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Fluorescence Properties of Modified Polyvinyl Alcohol Conjugates And Doped Modified Polyvinyl Alcohol Conjugates

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ABSTRACT

The Fluorescence properties modified polyvinyl alcohol conjugates and doped modified polyvinyl alcohol samples were studied. It can be seen that the emission peaks are at the same spectral position in MPVA and different spectral position in DMPVA. These bands may be assigned to the recombination of free charge carriers at the defects in PVA. The doping level dependence on the emission intensity of one of these bands. It is found that, the fluorescence intensity of the doped MPVA and MPVA is higher than that of pure PVA. Emission intensity and wavelength increase with doping of MPVA this is due to strong interaction between MPVA and metal ions.

Keywords: Fluorescence properties, Emission intensity, MPVA and DMPVA.

INTRODUCTION

Over recent year poly vinyl alcohol (PVA) polymer shave attracted attention due to their variety of applications .PVA is a potential material having high dielectric strength, good charge storage capacity and dopant-dependent electrical and optical properties. Fluorescent organic and inorganic materials are promising in studying the complexity and dynamics of biological process [1,2]. The physicochemical properties will change radically as the materials evolve from the bulk level to the atomic or molecular counterparts [3]. Compared to the traditional dyes (fluorescent organic molecules), semiconductive nanocrystals have broader excitation wavelength range, narrower and tunable emission spectra more resistant to chemicals and metabolic degradation, and higher photobleaching threshold [4–6]. Nanocrystals with controllable solubility and shape can be accurately synthesized by judiciously controlling the reaction conditions [7–9]. These nanocrystals have attracted much interest due to their wide potential engineering applications such as biology and medication, biological fluorescence labeling and imaging [10,11]. The prominent focus has been the optical properties, showing a strong size-dependent quantum confinement effect [12,13]. The quantum confinement effect takes place when the quantum well thickness becomes comparable to the de Broglie wavelength of the carriers (generally electrons and holes), leading to energy levels called “energy subbands”. In other words, the wavelength is inversely proportional to the momentum of a particle and the frequency is directly proportional to the particle's kinetic energy. The electrons and holes in a semiconductor are confined by a poten- tial well when at least one dimension approaches the size of an electron in bulk crystal [14].Moreover, the emission pattern can be narrow and independent of the excitation frequency, even though the absorption spectrum is a continuum from infrared to UV [15,16]. Fluorescence anisotropy measurements are useful in the study of orientation and molecular dynamics in polymer films and fibers [17]. Such studies render important information about the conformational changes at the micro structural level surrounding the doped fluorescent molecule in the polymer [18]. Mono dispersed spherical CdS nanoparticles embedded into polyvinyl alcohol (PVA) films are synthesized by using an in-situ gamma-irradiation-induced method[19]. Photoluminescence properties of polyvinyl alcohol (PVA) capped $ZnS:Mn^{2+}$ nanoparticles are reported [20]. Literature Survey reveals that the demands improvement of different properties of various form of MPVA materials. In this paper an effort has been made to study the effect of modification of PVA on Fluorescence properties of polymeric films by studying the emission spectra of the samples. The results obtained from these measurements have been analyzed and discussed.

MATERIALS AND METHODS

The fluorescence emissions spectra of modified polyvinyl alcohol conjugates (MPVA) and doped modified polyvinyl alcohol conjugates (DMPVA) were recorded at room temperature using FluroMax-2 spectroflourophotometer. The wavelength accuracy of emission was ± 1 nm. It was observed that there is remarkable change in Fluorescence emission spectra. In practice, the fluorescence spectroscopic measurements are more complex than the relatively simple emission intensity equations imply, to see why, it is necessary to look at a simple diagram for a spectrofluorometer. The spectrofluorometer consists of a light source, an excitation monochromator, a sample holder, an emission monochromator, and a detector (Fig.1).

