

Synthesis and Characterization of a Near-Infrared Optical Materials for Shielding Infrared Rays

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Abstract:

The metal complexes can be influenced not only by the central metal atoms and the substituent groups, but also by the native of the chelating atoms. For example, near-infrared absorbing chromophores were synthesized by the reaction of phenylenediamine derivatives with a solution of potassium hydroxide followed by the addition of nickel(II) chloride. These dyes provide absorbing infrared light over 780-840 nm with an extinction coefficient of $2.5-6.0 \times 10^4$. By introduction of alkyl, alkoxyl, cyano, and other functional group into the parent dye, these dyes greatly improved the solubility in organic solvent. New near-infrared absorbing donor-acceptor chromophores have been investigated by varying the electron donating and accepting strength of the two halves of the molecule. The cyanine chromophores permit the simplest way of obtaining systems that absorb well into the near-infrared region of the spectrum. Cyanine dyes possess high extinction coefficients that initially increase with increasing chain length. These chromophores could be useful in near-infrared optical materials.

Introduction

The near-infrared, i.e. beyond about 700 nm, have been a increase in interest in recent years. In past time they are undetectable, since light absorption beyond 750 nm is invisible by the eye and makes no contribution to the observed colour. However now such dyes find use in high technology application, i.e. lasers, laser addressed liquid crystal display, optical data storage, optical filters and many other electro-optical application.

Experiments

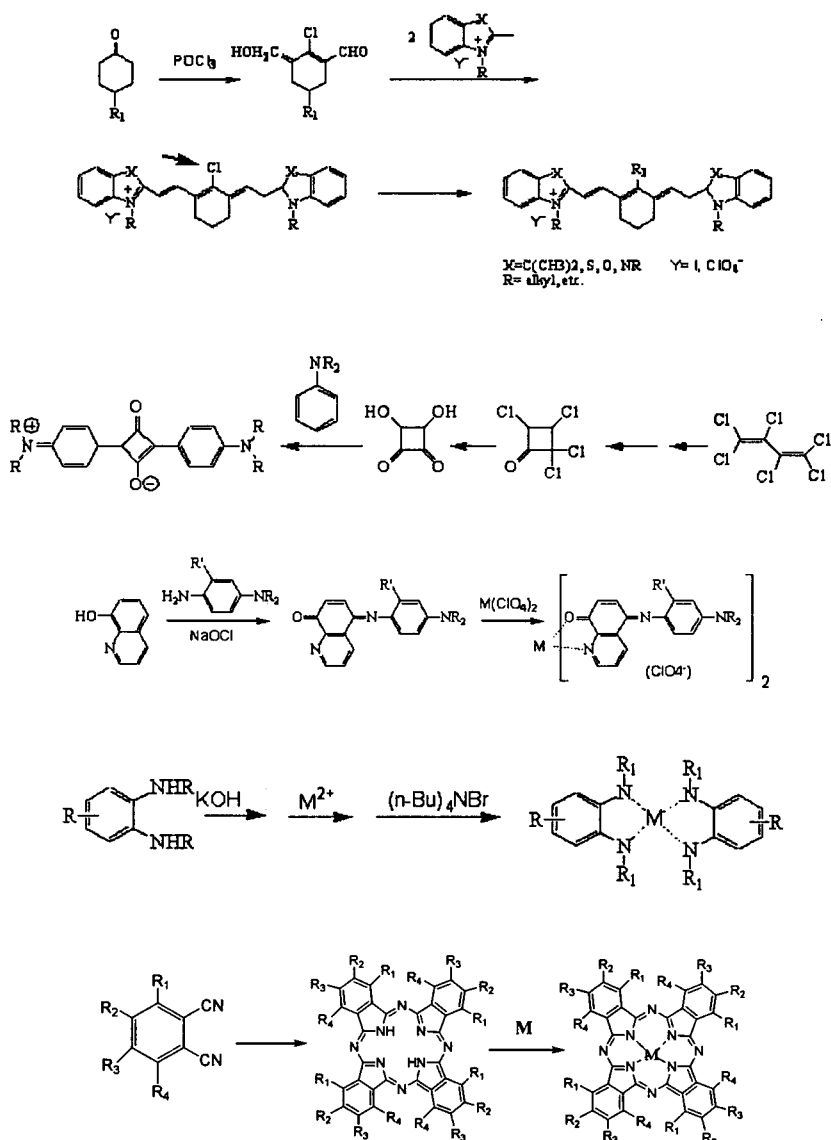
- The light absorption properties of the various near-infrared dyes were measured in

organic solvents with molar absorption coefficients.

- The molar absorption coefficients of all the near-infrared dyes derived from chromophores are very high and narrow bands. The dyes can be considered in many respects as donor-acceptor chromogens

The major infrared absorbing dyes classes are:

1. Cyanine-typed dyes
2. Donor-acceptor dyes
3. Metal complex dyes



Conclusion

For many high technology applications the absorption spectrum of an infrared dye should show minimal absorption between 400–700 nm (the visible region) and possess a narrow intense absorption band (ϵ_{max} greater than 20,000 $\text{L mol}^{-1}\text{cm}^{-1}$) at the desired point.

Some typical uses include;

- i. Solar screens (car windscreens/window)
- ii. Laser screens (military uses, protective goggles)
- iii. Solar heating (horticultural plastics)
- iv. Optical data storage
- v. Infrared camouflage
- vi. Security printing
- vii. Laser dyes