



Synthesis of a New Schiff Base: Nonlinear Optical Properties Investigations

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Abstract

A Schiff base is prepared by the reaction of 7-hydroxy-1-naphthaldehyde with 4-aminobenzenesulfonamide. The prepared Schiff base L4 compound was characterized by ¹H NMR, Mass and FTIR spectroscopies. The optimization of the prepared L4 compound is carried out via DFT-B3LYP and 6-311G (d,p). The nonlinear optical (NLO) properties of the prepared L4 compound are investigated theoretically by the calculation of some quantum chemical descriptors (QCDs). TD-DFT via B3LYP and 6-311G calculations are used to study L4 compound UV–vis. spectrum at the same theoretical method and level. The L4 compound NLO properties are examined via irradiation with a CW laser beam, where the nonlinear index of refraction (NLIR) is calculated via diffraction patterns (DPs) and the Z-scan and as high as $4.579 \times 10^{-11} \text{ m}^2/\text{W}$ of NLRI is obtained. Static (S) and dynamic (D) all optical switching (AOS) are examined using two CW and pulsed laser beams of wavelengths (473 and 532) nm.

Keywords Schiff base · Diffraction patterns · Z-scan

Introduction

Since their discovery by H. Schiff in 1864, Schiff base compounds and their metal complexes are increasingly being used extensively in biological systems as catalysts [1–6], polymers, and dyes. They have been used in medicine and pharmacy [7–11]. They exhibit antibacterial and antifungal effects in their biological properties. They are identified as possessing antibacterial agents [12–19]. They are used in the destruction of parasites and protozoa. Schiff bases are fascinating compounds that might be part of antimalarial drugs. Some Schiff bases have shown protective effect on the hematopoietic system. They have modern technology applications for their photo and thermochromic properties, and together their biological activity makes them applicable in synthesis and chemical analysis [20–31].

So many Schiff bases compounds nonlinear optical (NLO) properties have been studied excessively since 2008, such as $\text{C}_{10}\text{H}_{13}\text{NO}_2$ [32], metallo organic chromophores [33], nano structured Schiff base metal complex [34], tridentate and tetradentate Schiff base ligands [35], bidentate (NO) Schiff base ligands [36], ($\text{C}_{14}\text{H}_{11}\text{NO}_4$) Schiff -base compound [37], epy (4- phThCa) and (1R,2R) (-) chxn (SalH) (naftalH) Schiff-base compound [38], Zn (II) zwitterionic Schiff -base [39], Palladium Schiff-base complex [40], Schiff-base containing heterocyclic compounds (pyrazoles, pyrimidines, benzimidazoles, benzothiazole, etc.) NLO response by static hyperpolarizability coefficients etc. [41], EHB Schiff bases derived from ethyl -4- amino benzoate NLO properties [42], Enantiomeric ally pure tetradentate Schiff base ligand NLO properties [43], etc. Das group and Sahoo group have studied number of materials for various reasons during the last eight years [44–48].

The new 4-(((2-hydroxy naphthalene-1-yl) methylene) amino benzene sulfonamide L4) Schiff compound was synthesized and characterized in this present work. The NLO properties of the L4 Schiff base was studied using two techniques viz. diffraction patterns (DPs) and the Z-scan. The property, all-optical switching (AOS), was examined using two laser beams for static and dynamic techniques.

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