

شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلو

## بسم الله الرحمن الرحيم





MONA MAGHRABY



شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلو



شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



MONA MAGHRABY



شبكة المعلومات الجامعية التوثيق الإلكترونى والميكروفيلم

## جامعة عين شمس التوثيق الإلكتروني والميكروفيلم قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



MONA MAGHRABY

Ain Shams University
Faculty of Science
Chemistry Department



### Effect of Inclusion in Cyclodextrin Nanocavities on the Excited State Intramolecular Charge Transfer of Aminonaphthalene Derivatives

A Thesis

Submitted for the Degree of Master of Science

As Partial Fulfillment for Requirements of Master of Science

"Chemistry Department"

### Hossameldin Nabeh Akl Metwally

B.Sc. in Special Chemistry, Faculty of Science,

Zagzig University

2006

### **Under Supervision of**

### Prof. Dr. Ayman Ayoub Abdel-Shafi

Professor of Inorganic and photochemistry, Faculty of Science, Ain Shams University

#### Dr. Hesham Samir Abdel-Samad

Lecturer of Physical Chemistry, Department of Chemistry, Faculty of Science, Ain Shams University

### Dr. Dina Salah Eldin Mohamed Abdelrhman

Lecturer of Biophysics, Department of Physics, Faculty of Science,
Ain Shams University

# Ain Shams University Faculty of Science Chemistry Department



### **Approval Sheet**

# Effect of Inclusion in Cyclodextrin Nanocavities on the Excited State Intramolecular Charge Transfer of Aminonaphthalene Derivatives

By

### Hossameldin Nabeh Akl Metwally

B.Sc. in Major Chemistry, Faculty of Science

Zagazig University

2006

### This Thesis for Master Degree has been approved by:

### Prof. Dr. Ayman Ayoub Abdel-Shafi

Professor of Inorganic and photochemistry, Faculty of Science, Ain Shams University

#### Dr. Hesham Samir Abdel-Samad

Lecturer of Physical Chemistry, Faculty of Science, Ain Shams University.

#### Dr. Dina Salah Eldin Mohamed Abdelrhman

Lecturer of Biophysics, Faculty of Science, Ain Shams University.

**Head of Chemistry Department** 

Prof. Dr. Ayman Ayoub Abdel-Shafi

# Ain Shams University Faculty of Science Chemistry Department



Student Name: Hossameldin Nabeh Akl Metwally

Scientific Degree: M.Sc.

Faculty Name: Faculty of Science – Zagazig University

**Graduation Year: 2006** 

**Granting Year: 2020** 

### **Acknowledgment**

All the praises and thanks be to Allah, who has guided me to this, and never could I have found guidance, were it not that Allah had guided me

From the bottom of my heart I would like to say big thank you for all the photochemistry research group members for their understanding and help throughout my project, especially to Mr. Ahmed El Azaly and Mrs. Aya Saied for the help throughout the experimental part of my work, Dr. Hesham Samir and Dr. Dina Salah for their great guidance, Support and encouragement. I also would like to dedicate a special thank you to Prof. Dr. Ayman Ayoub without your help and wise guidance and giving me the chance to be your student this work would have not been the same!

Finally, I would like to thank all my family for being with me in every step on my life.

Hossam Nabeh

### **Contents**

List o	f Figures	i
List o	f Tables	viii
List o	f Symbols	ix
List o	f Abbreviations	X
Aim o	of Work	xi
Chap	ter I	1
1	Introduction and Overview	1
1.1	Cyclodextrins Inclusion	1
1.2	Cyclodextrins Applications in Pharmaceutical Field	5
1.3	Cyclodextrins Applications in Medicine	10
1.4	Cyclodextrins Applications in Food Industries	11
1.5	Cyclodextrins Applications in Textiles Field	12
Chap	ter II	14
2	Materials and Methods	14
2.1	Materials	14
2.2	UV-visible spectroscopy	14
2.3	Photoluminescence	14
2	3.1 Fluorescence Quantum Yield	15
2.4	Photoluminescence Lifetime	15
2.4	4.1 Time-Resolved Fluorescence Lifetime Measurement	s 16

