



Influence of functional groups on the photophysical properties of dimethylamino chalcones as laser dyes



K.H. Ibaouf^{a, b}, A.O. Elzupir^{c, d, *}, M.S. AlSalhi^{e, f}, Abdulaziz S. Alaamer^{a, c}

^a Al Imam Mohammad Ibn Saud Islamic University (IMSIU), College of Science, Physics Department, P.O. Box 90950, Riyadh, 11623, Saudi Arabia

^b Alneelain University, School of Physics, Faculty of Science and Technology, P.O. Box 12702, Khartoum, 11121, Sudan

^c Al Imam Mohammad Ibn Saud Islamic University (IMSIU), College of Science, Committee on Radiation and Environmental Pollution Protection, Riyadh, Saudi Arabia

^d Ministry of Higher Education, Central Laboratory, Khartoum, Sudan

^e KSU Research Chair on Laser Diagnosis of Cancers, College of Science, King Saud University Riyadh, 11451 Saudi Arabia

^f Department of Physics and Astronomy, College of Science, Riyadh, 11451 Saudi Arabia

ARTICLE INFO

Article history:

Received 20 June 2017

Received in revised form

12 December 2017

Accepted 16 December 2017

Keywords:

Dimethylamino chalcone

Synthesis

Functional groups

Solvents effect

ASE

ABSTRACT

In this report, a series of 3-(4-(Dimethylamino) phenyl)-1-(4,3 di-substituted phenyl)-(2E) - propen -1-one chalcones was synthesised and examined as optical materials. The influence of functional groups (FG) and solvents on their photophysical properties was investigated. These include absorption, fluorescence, Stokes shift, and amplified spontaneous emission (ASE). The absorption spectra of all compounds showed a wavelength band in the range 404–429 nm, whereas the fluorescence spectra exhibited a band at 470–535 nm. We found that the fluorescence intensity was inversely proportional to the concentration of chalcones. The FGs and solvents had an amazing effect on the photophysical properties of the synthesised materials. Unexpectedly, the electron withdrawing group showed a highly red shift, whereas the electron donating group exhibited a blue shift. Further, these compounds showed large Stokes shifts (up to 5800 cm⁻¹). ASE was observed under pump pulse laser excitation, and the wavelengths were tuned from 509 to 566 nm.

© 2017 Published by Elsevier B.V.

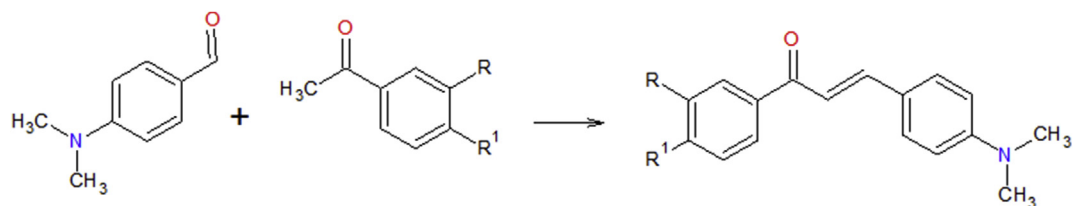
1. Introduction

Chalcone derivatives have a functionality of a carbonyl group in conjugation with a carbon-carbon double bond, which is known as α,β -unsaturated keto group, or enone function [1–5]. The N,N dimethyl amino group attached to para-position in ring B in chalcones enhances its photophysical properties via intramolecular charge transfer (ICT) [6]. The photophysical properties of the chalcones have attracted much attention during the past decade due to their increasing application in electronic and optoelectronic devices [7–11]. A variety of laser materials has been investigated by a host of scientists to make and design a broadband laser, with a wide range of applications [7]. The dye lasers based on rhodamine and coumarin derivatives are excellent laser media, but they have some shortcomings, such as a lack of photochemical

stability [12]. According to their chemical structures, the materials discussed in this paper have better photochemical and thermal stability [13–15]. Hence, the chalcones should result in good dye lasers. However, the photophysical properties depending on solvent environment and the influence of the FGs have not been fully studied. In our earlier communication, we showed that 3-(4-(dimethylamino) phenyl) -1-phenyl-(2E) - propen -1-one (C1) produced ASE under pulsed Nd: YAG laser excitation at 532 nm [16]. Our results revealed that C1 has a large Stokes shift, an excellent photo stability, and high intensity lasing action (Scheme 1). The main goal of the present study is to report on the photophysical and ASE behaviors, with particular focus on electrons withdrawing and donating groups attached to ring A. To achieve this goal, we have designed and synthesised a series of 3-(4-(Dimethylamino) phenyl) -1-(4,3 di-substituted phenyl)-(2E) - propen -1-one chalcones. We compare their photophysical properties with C1 compound with no functionality in ring A, as shown in Scheme 1.

* Corresponding author. Al Imam Mohammad Ibn Saud Islamic University (IMSIU), College of Science, Committee on Radiation and Environmental Pollution Protection, P.O. Box 90905, Riyadh, 11623, Saudi Arabia.

