



# Synthesis, characterization and nonlinear optical properties of new azo compound using CW laser beam

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## Abstract

An azo compound, T-3OCH<sub>3</sub>, is synthesized and diagnostics using <sup>1</sup>H and <sup>13</sup>C NMR and mass spectroscopies. The compound theoretical structure is optimized via the DFT/WB97XD approach with a 6-31+G(d,p) basis set level. The compound nonlinear optical properties are studied under irradiation with a visible CW laser beam via diffraction patterns and the Z-scan. As high as  $6.739 \times 10^{-11}$  m<sup>2</sup>/W of the nonlinear refraction index is obtained. Static and dynamic all-optical switching are tested in the synthesized compound using two visible CW laser beams.

**Keywords** Azo compound · Nonlinear optical properties · Diffraction patterns · Z-scan · All-optical switching

## 1 Introduction

The development during the past four decades in the field of manufacturing optical devices opened a wide scope for research on materials with extreme nonlinear optical (NLO) properties to use in the manufacture of optical devices. To achieve this goal, the researchers studied the NLO characteristics of numerous materials, including organic dyes (Al-Timimy et al. 2020; Ali et al. 2020; Emshary et al. 2021; Hassan et al. 2021; Khalaf et al. 2022), vegetable oils (Hassan et al. 2018; Sultan et al. 2018) and polymers (Shabeeb et al. 2020; Hassan et al. 2022a, b), as well as preparing new organic (Raheem et al. 2023; Moker et al. 2023; Issa et al. 2023; Faisal et al. 2022; Salim et al. 2022; Al-Hujaj et al. 2022) and inorganic compounds (Fagnani et al. 2022; Rigamonti et al. 2019; Tahmasbi et al. 2023) and semiconductors (Al-Asadi et al. 2020; Hasanirokh et al. 2019). Among the many materials that were studied, it was found that organic materials are the best because they are easy

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