2.5	<sup>1</sup> H NMR Measurements	18
Chap	oter III	19
3	Results and discussion	19
3.1	Steady-State Measurement	19
3	.1.1 Absorption spectra of 2NA6S and 1NA4S	19
3	.1.2 Emission Spectra of 2NA6S and 1NA4S	34
3.2	Lifetime Measurements	60
		64
3.3	<sup>1</sup> H NMR Measurements	77
4	Conclusion	107
5	References	108

### List of Figures

Figure 1.1: A schematic diagram for different cyclodextrins (CDs) 1
Figure 1.2: 2-naphthylamine-6-sulfonate (2NA6S)
Figure 1.3: 1-naphthylamine-4-sulfonate (1NA4S)
Figure 3.1: Effect of $\beta$ -CD concentrations on the absorption spectrum of
2NA6S in water
Figure 3.2: The absorbance change at λabsmax with different
concentrations of β-CD22
Figure 3.3: Effect of $HP_{\beta}$ -CD concentrations on the absorption spectrum
of 2NA6S in water
Figure 3.4: The absorbance change at λabsmax with different
concentrations of $HP_{\beta}$ -CD
Figure 3.5: Effect of M-β-CD concentrations on the absorption spectrum
of 2NA6S in water
Figure 3.6: The absorbance change at λabsmax with different
concentrations of Mβ-CD26
Figure 3.7: Absorption spectra of 1NA4S in the presence and absence of
0.01 MB-CD27

Figure 3.8: Benesi–Hildbrand plot of $1/\Delta A$ versus $1/[\beta\text{-CD}]$ for 2NA6S.
Figure 3.9: Benesi–Hildbrand plot of 1/ $\Delta A$ versus 1/[HP $_{\beta}$ -CD] for
2NA6S30
Figure 3.10: Benesi–Hildbrand plot of 1/ $\Delta A$ versus 1/[M $\beta$ -CD] for
2NA6S31
Figure 3.11: Fluorescence emission spectra of 2NA6S in the absence and
presence of various concentrations of $\alpha\text{-CD}$ in aqueous solution 36
Figure 3.12: Changes in the fluorescence quantum yield of 2NA6S with
α-CD concentration
Figure 3.13: : Fluorescence emission spectra of 2NA6S in the absence
and presence of various concentrations of $\beta\text{-CD}$ in aqueous solution 38
Figure 3.14: Changes in the fluorescence quantum yield of 2NA6S with
β-CD concentration39
Figure 3.15: Fluorescence emission spectra of 2NA6S in the absence and
presence of various concentrations of M $\beta\text{-CD}$ in aqueous solution 40
Figure 3.16: Changes in the fluorescence quantum yield of 2NA6S with
Mβ-CD concentration
Figure 3.17: Fluorescence emission spectra of 2NA6S in the absence and

Figure 3.18: Changes in the fluorescence quantum yield of 2NA6S with
HP-β-CD concentration
Figure 3.19: Fluorescence emission spectra of 2NA6S in the absence and
presence of various concentrations of $\gamma$ -CD in aqueous solution 44
Figure 3.20: Changes in the fluorescence quantum yield of 2NA6S with
γ-CD concentration
Figure 3.21: Fluorescence emission spectra of 1NA4S in the absence and
presence of various concentrations of $\beta$ -CD in aqueous solution 46
Figure 3.22: Changes in the fluorescence quantum yield of 1NA4S with
β-CD concentration47
Figure 3.23: Fluorescence emission spectra of 1NA4S in the absence and
presence of various concentrations of M $\beta$ -CD in aqueous solution 48
Figure 3.24: Changes in the fluorescence quantum yield of 1NA4S with
Mβ-CD concentration49
Figure 3.25: Fluorescence emission spectra of 1NA4S in the absence and
presence of various concentrations of HP- $\beta$ -CD in aqueous solution 50
Figure 3.26:Changes in the fluorescence quantum yield with HP-β-CD.
51
Figure 3.27: Benesi–Hildbrand plot of $1/(^0\Phi_f-\Phi_f)$ versus $1/[\alpha\text{-CD}]$ for
2NA6S

