Influence of the polymer mold on the laser absorption and fluorescence spectra of Rhodamines Dyes

***Mohammed .Obeid Hsian. AL-Lheiby (M.Sc .physics)**

****Thea Abas mahmood .AL-mula (BSc. Physics)**

College of Medicine, AL_Anbar University, Ramadi , IRAQ

Department of physiology & medical physics

Received 4 April 2013 ; Accepted 28 October 2013

Abstract

This research includes influence of polymer mold of the absorption spectra and fluorescence of Rhodamine B and Rhodamine 6G in the different melts for example chloroform, methanol and dimethyl sulphoxides in the different concentrations (10^{-4} -10^{-6}) mole/liter.

The results show that intensity and wave length at top of absorption spectra and fluorescence for dye solutions of two dyes; Rhodamine B and Rhodamine 6G ,should be depend on the increasing polymer size ratio adding ,measure the spectra characters and Photophysical Properties for dyes solutions in the polymer molds (PMMA) ,so results show of this research that absorption spectra and fluorescence for this solutions (dyes solutions) shift towards short waves lengths (high energies) more than liquids solutions for dyes ,also the intensity of absorption spectra and fluorescence increasing, and mixing Dye solution concentration with polymer which appear active effect for polymer which increasing of efficiency of the absorption spectra and fluorescence of Rhodamine B and Rhodamine 6G.

Key words: Polymer, Rhodamine B, Rhodamine 6G**,** absorption spectra**,** fluorescenc

Influence of the polymer mold on the laser absorption and fluorescence spectra of Rhodamines Dyes

*Mohammed .Obeid Hsian. AL-Lheiby ,**Thea Abas mahmood .AL-mula

تأثير القالب البوليمري على الامتصاص الليزري وأطياف الفلورة لصبغات الروداميات

م.محمد عبيد حسين أللهيبي *

م.باحث ضياء عباس محمود المولى **

كلية الطب-جامعة الانبار –الرمادي –العراق

فرع الفسلجة والفيزياء الطبية

الخلاصة

تضمن هذا البحث تاثير القالب البوليمري على اطياف الامتصاص والفلورة الضوئية لصبغتي رودامين B ورودامين 6G في مذيبات مختلفة مثل الكلوفوروم ،الميثانول وثنائي مثيل اوكسيد الكبريت وبتراكيز مختلفة (10^{-4}-10^{-6}) مول/لتر.

وقد بينت النتائج بان الشدة والطول الموجي لقمة اطياف الامتصاص والفلورة للمحاليل الصلدة لصبغتي الرودامين B ورودامين 6G فيعتمدان على زيادة نسبة البوليمر الحجمية المضافة وقياس الخصائص الطيفية والصفات الفيزياوية الضوئية لمحاليل الصبغة الصلدة في قوالب البوليمر (PMMA) ،كذلك بينت النتائج لهذا البحث بأن اطياف الامتصاص والفلورة لهذه المحاليل (محاليل الصبغة) تزاح باتجاه الاطوال الموجية القصيرة (الطاقات العالية) اكثر من تلك للمحاليل السائلة للصبغات ،كما ان شدة اطياف الامتصاص والفلورة تزداد ايضا ،وعند مزج محلول الصبغة المركز مع البوليمر يظهر التاثير الفعال للبوليمر حيث يزيد من الكفاءه على اطياف الامتصاص والفلورة اللليزري لصبغتي رودامين B ورودامين 6G .

الكلمات الدالة: البوليمر ،صبغة رودامين 6G، B ، طيف الامتصاص ،الفلورة الضوئية

Introduction

Laser dyes are organic matters which complex setup somewhat of the a large molecular weigh and that contain of the structures of chain of carbon atoms join with single bond or double and a shape sequence with other ,most dyestuff with ability to absorb visible rays electromagnetic with high qualification result that which move rays with a large range with visible frequencies but wavelengths a large of wavelengths which absorb it [1].

Laser dyes classify in to different parts according to organic chemistry of the dyes, Xanthenses dyes, the laser in this area which where visible ray (500-700) nanometer [2].

Use one type of xanthenes to describe this part:

1.Rhodamine B dye : Scientific name is (6-Diethylamino-3diethyliminiue -3H-Xanthene -9-YL) BenzoicAcid, Rhodamine610, pilot578 or Tetraethyrhodamine, chemical formula ($C_{28}H_{31}N_2O_3Cl$) , molecular weight, its 479.02 g/mole, which provided from company (KODAK) American.