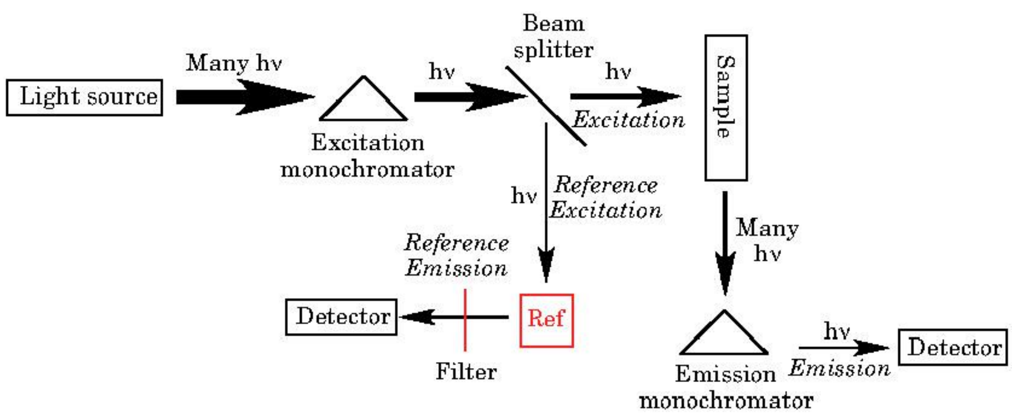

Fig. 1 : block Diagram of spectrofluorometer

RESULTS AND DISCUSSION

Fluorescence Emission Spectra of Modified Polyvinyl Alcohols: In order to understand the fluorescence properties modified polyvinyl alcohol, the fluorescence emission spectra of all the modified polyvinyl alcohol (MPVA) samples were recorded at room temperature (Fig. 2).

1) The wavelength of excitation chosen for all samples is 250 nm.
2) It can be seen that the emission peaks are at the same spectral position in MPVA
3) The emission spectra of the MPVAs exhibit obvious main four peaks centered at different wavelengths as shown in table 1.

4) Similar bands appear in the emission spectrum of PVA.
5) These bands may be assigned to the recombination of free charge carriers at the defects in PVA and MPVA.
6) Fluorescence intensity of peaks increases with modification.

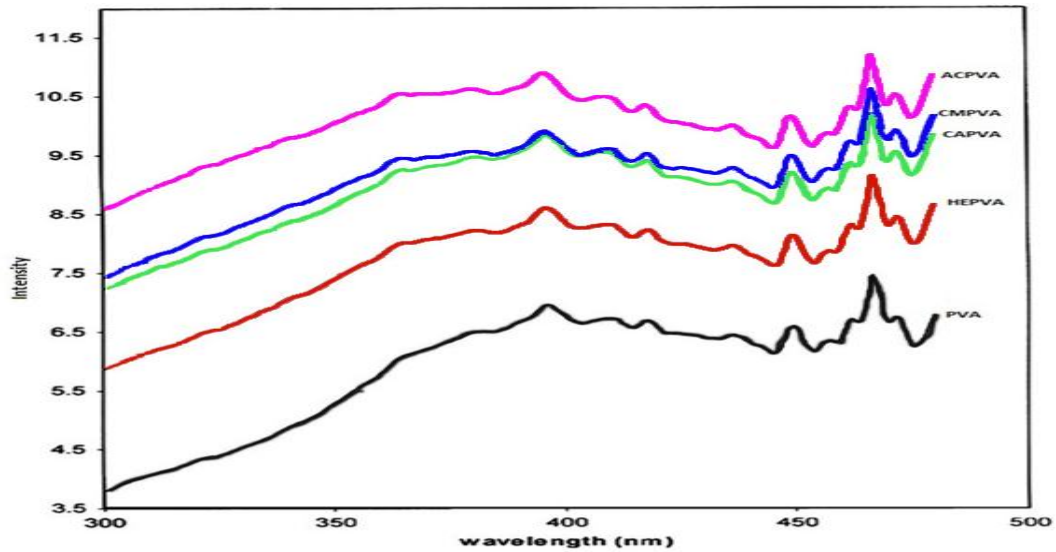

Figure 2: Emission spectra of PVA and MPVA

Table 1 : Wavelength of emission peak of PVA and MPVA

S. No.	Samples	Peak Wavelength (nm)			
		1	2	3	4
1	PVA	366	398	450	467
2	HEPVA	366	398	450	467
3	CAPVA	366	398	450	467
4	ACPVA	366	398	450	467
5	CMPVA	366	398	450	467

Fluorescence Emission Spectra of Doped HEPVAs: In order to understand the fluorescence properties doped HEPVA, the fluorescence emission spectra of all the doped HEPVA samples were recorded at room temperature as shown in fig. 3.

