International Journal of Luminescence and Applications (ISSN: 2277-6362)
Vol. 5, No. 1, February 2015. Article ID: 040. pp.9-11.

# Preparation of trans-3-(9-Anthryl)-1-phenylprop-2-en-1-one (APPO) Nanoparticles and its Characterization

**Prasad G. Mahajan, Dhanaji P. Bhopate, Avinash A. Kambale, Govind B. Kolekar** and **Shivajirao R. Patil***

*Fluorescence Spectroscopy Research Laboratory,
Department of Chemistry, Shivaji University, Kolhapur-416004(MS, India)*

***Abstract***— *A simple chalcone derivative trans-3-(9-Anthryl)-1-phenylprop-2-en-1-one (APPO) was prepared by Claisen-Schmidt condensation and its nanoparticles are prepared by reprecipitation method. Dynamic Light Scattering (DLS) measurement indicates narrow particle size distribution and average particle size - 37.2 nm. The Scanning Electron Microscopy (SEM) microphotograph of air dried film of nanoparticles shows fiber like morphology of nanoparticles. Further formation of APPO nanoparticles was confirmed on the basis of Absorption and Fluorescence Spectroscopy. APPO nanoprticles having a zeta potential $\zeta$ = -14.3 mV are of high level stability and found to recognize Aluminum ($Al^{3+}$) ion when tested using fluorescence quenching method.*

***Keywords***— *Chalcone, APPO Nanoparticles, Cation sensing, Fluorescence quenching*

## 1. INTRODUCTION

Recently, nanomaterials are being paid a great deal of attention for the detection of heavy metals and bio-molecules resulting in new sensor strategies. Functionalized Fluorescent organic nanoparticles are employed to act as chemoprobe to sense metal ions [1], anions [2] and biomolecules [3]. Inorganic materials and metal nanoparticles are reported [4] successively in recent years but least attempts have been made to design and characterize the fluorescent organic nanoparticles. The methods of preparation of inorganic and metal nanoparticles are lengthy, complicated and expensive. In contrast preparation of fluorescent organic nanoparticles is simple, quick and cost effective. Growth of toxic heavy metal ions over time in the bodies of humans and animals can lead to serious debilitating illnesses [5]. Therefore, the development of increasingly selective and sensitive methods for the sensing of heavy metal ions is currently receiving considerable attention. Recently, various approaches has been reported for the preparation of the organic nanoparticles such as Reprecipitation method, Micro emulsion, Pulsed – Laser ablation, Direct condensation, Ultra sonication etc. Amongst these approaches for the reprecipitation method [6] is one of the suitable method due to its advantages such as simplicity, cost effective, manageable, swift process, superior outcomes, etc. over other methods. Organic nanoparticles have unique physical, mechanical, chemical, electrical, optical, magnetic, electro-optical and magneto-optical properties [7]. The multifunctional activities through organic molecules to form fluorescent organic nanoparticles have been a topic of considerable interest [8]. The chalcones and their derivatives are important intermediates in organic synthesis [9]. They serve as starting material for the synthesis of variety of heterocyclic compounds which are of physiological importance. The Chalcone derivatives or chalcones having enone functionality may interact with metal ion of particular interest. The presence of enone functionality confers biological activity like anti- inflammatory [10], antimalarial [11], antituberculosis [12], anti HIV [13] and antitumor activities [14] in the chalcone moiety. Functionalized Fluorescent organic nanoparticles of various shape, size and composition offer opportunities for sensor research and as a result wide variety of nanomaterial based sensors have been developed for sensing of chemical, biological and environmental species. Consequently it is proposed to prepare and characterize the functionalized organic nanoparticles using chalcone derivative [trans-3-(9-Anthryl)-1-phenylprop-2-en-1-one] (APPO) and its application as probe for the detection of metal ion from aqueous solution.

## 2. EXPERIMENTAL

### 2.1 Preparation of APPO

Preparation was carried out by using Claisen-Schmidt condensation reaction [15] as shown in Scheme No. 1.

