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Original research article

Fluorescence analysis of natural dyes from *Plumeria rubra* (red and white) flowers

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ABSTRACT

Eco-friendly aqueous dye is extracted from the flowers of *Plumeria rubra* (red and white). Absorption, luminescence and fluorescence spectroscopic properties of the extracted dyes are analyzed by respective spectroscopic techniques. Fluorescence quantum yields, Stoke's shift, fluorescence life time, radiative and non-radiative rate constants are discussed with various excitation wavelengths in the range of 200–420 nm. Hence, a suitable excitation wavelength of the extracted dye is found to be in the range of 300–370 nm and the dye shows strong fluorescence in this range. Radiative and non-radiative rate constants and fluorescence life time results elucidate the effective fluorescence properties of the extracted dyes. It can be used as a potentially durable natural dye for fluorescence related applications.

1. Introduction

In recent times, the production of potentially dangerous dyes and toxic effluents has been stopped in the textile dye industry. Natural dyes derived from flora are safe because of their non-toxic, biodegradable and non-carcinogenic characteristics. They do not cause pollution, waste water problems and represent a more ecologically friendly alternative dye [1–5]. A large number of plant and animal/insect sources have been identified for extraction of colors to be used in the textile industry [6,7]. Natural dyes have been extracted from more than 500 varieties of plants in India [8]. *Plumeria rubra* is a small/medium sized, deciduous tree belonging to the Apocynaceae family, commonly known as "*Temple Tree*" or "*Champa*" in India. It is found in abundance in Central and South America, although it is grown worldwide. The flowers are also used in pectoral syrups.

The genus *Plumeria* (Apocynaceae) consists of eight species growing in tropical and sub-tropical regions of the world [9,10]. Two species namely *Plumeria rubra* and *Plumeria obtusa*, are found in Pakistan which are grown for ornamental purposes [11]. Various species of this genus are used as medicine to cure diarrhea, gonorrhea, syphilis, venereal sores and leprosy [12]. The members of this genus possess anti-inflammatory, diuretic, emmenagogue, febrifuge, purgative and used as tonic and expectorant [13]. The iridoids like grandines A–C, phoebegrandine B, and fulvoplumeirin, constituents of *Plumeria acutifolia* are used as antibacterial agent [14,15]. The aqueous extract of *Plumeria rubra* is showed antimicrobial [16] anti-

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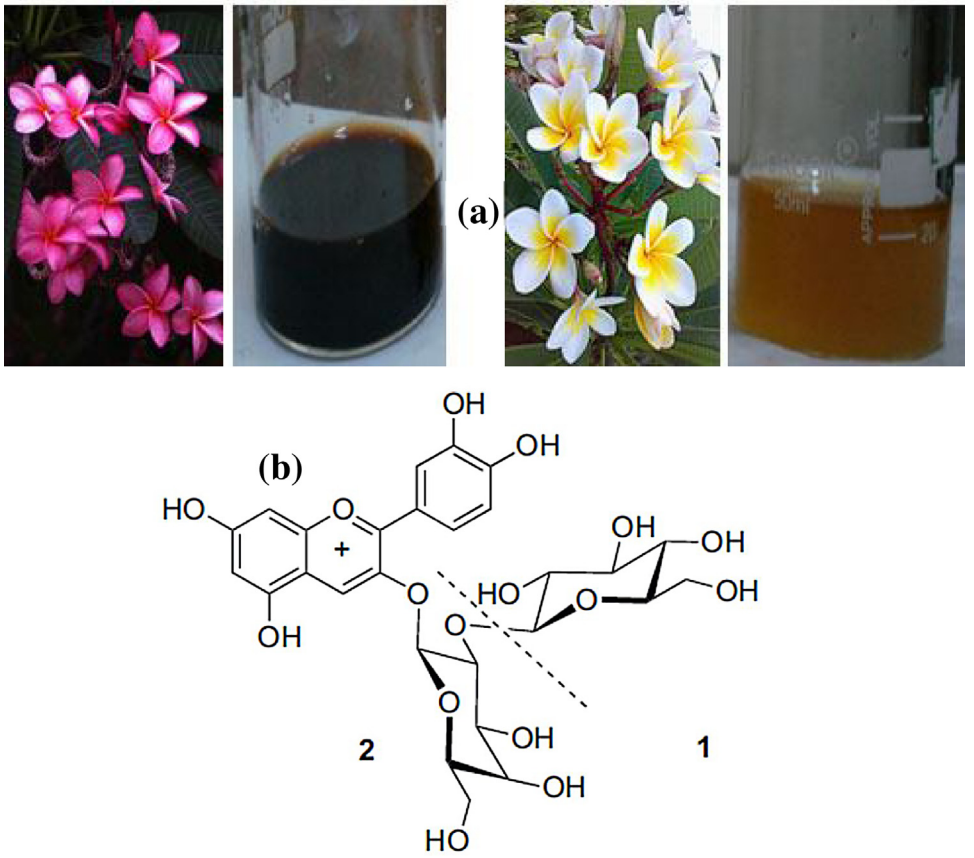

Fig. 1. **(a)** Red and white flowers of *Plumeria rubra* and their extracted dyes, **(b)** Molecular structures in the extracted dyes. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

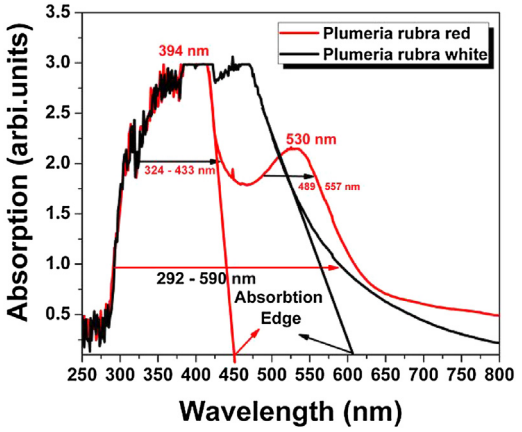

Fig. 2. Absorption spectra of extracted dyes of *plumeria rubra* red and white flowers.

inflammatory activities [17] and used for the treatment of respiratory ailments [18,19]. Plumericin, an iridoid isolated from *Plumeria rubra* is used as antimicrobial agent [20].

The prescribed review was reported on the phytochemical and pharmacological screening of *Plumeria rubra* for medicinal purpose [21]. Preliminary phytochemical and chromatography analysis of flower dye was done for Phenolic groups [22]. The dye was applied on silk cloth for soothing shades and tested against some bacterial strains for antibacterial activity [23]. Rupali *et al* reported that the application of dye from *Plumeria rubra* on silk cloth and the effect of various chemical mordant, pretreatment of cloth by Terminalia chebula (hidra) on shade of dye [24]. Byamukama et al. reported that the isolation and structure elucidation of the pigments responsible for the attractive anthocyanic colours of the flowers of red