1) The wavelength of excitation chosen for all samples is 250 nm.
2) The emission spectra of the doped HEPVA exhibit obvious main four peaks centered at different wavelengths as shown in table 2.
3) It can be seen that the emission peaks are at different spectral position in doped HEPVA
4) These bands may be assigned to the recombination of free charge carriers at the defects in doped HEPVA.
5) Fluorescence intensity of peaks increases with doping HEPVA.
6) The doping level is dependent on the emission intensity of one of these bands.
7) The peak wavelength of HEPVA and HEPVA-Sm (III) is same indicating less interaction between metal ions and polymer [21].

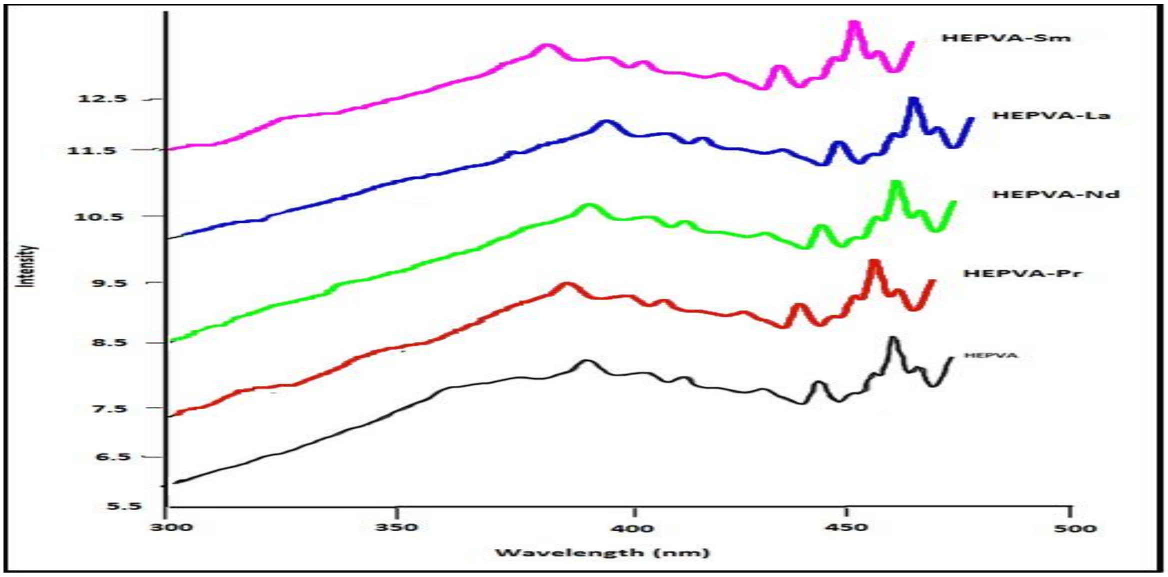

Figure 3: Emission spectra of HEPVA AND DHEPVA

Table-2: Wavelength of emission peak of HEPVA and DHEPVA

S. No.	Samples	Peak Wavelength (nm)			
		1	2	3	4
1	HEPVA	366	398	450	467
2	HEPVA- LA (III)	375	400	450	475
3	HEPVA-Pr (III)	370	385	435	470
4	HEPVA- Nd (III)	367	390	440	471
5	HEPVA- Sm (III)	366	375	435	450

Fluorescence Emission Spectra of Doped CMPVAs: In order to understand the fluorescence properties of doped CMPVA, the fluorescence emission spectra of all the doped CMPVA samples were recorded at room temperature as shown in fig.4.

