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Optics and Laser Technology
Volume 115, July 2019, Pages 97-103

Transition from saturable absorption to reverse saturable absorption of carmoisine dye under low-powered continuous wave laser excitation

(Article)

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Abstract

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Unique nonlinear optics (NLO) properties i.e. intensity-dependent nonlinear absorption and refraction of carmoisine (food dye) is studied using a single beam z-scan technique. A switchover behavior from a saturable absorption (SA) to reverse saturable absorption (RSA) is observed by increasing concentration of carmoisine dye. The flip in the absorption response is attributed to the aggregated dye molecules under intense laser beam, which induces the formation of carmoisine dimers. In the UV-Vis absorption analysis, the appearance of two bands at higher concentration confirms the formation of carmoisine dimers. Fourier transform infrared spectroscopy (FTIR) suggests the intermolecular charge transfer (ICT) within the naphthyl-azo bonds. Huge magnitude of $\chi^{(3)}$ is calculated in the order of 10^{-5} esu due to ICT process within the dye molecules. Optical limiting (OL) behavior is observed with low OL action threshold ~ 0.01 kW/cm² under continuous wave laser beam. The experimental findings shows that carmoisine dye has potential as an optical material for photonics applications such as an optical limiter under low-powered continuous wave laser. © 2019

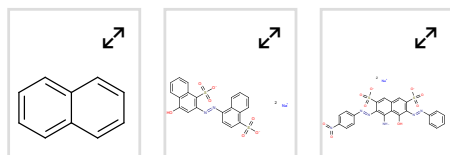
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Funding details

Funding sponsor	Funding number	Acronym
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Ministry of Higher Education, Malaysia

Universiti Teknologi Malaysia

Funding text

The authors would like to thank the Malaysia Ministry of Education and Universiti Teknologi Malaysia for their financial support through Tier 1 with vote 18H67. Special thanks also to Universiti Teknologi Malaysia for the postdoctoral scheme under vote number 04E08 for Mundzir Abdullah. Corresponding author is grateful to the Malaysia Ministry of Education through the FRGS fund with vote 03EE89. Appendix A

ISSN: 00303992

CODEN: OLTC A

Source Type: Journal

Original language: English

DOI: 10.1016/j.optlastec.2019.01.032

Document Type: Article

Publisher: Elsevier Ltd

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