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Synthesis and properties of disperse dyes containing a built-in triazine stabilizer

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Abstract

Novel monoazo disperse dyes containing a built-in triazine moiety have been synthesized and evaluated for their ability to give protection against the harmful effects of UV radiation. The results showed that some of the new dyes have the properties needed to provide enhanced skin protection following their incorporation into polyester fabric. It was also found that in certain cases, protection against UV radiation diminished slightly after washing the fabric.

Keywords: Triazine photostabilizer; UV radiation protection; Disperse dyes

1. Introduction

Skin cancer is the most common type of cancer in certain countries and is increasing in incidence [1]. It was projected that in 2004, more than 1 million people would be diagnosed with squamous cell carcinoma and more than 2200 deaths would occur [2]. It was also projected that another 54,200 people would be diagnosed with melanoma, the most lethal of all skin cancers, and 7600 persons would die from this disease during 2004. It is evident that high levels of exposure to ultraviolet radiation (UVR) increase the risk of three major forms of skin cancer, with approximately 65–90% of melanomas caused by UVR exposure [3].

UV absorbers having intramolecular hydrogen bonding include 2-(2-hydroxyaryl)benzotriazoles and 2-(2-hydroxyaryl)-1,3,5-triazines that are widely employed for protecting polymers against photodegradation [4,5]. The application of UV absorbers to textiles was studied by Strobel [6,7], who showed that co-applying UV absorbers and dyestuffs to fabrics could be achieved. However, the efficiency with which UV absorbers were exhausted during the dyeing process was only 50% on polyester (PET) fibers, and even lower when the dyeing was carried out on nylon. This can prevent the co-dyeing process from being cost effective. In order to enhance cost effectiveness and dye photostability, and to develop fabrics that can be used simultaneously to protect the human body from ultraviolet (UV) radiation, a hydroxyphenyl-1,3,5-triazine moiety was incorporated into disperse dye structures. This concept led to the synthesis of monoazo disperse dyes as shown in Scheme 1.

2. Experimental

2.1. General

Cyanuric chloride was obtained from Longsheng Chemical Engineering Company and was of reagent grade. Other chemicals were commercial products of analytical grade.

Melting points were determined with a Mel-Temp capillary melting point apparatus (made in Shanghai, China) and are uncorrected. IR spectra were obtained on an FT/IR-430 Infrared

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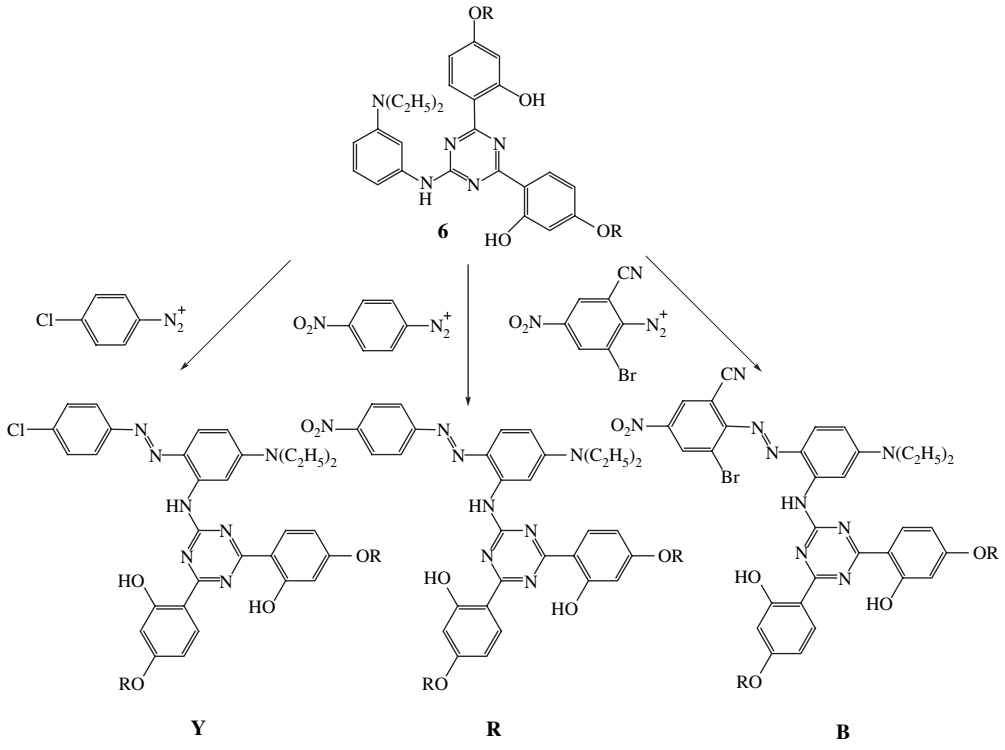
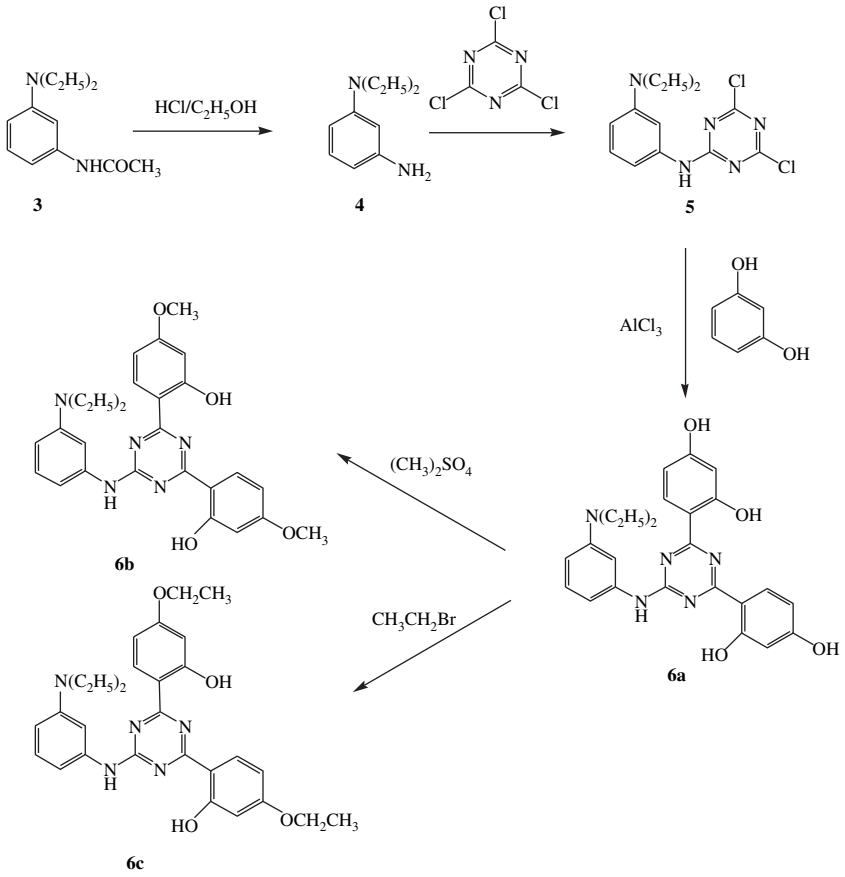


Scheme 1. Synthesis of monoazo disperse dyes containing a triazine photostabilizer, where R = H, Me, Et.



Scheme 2. Synthesis of compounds **6a–c**.