1) The wavelength of excitation chosen for all samples is 250 nm.
2) The emission spectra of the doped CMPVA exhibit four main peaks, centered at different wavelengths as shown in table 3.
3) It can be seen that the emission peaks are at the different spectral position in doped CMPVA
4) These bands may be assigned to the recombination of free charge carriers at the defects in doped CMPVA.
5) Fluorescence intensity of peaks increases with doping CMPVA.
6) The doping level is dependent on the emission intensity of one of these bands.

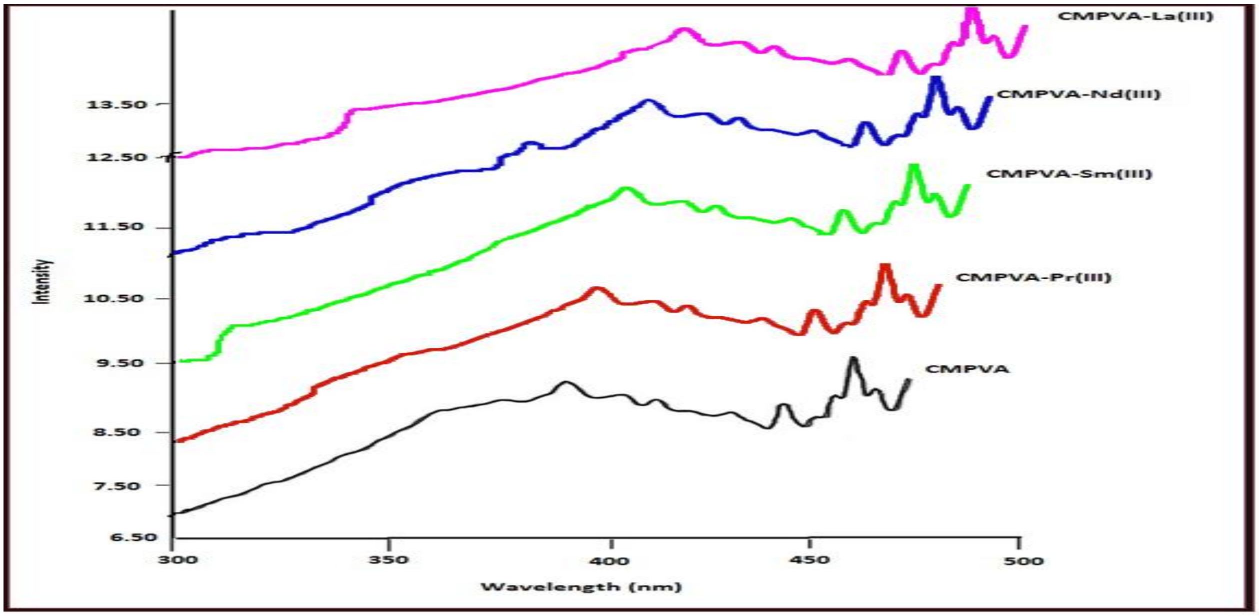

Figure 4: Emission spectra of CMPVA and DCMPVA

Table 3: Wavelength of emission peak of CMPVA and DCMPVA

S. No.	Samples	Peak Wavelength (nm)			
		1	2	3	4
1	CMPVA	366	398	450	467
2	CMPVA – LA (III)	340	425	480	490
3	CMPVA –Pr (III)	335	399	425	470
4	CMPVA – Nd (III)	387	415	424	480
5	CMPVA – Sm (III)	320	410	470	482

APPLICATIONS

An effort has been made to study the effect of modification of PVA on Fluorescence properties of polymeric films by studying the emission spectra of the samples.

CONCLUSIONS

It is found that, the fluorescence intensity of the MPVA and doped MPVA is higher than that of pure PVA. The increase of the intensity of the emission peak may be due to the strong interaction between the dopant and the polymer. This observation is in agreement with previous works [22].

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