2 .Rhodamine dyestuff 6G : Scientific name is (6-Ethylamino-3ethylimino-2,7-dimethy 1-3H-Xanthene-9-YL) Benzoic Acidethy lester ,Rhodamine 590, pilot 559, chemical formula($C_{28}H_{31}N_2O_3Cl$) , molecular weight, its 479.02 g/mole , which provided from company (KODAK) American [3,4].

The polymer used in the research polymethel methacrylate (PMMA) it's a plastic matter transparent without colour contain with high flexibility to describe the flexibility it with coefficient high refraction to be importance in using with organic dyes example Rhodamine 6G as condensed luminescent solar LSC (Luminescent solar concentrators) to improve dye laser to be using it with organic high with contain (Dimers) or high molecular collected [5], as that using many of melting its methanol ,chloroform ($CHCl_3$)and (CH_3OH)or sulphoxides (C_2H_6OS) to show the table (1) specialist this solving [4,6] .

Table (1)properties of solvents uses [4,6]

electricity Dielectric constant	Viscosity centi poises	Coefficient of Refraction	Molecular weigh g / mol	Solvent used
4.77	----	1.446	119.38	$CHCl_3$
33.42	0.544	1.328	32.04	CH_3OH
46.68	1.996	1.479	78.13	C_2H_6OS

Method of working

1. Preparation of sample:

(1-1)-preparation the different concentrations of dye solution.

To prepare solution of dye certain of different concentration, where suitable quantity melt of powder dye in the size certain from the solvent. . according to the relationship:

$$m = \frac{CVM}{1000} \ldots\ldots\ldots (1-1)$$

Where:

m: weight of dye required to obtain required concentration with gram unit.

C: the concentration of required preparation with unit (Mole/liter).

V: solvent size with (cm^3) should adding to matter

M: molecular weight to using dye.

For that to wrong littlie with samples preparation ,so that high solution preparation somewhat (1×10^{-3}) mole /liter from each dyestuff in the different melting ,after that adding certain size of a melt in to certain size of solution for more concentration to obtain of dilution solutions by use the relationship which named "the dilution relationship" :

$$C_1V_1 = C_2V_2 \ldots\ldots\ldots (2-1)$$

Where C_1: the first concentration (high)

C_2 : the second concentration (dilution)

V_1 : the required size take it from the first concentration to obtain on the second concentration

V_2 : the required size adding it to the first concentration to obtain on the second concentration

(2-1)- Preparation solution the second the hard for dye in Polymer mold.

So that preparation hard solution for the dye in the polymer mold to take firm ratio of solution high dye concentrate and maxing with different ratio of polymer solution to obtain of the solutions polymer dye.

2. The measure spectrums absorb and the fluoric:

For using a set to measure absorb spectrums and fluoric of the kind (spectrofluorimeter model RF-5000) to provide from company (shimadzu) Japanese and contain a lamp AL-Zenon to ability (150) watt and cover two areas above violet and visible of electromagnetic spectra when to use the set to measure fluoric should be choice the suitable wave length for to excite in absorption range for matter which to study matter so should delete wave lengths of the certain rang though coloring analyses (Monochromator) to emision (fluoric) so that measure excitation spectra (absorption) should be that wave length certain should be in emision spectra (fluoric) and delete wave length certain in rang of coloring analyses(Monochromator) for excitation [7].

Resulting and Discussion

To be studying to absorb spectrums and fluoric for dyes (Rhodamine 6G, Rhodamine B) with polymer in Chloroform, dimethyl sulphoxides and maxing fixed ratio of the dye solution fixed (1×10^{-4}) mole/liter ,with different ratios of polymer solution .

To clear figures (1,2) to absorb solution Rhodamine B in the Chloroform and dimethyl sulphoxides of fixed (1×10^{-4}) mole/liter to different ratio polymer to adding on the sequence.

While the figures (3,4) show florescence spectra for solution Rhodamine B in the Chloroform and dimethyl sulphoxides of fixed (1×10^{-4}) mole/liter to different ratio polymer to adding on the sequence.

After that measure absorption spectra to solution Rhodamine 6G in the Chloroform and dimethyl sulphoxides about concentrate (1×10^{-4}) mole/liter to different polymer ratio to adding and that in figures (5,6) on the followed sequence .

