All-optical limiting behavior of the natural dye extract from clitoria ternatea

Maha Al-Hamadani* and Haitham Al-Tameemi

Laser Applications Research Group (LARG), Department of Physics, College of Science, University of Basrah, Basrah, Iraq

*Corresponding Author: Email: mahabct@yahoo.com (Maha)

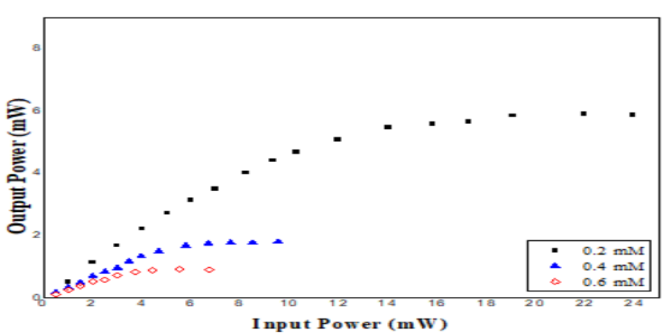
Abstract In this work, we extract the natural dye ingredient found in clitoria ternatea (CT), and investigate the nonlinear optical absorption of the CT freestanding films achieved through doping polyvinyl alcohol (PVA) at scanning wavelength of 532 nm. The absorption, Raman spectroscopy, excitation and emission spectra of the CT dye and CT/PVA freestanding composite films have been measured. The results show an excellent all-optical limiting behavior with optical limiting threshold less than 12 mW. This green and cost-effective natural dye doped polymer is potentially useful for the fabrication of all-optical limiter devices for eye and sensor protection.

Introduction

The use of natural dyes is being actively considered nowadays in view of their non-toxicity and cost-effectiveness. Natural dyes can be extracted from bio-resources such as fruits, vegetables, plants, roots, leaves, barks and micro-organisms [1-3]. The propagation of laser beam via a material that contains natural dyes and their associates can induce nonlinear optical processes that can be useful in all-optical limiting devices.

Results and discussion

The absorption, excitation and emission spectra of the dye were measured. Nonlinear optical responses reveal that the CT dye and CT/PVA freestanding composite films shows an excellent all-optical limiting behavior, which lead to achieve important information in all-optical limiting device such as low optical limiting threshold, good optical damage, and dynamic range with values less than of 12 mW, 22 mW, and 8 mW, respectively. Thus, the results offer the possibility of developing an all-optical limiting. Some of obtained results for all-optical limiting can be illustrated in figure.



References

[1] Rahma M. A., Saadon H. L. (2018) High-performance all-optical limiting based on nonlinear refraction of metal-doped PbS/PVA freestanding nanocomposite films, Optik 174, 580

[2] Rahma M. A., Saadon H. L. (2019) Natural Dyes Extracted from Plants and their Application to All-Photonic Devices, AIP Conference Proceedings **2190**, 020031.

[3] Haripadmam P. C, Beryl C. Philip- R. (2022) Optical Limiting Properties of the Natural Dye Extract from Alternanthera brasiliana Leaves , J. Electr. Mater. 26.