E-mail address: aminosman81@gmail.com (A.O. Elzupir).



C1, R = H, R¹ = H
 C2, R = OMe, R¹ = OMe
 C3, R = H, R¹ = Me
 C4, R = H, R¹ = Cl

Scheme 1. Chemical reaction of chalcones preparation.

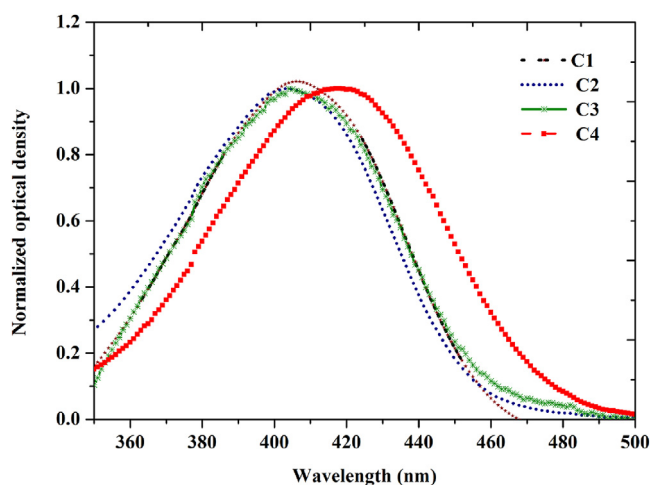


Fig. 1. Absorption spectra of the chalcones in acetone.

2. Experimental

2.1. Synthesis

A green synthesis of chalcones was performed using a condensation reaction of 4-dimethylaminobenzaldehyde (0.01 mol) and acetophenones derivatives (0.01 mol) in a basic solution of sodium hydroxide (1.0 gm) and ethanol (50 ml). The product was recrystallised from ethanol and water, filtered, washed with water, and left to dry. The synthetic compounds were characterised by H1 NMR and UV–Vis spectroscopy [1] (see [supplementary materials](#) for more details). The chalcones that were designed and synthesised are: 3-(4-(dimethylamino) phenyl)-1-phenyl-(2E)-propen-1-one (C1), 1-(3,4-dimethoxyphenyl)-3-(4-N,N-dimethylaminophenyl)-[2E]-propen-1-one (C2), 1-(4-methylphenyl)-3-(4-N,N-dimethyl amino phenyl)-2-propen-1-one (C3) and 1-(4-chlorophenyl)-3-(4-N,N dimethyl amino phenyl)-2-propen-1-one (C4) (Scheme 1).

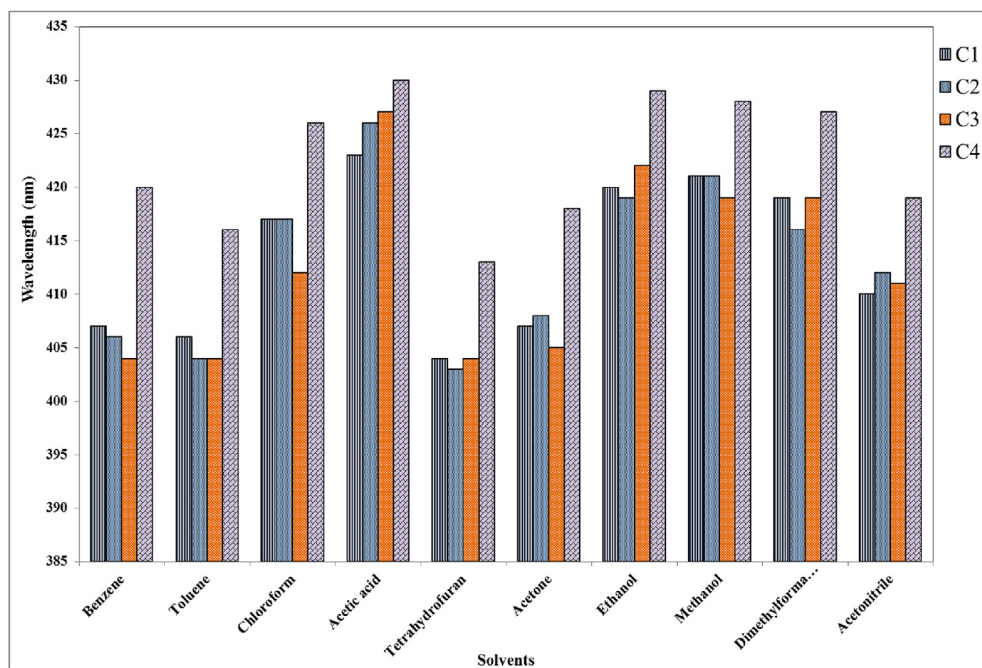


Fig. 2. Absorption spectra of the chalcones in different solvents.

Download English Version:

<https://daneshyari.com/en/article/7907596>

Download Persian Version:

<https://daneshyari.com/article/7907596>

[Daneshyari.com](https://daneshyari.com)