The figures (7,8) show florescence spectra for solution Rhodamine 6G in the Chloroform and dimethyl sulphoxides of fixed (1×10^{-4}) mole/liter to different ratio polymer to adding on the sequence.

Find of shapes and previous tables as of the adding polymer to dye solution concentrate appears shift in the absorb spectra and fluoric by direction short wave lengths which shift blue.

This agreement with results Lopez Arbeloa and group it [8,9,10,11]] that show that is adding polymer in to dye solution concentrate should be to shift absorb spectra and fluoric blue shift which deceases spectral interference between absorptions bundles … florescence growing of re-absorption and re-emission, this it means to obtain of shift stocks large and should to be obtain wide range of tune dye laser as hard matter and adding polymer to dye solution concentrate to obtain on the metastable photic high for dye and after that influence add polymer to dye certain solution for the polymer mold .

Reisfeld and his groups show [7] this spectra changed which occur in dye solution that to react surface molecules dye with oxygen, where the decay which inflict the dye that to dwindle a large shape with combination dye inter the mold polymer, because this combine do prevent dye molecules from diffusion to the surface and this lead to high metastable of tops absorb spectra and fluoric ,also lead to very low change in the intensity of emision which show that period weeks, so that don't be Diamer.

Amat-Guerri and his groups clear [12] dye Chromofor melt in the interior mold polymer always influence in the adding mold ,also the dye molecule in the polymer mold adding can rotation with free in the area which has enough quantity of free size ,while choking move that molecule in the area which didn't has enough free size ,also Chromofor charachertristic dyes excitation in the polymer mold may be influence to react with adding polymer through decay operation, where decrease free size because increase the joint -displaying insure mold polymer will be dye molecules unable of the decay fully interior space free size ,after that be obligation of Dimirate collections and large collections have little fluoric or not.

Balance state between Diamer and Al-monimor show by increasing dye concentration in polymer; this mean enough quality of free size about polymer mold and dye molecules dividing herself in it as follow balance state dynamic without work full with similar way when occurs in liquid solution lighter of dye, also increasing hard polymer mold prevent decay operation for excitation molecules dye rustlings from way photo chemical interaction then dye metastable will be increase.

Lopez Arbeloa and his groups [13,14] show; the laser characters for Rhodamines in the polymer depend on the hard matter adding ,where display that characters that laser efficiency

and metastable light for dye molecules increase in two ways ;either constraint of the join-displaying (cross-linking) of polymer matter and effect monimors or change characters of flexibility viscosity for media with control of inter flexibility for adding polymer ,as he shows for this the laser behavior for dye molecules which many improve by bond dye Chromofor to chains polymer.

Conclusions

Through of studying to the two dyes solutions Rhodamine B and Rhodamine 6G in the different solvents (Chloroform, Methanol, dimethyl sulphoxides) of solutions for dyes in the polymer mold and influence in the polymer mold for many factors, ex.(polymer mold, solvents, absorption,…) the show following :

1. increasing interning area between two absorb spectra and florescence for solutions two dyes Rhodamine B and Rhodamine 6G with increase the concentration.
2.to shift absorb spectra and florescence for solutions two dyes Rhodamine B and Rhodamine 6G by direction long wave length (lower energies) with increasing concentration of solutions two dyes.
3. to obtain most interference area should be narrow between two absorb spectra and florescence _which can be able wide tune_ prefer is using hard solution of dyes in the polymer molds, where should be shift stokes and intensity more large than the liquid solutions for dyes and shift absorb spectra and florescence towards short wave lengths, then increasing efficiency with shape clear .
4. For enhancing characteristics spectra for concentration Rhodamine dyes solutions, so that maxing with polymer (PMMA) and studying photo physical properties.
5. Put active media for dye laser (dye + polymer (PMMA) under air conditioner of knowledge increasing rang dye resister in the polymer mold

Influence of the polymer mold on the laser absorption and fluorescence spectra of Rhodamines Dyes

