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Research Article

A Way to Improve Luminescent Efficiency of Bis-Chalcone Derivatives

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Chalcone related compounds have been reported as a poor luminescence molecule due to the quenching processes from the intramolecular torsional motions and *cis-trans* isomerization in the α,β-unsaturated ketone moiety. Despite this limitation, we found a way to improve the luminescent efficiency of our bis-chalcone derivative. In this project, two series of bis-chalcone compounds have been synthesized through Claisen-Schmidt condensation by reacting terephthaldehyde or 2,5-dimethoxyterephthaldehyde with the respective R-acetophenone [where R = H (**1a** and **2a**) and *ortho*-hydroxy (**1b** and **2b**)] in 1 : 2 mole ratio. The presence of a methoxy (OMe) substituent on the central phenyl ring of bis-chalcone has weakened the C=C bond at the α,β-unsaturated ketone moiety of **2a** and **2b**. Interestingly, the OMe group has improved the emission efficiency of the bis-chalcone; that is, the quantum yield of **1a** in DCM solution was not able to be determined due to poor luminescence, but the quantum yield of **2a** in DCM solution was improved to 0.57. In addition, compound **2a** also shows solvatochromism effect where the λ_{max} emission shifted from 499 nm in nonpolar solvents (benzene) to 523 nm in polar solvents (acetonitrile). This work provides another way to improve the emission efficiency of chalcone related compounds apart from using the complexation method which has been reported before.

1. Introduction

Chalcone and its derivatives have been known to exhibit antimicrobial, antitumor, anti-HIV, antimalarial, anti-inflammatory, and anticarcinogenic activities [1–6]. The α,β-unsaturated ketone (C=C-C=O) moiety in the chalcone structure plays an important role in chalcone derivative compounds' biological activities. Selvi and coworkers (2012) found that most of these biological effects are related to the ability to create an electrophilic site that is then able to act as a binding site for biological targets [7].

Apart from the biological activities, the photophysical properties of chalcone derivatives also attracted considerable attention from both chemists and physicists. For example, chalcone derivatives have been reported in relation to nonlinear optics (NLO), photorefractive polymers, holographic recording materials, and fluorescent probes for the sensing of metal ions [8–14]. However, one of the main limitations in the photophysical properties of chalcones is their weak luminescent efficiency, which is due to quenching processes from the intramolecular torsional motions and *cis-trans* isomerization in the α,β-unsaturated ketone moiety [15, 16].

Unlike the biological properties, the photophysical properties of chalcone derivatives such as 2′-hydroxychalcones have still not been fully understood. This could be the reason for limited use of chalcone derivatives and complexes in current green technology devices. D'Aléo and his coworkers (2012) found that the boron complexes with 2′-hydroxychalcone derivatives can increase the fluorescent efficiency from 0.02 to 0.79 by substituting different electron donor groups at the 2′-hydroxychalcone moiety [17]. Herein, we report two series of bis-chalcone derivatives (Scheme 1) in which the emission efficiency also showed dramatic improvement after addition of the methoxy (OMe) moiety on the central