Investigation of a series of near-infrared absorbing heptamethine cyanine dyes

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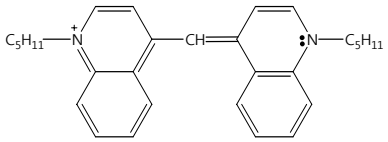
Abstract

In this study, near-infrared absorbing dyes, namely, new rigidified heptamethine cyanine dyes were synthesized and investigated their properties. The cyanine dyes have been synthesized by a condensation reaction between a quanternary salt containing as activated methyl group and an unsaturated bisaldehyde or its equivalent. We were investigated the synthesis of new rigidified heptamethine cyanine and related the compounds with near infrared absorption. The full spectroscopic characterization of all cyanine were described. Absorption properties in the near-infrared region may cause these dyes to the potential used in bio-probe, optical recording media materials.

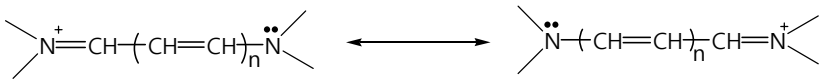
1. Introduction

The cyanine dyes were the first class of synthetic dye to be discovered, the first example being (1), synthesized by C.H.G Williams.



(1)

The cyanines permit perhaps the simplest way of obtaining systems that absorb well into the near-inrared region of the spectrum. The cyanine-type system that contains terminal nitrogen atoms, *i.e.* (2).



(2)

2. Experiment and Discussion

2.1 General procedure for the synthesis of heptamethine cyanine dyes

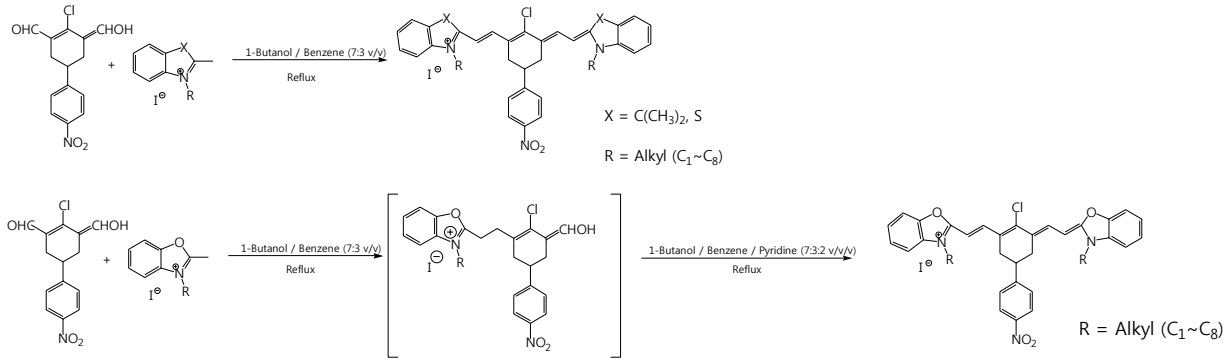


Fig. 1. Synthesis of heptamethine cyanine dyes.

General procedures to prepare the heptamethine cyanine dyes were shown in Figure 1. The cyanine dyes were synthesized by condensation between a quanternary salt *i.e.* indoline, benzothiazole, benzoxazole and bis-aldehyde derived from cyclohexanone to reflux in a mixture of 1-butanol and benzene (7:3 v/v) solvent without any catalyst (Figure 1). Otherwise, in case of benzoxazole typed cyanine dyes, we accomplished synthetic behavior, firstly, an uncatalysed condensation between the quaternary salt and bis-aldehyde derivative in 1-butanol/benzene (7:3 v/v) with the mixture under the heating. The resulting intermediate was secondly then treated a condensation in the presence of pyridine as a catalyst to produce the target heptamethine cyanine dyes.

3. Conclusion

Our experiments were investigated NIR absorbing dyes with a absorption maxima (λ_{max}) about 712~805nm with exitincton coefficient $2.6\sim4.1\times10^5$. The cyanine chromophores were shown a solvatochromism properties with a various organic solvents. With this optical chracteristic designed for NIR dye compounds, the prepared cyanine dye compounds can be potentially used in bio-probe, optical data storages and security sensors.

4. Reference

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