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RESEARCH

Study of DFT, Synthesis, and Nonlinear Optical Properties of a Schiff Base Compound

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Abstract
A Schiff base (LS2) compound is synthesized via a reaction of a hot ethanolic solution of (3-ethoxy salcyaldehyde) and a hot ethanolic solution of amine(methyl-4-amino benzoate). The LS2 compound is characterized via ^{1}H and ^{13}C NMR spectra, Mass spectrum, and FT-IR spectrum. We observed multiple diffraction patterns of a cw 473 nm laser beam from the LS2 compound caused by spatial self-phase modulation (SSPM). The nonlinear refractive index (NLRI) of the LS2 compound is estimated at the high-power input of the laser beam and found equals to 5.387×10^{-7} cm^2/W. The Z-scan techniques are used to estimate the NLRI and found equals to 0.12×10^{-7} cm^2/W. The all-optical switching (AOS) effect can be seen when 473 nm is used as the controlling beam and 532 nm is used as the controlled beam.

Keywords Schiff base compound · Z-scan · Diffraction patterns

Introduction

During the past few years, we have been engaged in the study of newly synthesized organic materials [1–6] for the sake of possible use in different photonic applications. These materials should exhibit rapid response in extremely brief periods and possess substantial nonlinear refractive indexes (NLRIs) [7–12]. Among the techniques used in the estimation of these materials NLRIs, there are two important techniques viz., the diffraction patterns (DPs) and the Z-scan [13–16] under the irradiation with CW, low power, visible laser beams. The methods are accurate, fast, and simple. Each requires small number of apparatus and limited period of time.

Schiff base is an analogue of a ketone or aldehyde in which the carbon group (C = 0) has been replaced by an amine or azomethine group. Alarge number of shiff base complexes are characterized by an excellent catalytic activity in a variety of reactions at high temperature and in the presence of moisture. Schiff base and their metal complexes are increasing being used as catalysis in various biological systems dye and polymers. Due to its various properties viz. in medicine and pharmacy, biological, antifungal, biocidal, antiviral, antimalarial, and anticancer, Schiff base are studied extensively viz. applications in modern technologies, in synthesis and chemical analysis [17].

The nonlinear optical properties of Schiff base have been studied minorally such as their optoelectronic properties [18], nonlinear optical properties [19], third-order optical properties using the Z-scan method [20]. We have studies the Schiff base nonlinear optical properties extensively during the last four years via diffraction patterns and the Z-scan [21–25].

The purpose of the current work is to find a material that has higher nonlinear optical properties compared to currently known materials so that it can be used in optical devices. So in the present work a Schiff base compound was synthesized and characterized using ^{1}H and ^{13}C NMR spectroscopies, Mass spectrum and FTIR spectrum. In this study, the Schiff base compound's nonlinear optical (NLO) features were looked at by using diffraction patterns and a visible, low-power laser beam to figure out the nonlinear

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