***Mohammed .Obeid Hsian. AL-Lheiby ,**Thea Abas mahmood .AL-mula**

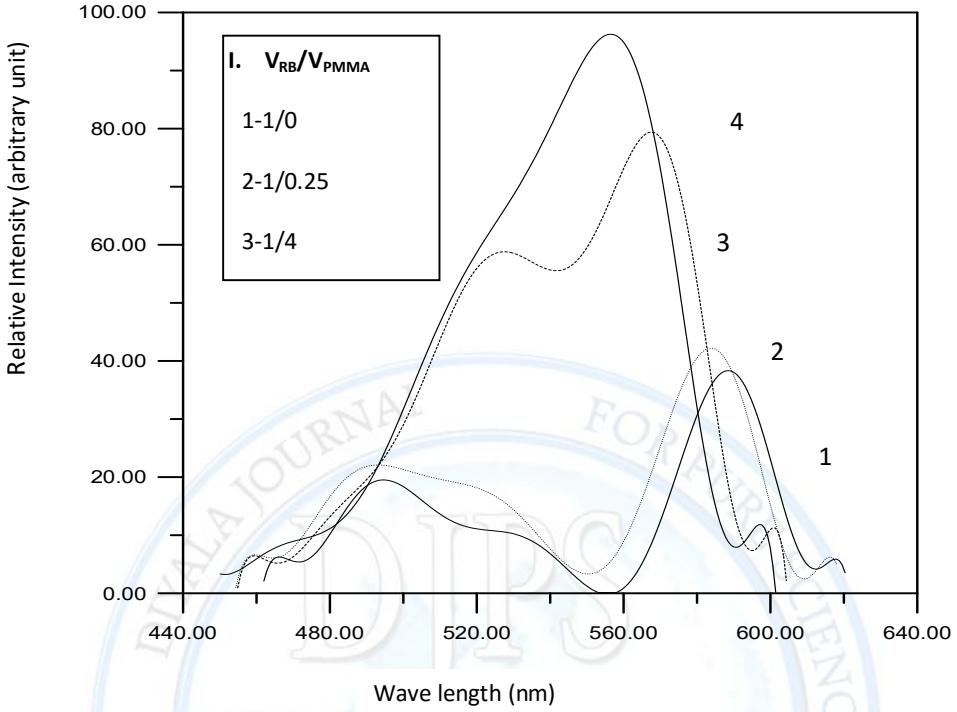

Figure (1) absorption spectra for rhodamine B in $CHCl_3$

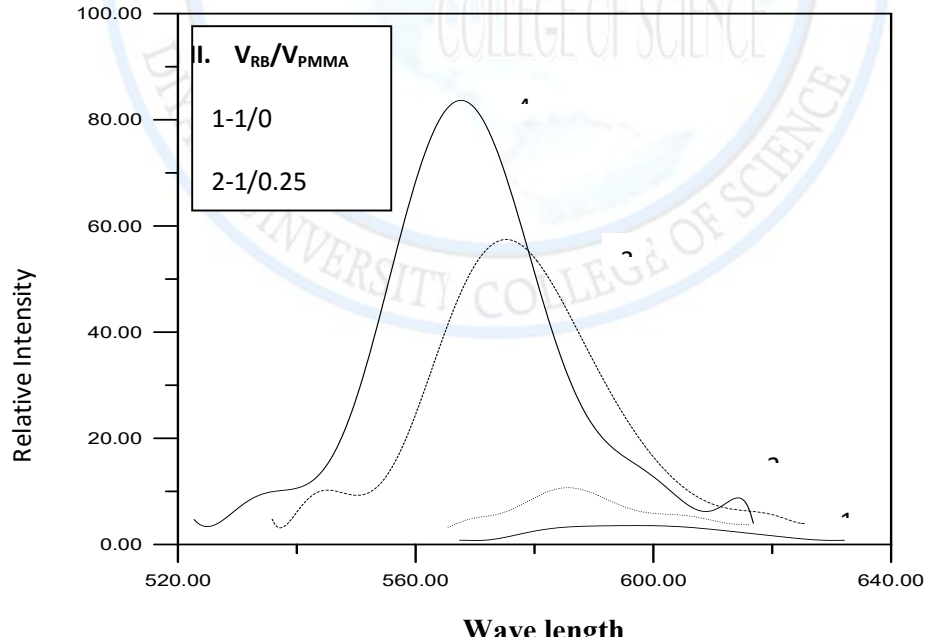

Figure (3) florescence spectra for rhodamine B in $CHCl_3$

Influence of the polymer mold on the laser absorption and fluorescence spectra of Rhodamines Dyes