Figure 3.28: Benesi–Hildbrand plot of $1/(^0\Phi_f-\Phi_f)$ versus $1/[\beta\text{-CD}]$ for
2NA6S
Figure 3.29: Benesi–Hildbrand plot of $1/(^0\Phi_f-\Phi_f)$ versus $1/[M\beta\text{-}CD]$ for
2NA6S
Figure 3.30: Benesi–Hildbrand plot of 1/ ( $^0\Phi_f$ – $\Phi_f$ ) versus 1/[HP- $\beta$ -CD]
for 2NA6S 56
Figure 3.31: Benesi–Hildbrand plot of 1/ ( $^0\Phi_f$ – $\Phi_f)$ versus 1/[ $\beta\text{-CD}]$ for
1NA4S
Figure 3.32 : Benesi–Hildbrand plot of 1/ $(^0\Phi_f-\Phi_f)$ versus 1/[ $M\beta\text{-}CD]$
for 1NA4S
Figure 3.33 : Benesi–Hildbrand plot of 1/ $(^0\Phi_f-\Phi_f)$ versus 1/[ HP\beta-CD]
for 1NA4S 59
Figure 3.34: Fluorescence decay traces of 2NA6S in the absence and
presence of different concentrations of $\beta$ -CD64
Figure 3.35: Fluorescence decay traces of 2NA6S in the absence and
presence of different concentrations of $\alpha$ -CD65
Figure 3.36: Fluorescence decay traces of 2NA6S in the absence and
presence of different concentrations of $\gamma$ -CD66
Figure 3.37: Fluorescence decay traces of 2NA6S in the absence and
presence of different concentrations of Mβ-CD67

Figure 3.38: Fluorescence decay traces of 2NA6S in the absence and
presence of different concentrations of HP-β-CD68
Figure 3.39: Fluorescence decay lifetime of 2NA6S changes with $\beta$ -CD
concentrations 69
Figure 3.40: The changes on the amplitudes of 2NA6S with $\beta$ -CD
concentrations 70
Figure 3.41: Benesi-Hildebrand plot for the evaluation of the association
constant of 2NA6S with β-CD concentrations71
Figure 3.42: Fluorescence decay traces of 1NA4S in the absence and
presence of different concentrations of $\beta$ -CD72
Figure 3.43 : Fluorescence decay traces of 1NA4S in the absence and
presence of different concentrations of HP-β-CD73
Figure 3.44: Fluorescence decay traces of 1NA4S in the absence and
presence of different concentrations of M-β-CD74
Figure 3.45: Fluorescence decay traces of 1NA4S in the absence and
presence of different concentrations of $\alpha$ -CD75
Figure 3.46: Fluorescence decay traces of 1NA4S in the absence and
presence of different concentrations of $\gamma$ -CD
Figure 3.47: Structure of the cyclodextrin derivatives together with a
pictorial picture showing interior and exterior protons

Figure 3.48: The Assignment of <sup>1</sup> H NMR peaks of 2NA6S79
Figure 3.49: The Assignment of <sup>1</sup> H NMR peaks of 1NA4S 80
Figure 3.50: The Assignment of <sup>1</sup> H NMR peaks for α-CD
Figure 3.51: The Assignment of <sup>1</sup> H NMR peaks for β-CD 82
Figure 3.52: The Assignment of <sup>1</sup> H NMR peaks for γ-CD
Figure 3.53: The Assignment of <sup>1</sup> H NMR peaks for Me-β-CD 84
Figure 3.54: The Assignment of <sup>1</sup> H NMR peaks for HP-β-CD85
Figure 3.55: <sup>1</sup> H NMR spectra of 0.01 M of α-CD in the absence and
presence of 0.01 M 2NA6S in D <sub>2</sub> O
Figure 3.56: ¹H NMR spectra of 0.01 M of β-CD in the absence and
presence of 0.01 M 2NA6S in D <sub>2</sub> O
Figure 3.57: <sup>1</sup> H NMR spectra of 0.01 M of γ-CD in the absence and
presence of 0.01 M 2NA6S in D <sub>2</sub> O90
Figure 3.58: <sup>1</sup> H NMR spectra of 0.01 M of M- β-CD in the absence and
presence of 0.01 M 2NA6S in D <sub>2</sub> O91
Figure 3.59: ¹H NMR spectra of 0.01 M of HP- β-CD in the absence and
presence of 0.01 M 2NA6S in D <sub>2</sub> O
Figure 3.60: <sup>1</sup> H NMR spectra of 0.01 M 2NA6S in the absence and 95
Figure 3.61: Effect of inclusion in α-CD, β-CD, γ-CD, M-β-CD and HP-β-