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Electrochemical properties of heterocyclic cyanine dyes

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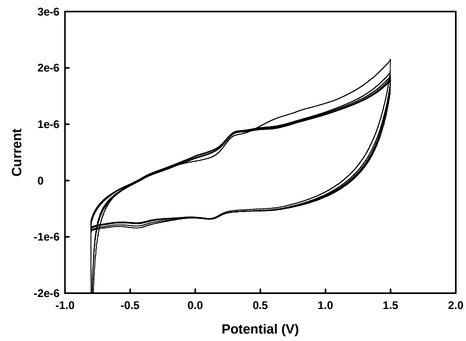
Introduction

Cyanine dyes are a class of dyes containing a -CH= group linked with two heterocyclic rings containing nitrogen: commonly used as sensitizers in photography. Hetero cyclic cyanine dyes have received much attention to researchers due to their potential applicable properties. These cyanine dyes can apply to storage, photography and biochemisty. Electrochemistry can forecast electrochemical properties of the organic compounds such as reduction and oxidation behaviors. These properties are of very importance to determine the basic characteristic of the compounds. Those properties can be applicable to the aspects of quantum chemistry calculation. In this study, using different substituents of cyanine dye, identification of electrochemical properties was determined using cyclic voltammetry (CV) measurement. Consideration of the above advantage of cyanine dye was discussed..

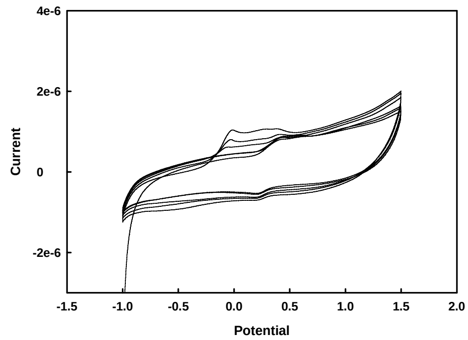
Experimental

Acetonitrile has been purchased from *Samchuan Chem.. Co.* Reagent grade tetrabutlyammonium hexafluorophosphate (Aldrich) was of the highest purity available and used as received. The voltammograms were recorded with a three electrode system utilizing a VersaSTAT3 model. The reference electrode, Ag/Ag+ was directly immersed in the reaction cell. The working electrode was a glassy carbon. The counter electrode was a platinum wire. The scan rate was used 100mV/s. The electrochemical properties such as HOMO/LUMO energy levels were calculated by the peck potential equation. Peck potential used highest oxidation peak and the lowest reduction peak. The following equation can be used in this calculation.

$$HOMO(\text{or } LUMO)(eV) = -4.8 - (E_{peak} - E_{1/2}(Ferrocene)) \cdots (1)$$



(a)



(b)

Fig 1. voltammograms (a) $5*10^{-3}$M (b) $3*10^{-6}$M in acetonitrile

Results and discussions

The HOMO/LUMO energy levels of heterocyclic cyanine dyes were characterized by CV. Fig. 1 shows electrochemical properties of these dyes. The half-wave potential of ferrocene is known to be 4.8eV under the vacuum level. The voltamograms showed a different potential position. The test was carried out to reveal the effect of different substituent structures on the electrochemical behavior of the heterocyclic cyanie dyes.

Conclusion

In this work, the effect of the different substituents of heterocyclic cyanie dyes was studied. HOMO/LUMO energy levels were considered with the states of molecular orbital and the identifications of electron transition. In this context, this experiment may provide useful information, namely forecast of electrochemistry and energy level characteristics.

Reference

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