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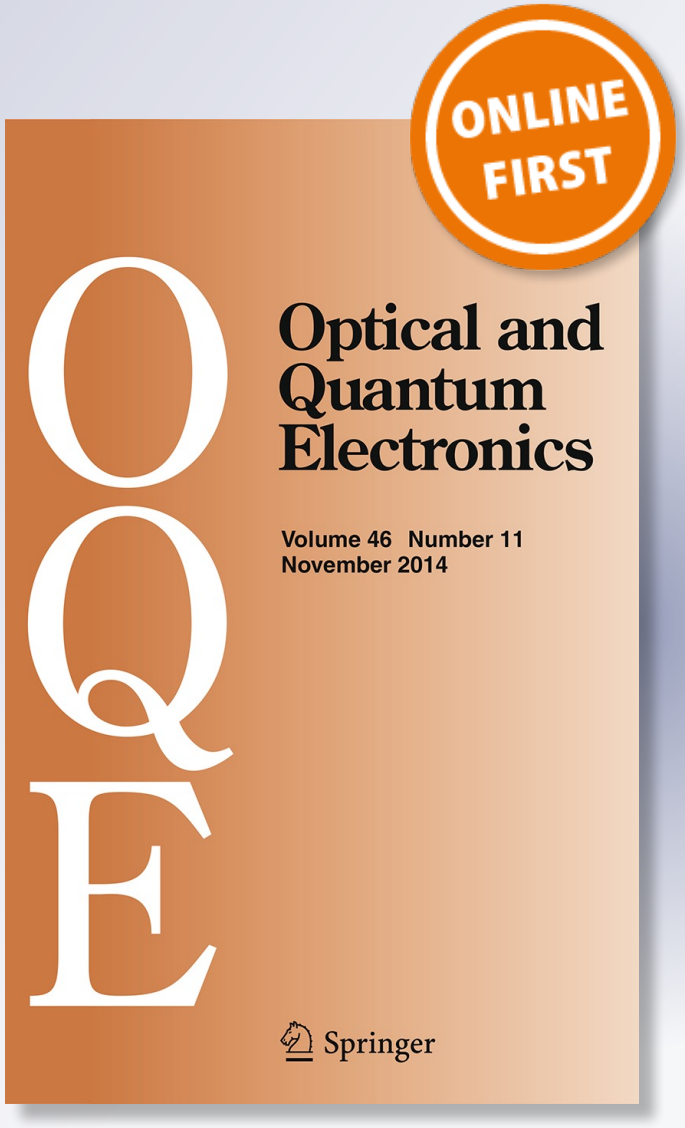

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Abstract The nonlinear optical properties of a new azo dye (1.8-Dihydroxy-naphthalin-3,6 disulfonic acid-[2-(4-azo)]-*N*-(2-pyrimiding)-benzene sulfonamide) in Dimethyl sulfoxide solvent were studied by Z-scan technique using cw diode laser at 532 nm. The nonlinear absorption coefficient and the nonlinear refractive index of the dye were calculated using the open aperture Z-scan and the closed aperture Z-scan techniques respectively. The sample showed a negative and large nonlinear refractive index value of -4.06×10^{-9} cm^2/W, and reverse saturable absorption with high value of nonlinear absorption coefficient equal to 1.37×10^{-4} cm/W. Diffraction ring patterns were generated in the azo dye sample under cw laser beam irradiation together with optical limiting of the azo dye solution was demonstrated. These results indicate that the new dye is a promising candidate for applications in nonlinear optical devices.

Keywords Z-scan technique · Reverse saturable absorption · Self-diffraction · Optical limiting

1 Introduction

Owing to the development of laser technology, much interest in the development of nonlinear optical (NLO) materials owe to their applications in integrated optics such as optical modulation, optical information, optical data storage, optical power limiting and imaging (Poornesh et al. 2010). Organic dyes has received great attention due to their environmental stability, ease of preparation, good-thermal stability, and theirs optical and electrical properties (Aziz and El-Mallah 2009). Nonlinear optical properties of dye molecules are important from the point of view of understanding their photo-physics and realization of theirs potentiality in laser technology (Kazem et al. 2000; Chari et al. 1996). The third order optical responses are responsible for the variation of refractive and absorptive properties of media

H. A. Badran (✉) · A. Y. AL-Ahmad · M. F. AL-Mudhaffer · C. A. Emshary
Department of Physics, College of Education for Pure Sciences, University of Basrah, Basrah, Iraq
e-mail: badran_hussein@yahoo.com

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