

Synthesis of cyanine dyes: potential fluorescent probes for biological applications

Diego S. Pisoni,* Marluza P. de Abreu, Cesar L. Petzhold, Fabiano S. Rodembusch, Leandra F. Campo

Instituto de Química, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves, 9500, CEP 91501-970, Porto Alegre, RS, Brazil

*Corresponding author: diego_qui@yahoo.com.br

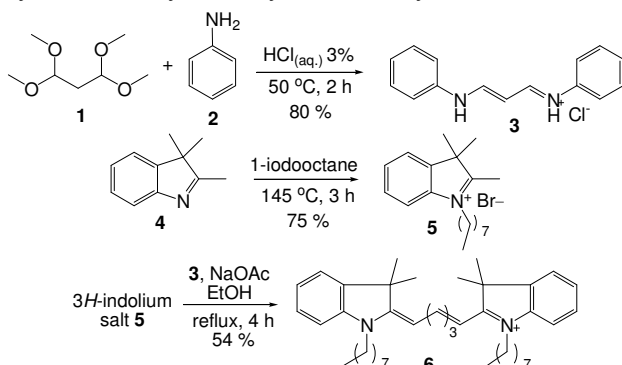
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INTRODUCTION

Cyanine dyes are important organic compounds due to the strong absorption in the visible region, interesting broad wavelength tenability and fluorescence emission in red and infrared regions.¹ These features allow the use of these dyes as photographic sensitizers, nonlinear optical materials, fluorescent probes for biological and analytical applications.² This work describes the synthesis of cyanine dyes prepared by the condensation of heteroaromatic compounds with a polymethine spacer derived from aniline.

RESULTS AND DISCUSSION

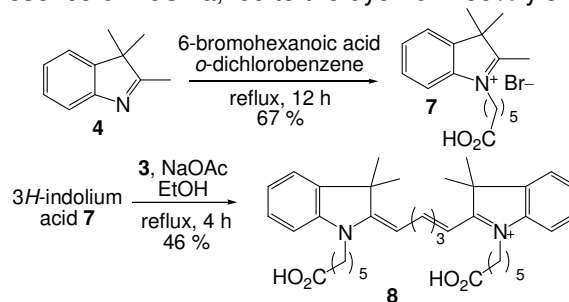
Symmetrical cyanine **6** was synthesized as shown in Scheme 1. The acid-catalysed condensation of 1,1,3,3-tetramethoxypropane (**1**) with aniline (**2**) afforded the polymethine precursor **3**. Subsequent alkylation of 2,3,3-trimethylindolenine (**4**) with excess of 1-iodooctane led to the ammonium salt **5** in 75% yield. Next, the condensation reaction of polymethine **3** (1.0 equiv.) with 3*H*-indolium salt **5** (2.0 equiv.), under reflux in EtOH in the presence of AcONa, afforded the symmetrical cyanine dye **6** in 54% yield.



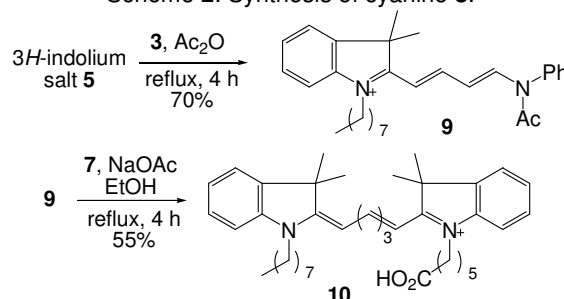
Scheme 1. Synthesis of cyanine **6**.

Cyanine **8** was obtained in 46% yield by condensation of polymethine **3** with 3*H*-indolium-acid **7**, prepared by alkylation of **4** using 6-bromohexanoic acid in *o*-dichlorobenzene (Scheme 2). Unsymmetrical dye **10** was synthesized

according to Scheme 3. Condensation of **3** (1.0 equiv.) with **5** (1.0 equiv.), in the presence of Ac₂O as solvent, afforded the acetanilinoindolium salt **9** in 70% yield. Subsequent reaction of activated indolium **9** with **7**, under reflux in EtOH in the presence of AcONa, led to the dye **10** in 55% yield.



Scheme 2. Synthesis of cyanine **8**.



Scheme 3. Synthesis of cyanine **10**.

The synthesized dyes exhibit in solution absorption and fluorescence emission in the red region (660 - 670 nm).

CONCLUSION

The dyes **6**, **8** and **10** were synthesized by the condensation of heterocyclic ammonium salts with polymethine precursor **3**. These compounds exhibit interesting photophysical properties for application in fluorescence microscopy and fluorescence imaging.

ACKNOWLEDGEMENTS

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REFERENCES

- Mojych, M. *et al.* *Top. Heterocycl. Chem.* **2008**, 14, 1.
- Chipon, B. *et al.* *Tetrahedron Lett.* **2006**, 47, 8279.