***Mohammed .Obeid Hsian. AL-Lheiby ,**Thea Abas mahmood .AL-mula**

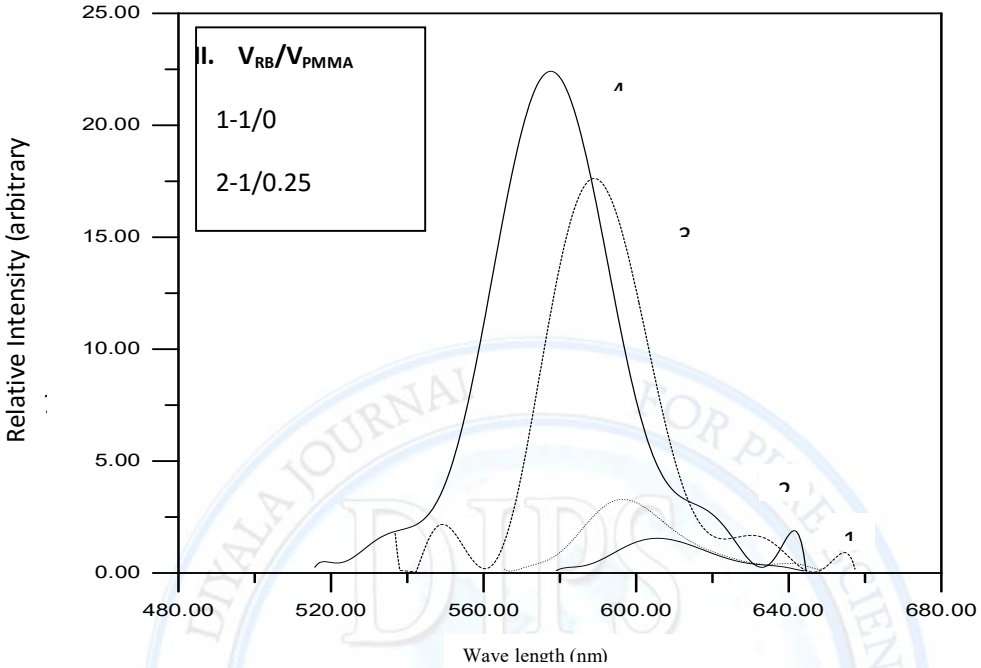

Figure (4) florescence spectra for rhodamine B in CH_3OH

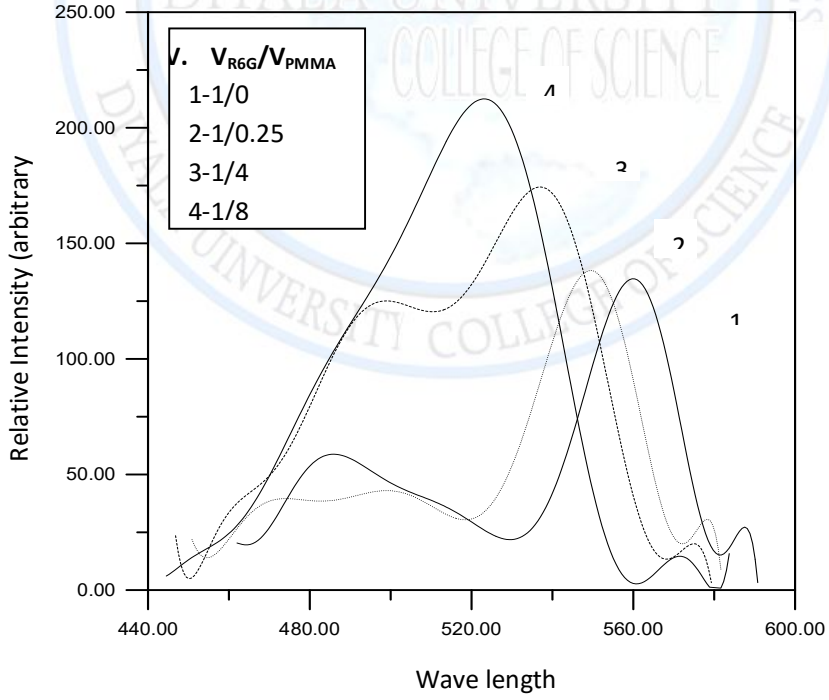

Figure (5) absorption spectra for rhodamine 6Gin $CHCl_3$

Influence of the polymer mold on the laser absorption and fluorescence spectra of Rhodamines Dyes

