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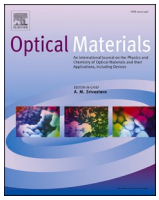

Research Article

The optical nonlinear properties of a new synthesized azo-nitrone compound

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ABSTRACT

In this article the preparation of compound heterogeneous azo-nitrone is introduced. Novel compound resulted via the reaction between azoaldehyde and N-phenylhydroxylamine through several steps. (Z)-1-(2-hydroxy-3-methoxy-5-((*E*)-(3-nitrophenyl) diazenyl) phenyl)-N-phenylmethanimine oxide derived from N-phenylhydroxylamine with (*E*)-2-hydroxy-3-methoxy-5-((3-nitrophenyl) diazenyl) benzaldehyde. The novel azo-nitrone compound has been identified via infrared spectroscopy (FT-IR), NMR proton spectrum (^{1}H NMR) and mass spectrometry (Mass spectra) as well as measurement of its melting point. The nonlinear index of refraction of the prepared compound is determined separately via the patterns of diffraction ring and the Z-scan. Ring patterns are simulated using the Fresnel-Kirchhoff diffraction theory. The optical limiting property of the prepared compound is tested where it is proved that such compound might be used as an optical limiter.

1. Introduction

During the last three decades, extensive research has been carried out and directed towards not only to understand the intrinsic origin of the optical nonlinear properties but also trying to find new materials with large nonlinear refractive indexes and fast response times. Different materials respond nonlinearly under the irradiation with continuous wave, cw, laser beams [1–21]. These materials have many potential applications such as optical modulation, optical limiting, all-optical switching, telecommunications, memory devices, to name a few [22–33].

When a cw laser beam traverses a medium with intensity-dependent index of refraction and having absorption coefficient, variety of phenomena occurs viz., self-phase modulation, SPM, beam brake-up, self-focusing, self-defocusing, and optical ring formation [34]. As a result of SPM concentric ring patterns can be obtained. Owe to the relation between the number of rings and the phase shift of the laser beam, the change in the medium refractive index and the nonlinear index of refraction can be obtained. On the other hand, the spatial distortion of laser beam traversing the nonlinear medium leads to the Z-scan technique where number of parameters of the nonlinear medium can be obtained.

Nitrone was first synthesized by Beckmann back in 1890 [35], then it received intensive research activities. It is used in the thermal cycloaddition to alkenes [36], as a new, stable and potential reagent for oxidization [37] derived from imidazole and other cyclic nitrone types [38], in C-aryl-N-phenyl nitrones [39], in heteroaryl nitrones with spin trap properties [40], in synthetic polymer chemistry [41], in microwave helped blend of novel spiro isoxazolidine derivatives [42], in computational investigations of 1,3-dipolar cycloaddition reaction of fullerene-C60 [43], in synthesis osmium (III) complexes [44], etc.

In 1982 nitrones were used in variety of normal biological processes [45], within the utilization of natural product and biologically active compounds [46], within the therapeutic effect of the nitrone-based antioxidant drug (HPN-07) [47], within the treatment of neurodegeneration, cardiovascular disease and cancer [48,49], in anticancer drug [50], in marine derives fungus penicillium oxalicum F30 [51], in the synthesis, antimicrobial and antioxidant activities [52], in the trapping of three radicals in chemical processes, in biochemical systems [53], in the structural pattern numerous biologically active molecules [54], as inhibitor of olipid oxidation towards synergistic antioxidant effects [55], its effect on the viability of the breast cancer line in vitro [56], etc.

Since the very first synthesis of nitrones that was described in the pioneering work of Beckmann in 1890 [35], the chemistry of nitrones became a widely studied subject by organic synthetic chemists [57].

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