , and the thermooptic coefficients, dn/dT are found to be of the order of 10-6 K-1. The nonlinear refractive index was found to vary with the concentration. The transmitted beam profiles, the distribution of intensity corresponding to the sample positions and D- distribution of rings number of each pattern variation for the rifampin samples have been studied. These results indicate that the sample is a promising candidate for applications in nonlinear optical field.**

Index Terms— **Nonlinear refractive index, Thermooptic coefficient, Nonlinear absorption, Diffraction ring.**

I. INTRODUCTION

In recent years, extensive studies have been carried out on organic nonlinear optical (NLO) materials due their very high nonlinearity, less dense, chemical stability and short response time to optical excitation properties irrespective of their poor mechanical and thermal properties [1]. Materials that possess nonlinear optical properties have been investigated extensively for their potential applications in optical fibers, data storage, optical computing, optical switching, and optical limiting [2-5]. Among the promising class of materials, organic dyes [6–9] play a vital role because of their good photo-thermal stability, dissolvability etc. The high nonlinear optical refractive index compares favourabl with that of some representative of third-order nonlinear optical materials, namely, CS2 [10], benzo congo red dye solution [11], oxazine (OX720) and oxazine (OX750) dyes in aqueous solution and in polyacrylamide hydrogel (PAA) matrix [10], photopolymerizable organosiloxane [12], and organic polymers [13]. Its potential application is to work as novel optical limiter for its nonlinear optics effect [14-16]. The extensive use of continuous wave lasers for various applications with power levels ranging from W to kW has induced a need to protect the human eyes and sensors [17-22]. In order to find the suitability of a material for nonlinear applications one needs to study its photo physical as well as its optical characteristics such as type of nonlinearity, its magnitude, response time etc .

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We in the present work are presenting the study of nonlinear optical properties i.e. estimation of the nonlinear refractive index, n_2, in rifampin via diffraction ring technique using a visible laser beam. The chosen sample is shown in Fig. 1. We report the results of the refractive nonlinearities studied by using the single beam Z-scan technique on low-cost of rifampin in Tetrahydrofuran (THF) solvent in their resonant region using a continuous wave 532 nm diode- pumped laser. To our knowledge, there is no previous work on the mentioned materials. The aim of our present work is to find the possibility of new applications of the rifampin in the field of the optical modulators. We present experimental evidences of observing diffraction patterns in rifampin at different concentrations with the calculations of the effective nonlinear refractive indices, n_2, and variation of refractive indices.

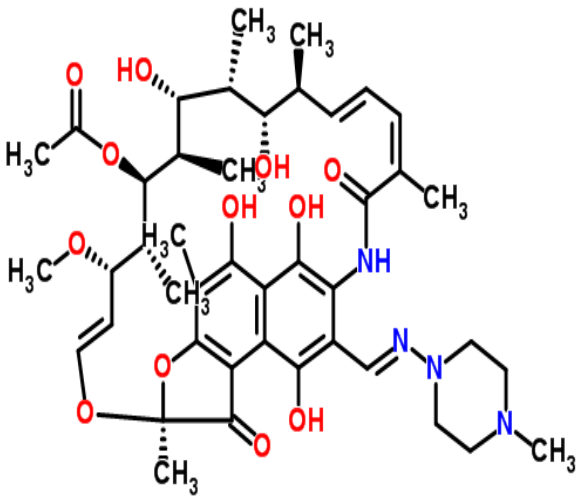

Figure 1. Chemical structure of rifampin

II. EXPERIMENTAL

A. UV–visible Spectroscopic studies

In order to study the effect of different concentrations on nonlinear optical properties a UV–visible spectroscopy has been used to characterize the rifampin in the spectral range (225–700nm). The absorbance (A) spectra of solution samples with different concentrations are shown in Figs. 2 measured using Cecil Reflected-Scan CE 3055 reflectance spectrometer. These measured was performed at room temperature. We can see from the Fig.2 that the absorbance of the sample increases with increasing the concentration of the sample this due to increase number of molecular per unit volume, so the absorbance will be increased.