***Mohammed .Obeid Hsian. AL-Lheiby ,**Thea Abas mahmood .AL-mula**

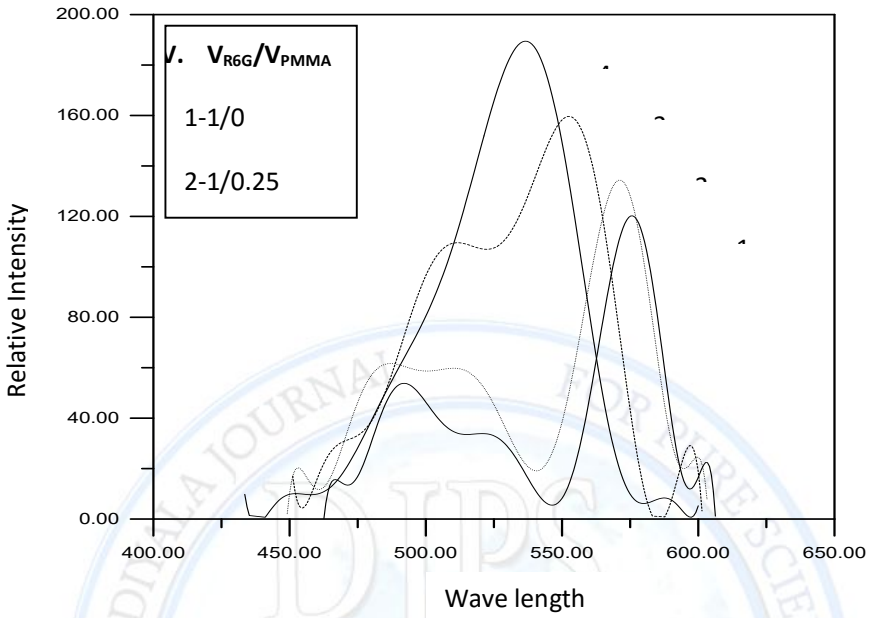

Figure (6) absorption spectra for rhodamine 6G in CH_3OH

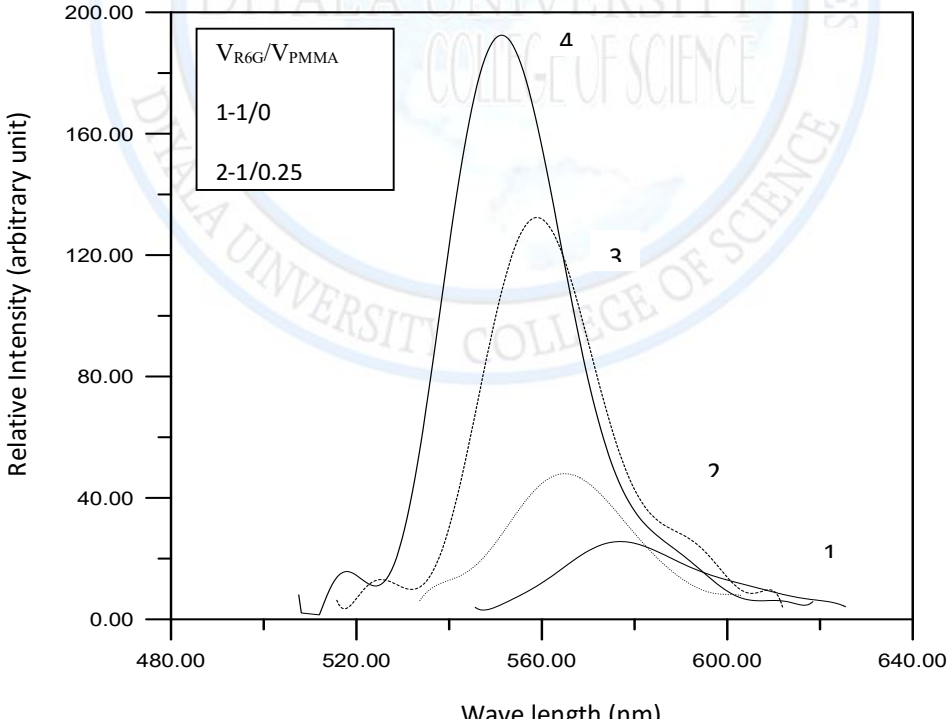

Figure (7) florescence spectra for rhodamine 6G in $CHCl_3$

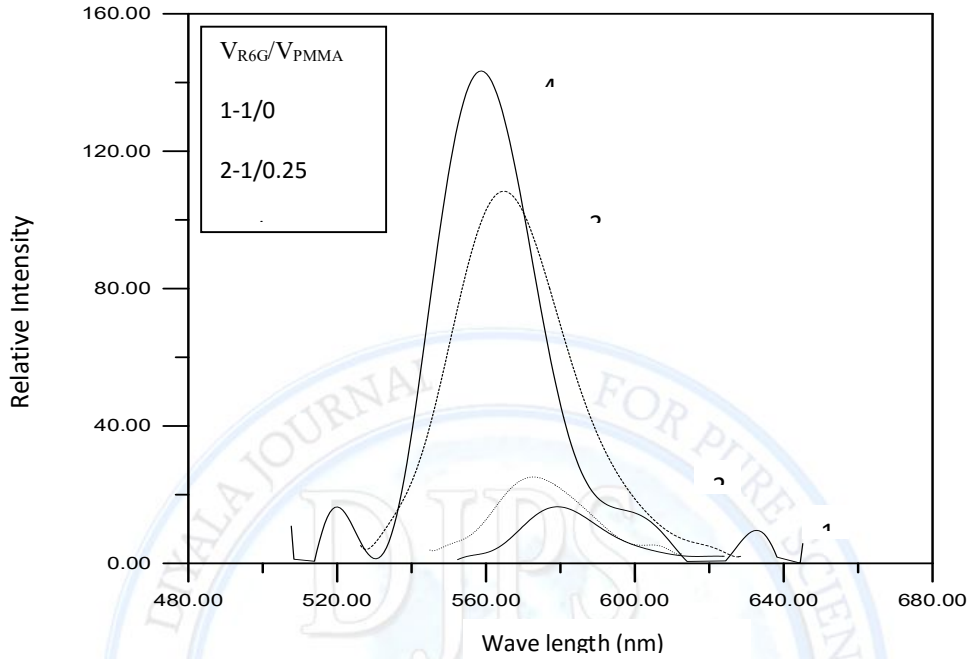

Figure (8) florescence spectra for rhodamine 6G in CH_3OH

References

1. خالد عبد الحميد: ضوئيات الكم والليزر 1985

2. O. Svelto: Principles of Lasers, (Plenum Press, New York 1989)
3. S.G. Schulman: Fluorescence and Phosphorescence Spectroscopy (Pergamon Press, Oxford, New York, Sydney, Paris, Frankfurt, 1977)
4. F. Iinuma, H. Mikawa, Y. Shirota: Macromolecular 14, 1747 (1981)
5. W. Holzer, H. Gratz, T. Schmitt, A. Penzkofer, A. Costela, I. Garcia-Moreno, R. Sastre, F.J. Duarte: Chem. Phys. 256, 125 (2000)
6. A. Dubois, M. Canva, A. Brun, F. Chaput, Jean-Pierre Boilot: Appl. Opt. 35, 3193(1996)
