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## Nonlinear optical responses and limiting behavior of sulfadiazine-chromotropic acid azo dye

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Received: 7 April 2014 / Accepted: 14 October 2014  
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**Abstract** The nonlinear optical properties of a new azo dye (1,8-Dihydroxy-naphthalen-3,6-disulfonic acid-[2,4-azet]-N-(2-pyrimidinyl)-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  $-4.06 \times 10^{-16} \text{ cm}^2/\text{W}$ , and reverse saturable absorption with high value of nonlinear absorption coefficient equal to  $1.37 \times 10^{-4} \text{ cm}^2/\text{W}$ . 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 (Pecorelli et al. 2010). Organic dyes has received great attention due to their environmental stability, ease of preparation, good thermal stability, and their optical and electrical properties (Aritz 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 their potentiality in laser technology (Kassim et al. 2000; Chai et al. 1996). The third order optical responses are responsible for the variation of refractive and absorptive properties of media

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