7. A. Costela, I. García-Moreno, J.M. Figuera, F. Amat-Guerri, R. Mallavia, R. Sastre: J. Appl. Phys. 80, 3167 (1996)
8. A. Costela, F. Florido, I. García-Moreno, R. Duchowicz, F. Amat-Guerri, J. M. Figuera, R. Sastre: Appl. Phys. B 60, 383 (1995)

9. V.V. Rodchenkova, S.A. Tsogoeva, T.M. Muraveva, L.K. Denisov, B.M. Uzhinov: Opt. Spectry. 60, 35 (1986)
10. F. López Arbeloa, T. López Arbeloa, I. López Arbeloa, A. Costela, I. Garcia-Moreno, J.M. Figuera, F. Amat-Guerri, R. Sastre: Appl. Phys. B 64, 651 (1997)
11. T. López Arbeloa, F. López Arbeloa, I. López Arbeloa, A. Costela, I. García-Moreno, J.M. Figuera, F. Amat-Guerri, R. Sastre: J. Lum. 75, 309 (1997)
12. M.J. Snare, F.E. Treloar, K.P. Ghiggino, P.J. Thistethwaite: J. Photochem.18,335(1982)
13. F. López Arbeloa, I.U. Aguirresacona, I. López Arbeloa: Chem. Phys. 130, 371 (1989)
14. F. López Arbeloa, T. López Arbeloa, I. López Arbeloa: Chem. Phys. 4, 191 (1996)
15. S.P. Mariano: Org. Photochem. 9, 1 (1987).