### 2.2 Spectral Characteristics of Compound

(87.9% Practical yield); MP $120^0$C (Literature): $119^0$C(Observed), UV(acetone):390,370,350,330nm. IR (KBr pallet): 1659 $cm^{-1}$, α-β unsaturated carbonul group. NMR($CDCl_3$): δ7.52-δ8.51 (14H, m, aromatic), δ8.857 (1H, dd, J= 15.9Hz, vinylic), δ8.351 (1H, dd, J= 15 Hz, Vinylic)

* *Corresponding Author Email: srp_fsl@rediffmail.com*

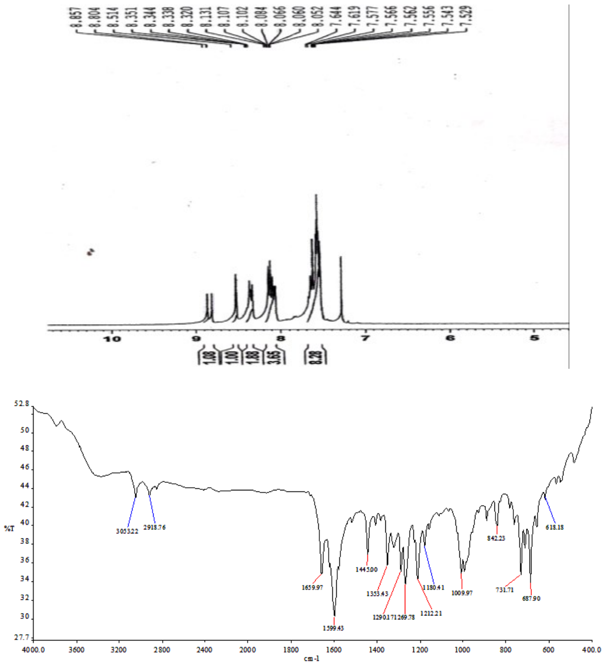
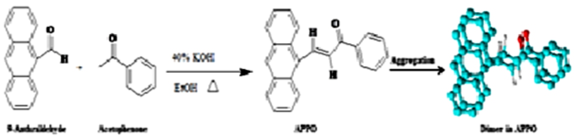


Fig. 1: H[1] NMR and IR spectrum

### 2.3 Preparation of Nanoparticles

A simple, quick and efficient reprecipitation method [6, 16-17] was developed in the laboratory to prepare nanoparticles. 2 mL solution of APPO in acetone (1mM) was injected into 100 mL aqueous solution by micro syringe. The whole solution was vigorously stirred by magnetic stirrer for 1hr and sonicated for 15 min at $30^{0}$C to disperse the nanoparticles in aqueous layer. Process of formation of nanoparticles shown in scheme 1.




Scheme 1

### 2.4 Instrumentation

Following instrumental techniques were used

i) Bruker Avance II, 300 MHz NMR Spectrometer

ii) Malvern Zeta Sizer (Nano ZS-90)

iii) Scanning Electron Microscope(JEON-6360 Japan)

iv) UV-3600,UV-visible-NIR Spectrophotometer (Shimadzu, Japan)

v) Spectrofluorometer (JASCO,Japan,Model FP-8300)

## 3. RESULT AND DISCUSSION

### 3.1 Particle Size Distribution of Nanoparticles

Size distribution histogram obtained from Dynamic Light Scattering (DLS) measurement shown in Fig. 2 indicates narrow particle size distribution and average particle size is 37.2 nm.

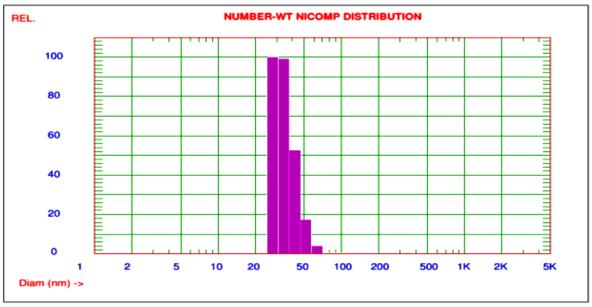



Fig. 2: Particle Size Distribution histogram of Nanoparticles obtained by DLS analysis

### 3.2 Zeta Potenial

Fig. 3 gives the zeta potenial value -14.3 mV. The value in the range from -25 mV to +25 mV indicate high stability of Nanoparticles and ability to bind with metal ion [6,16].

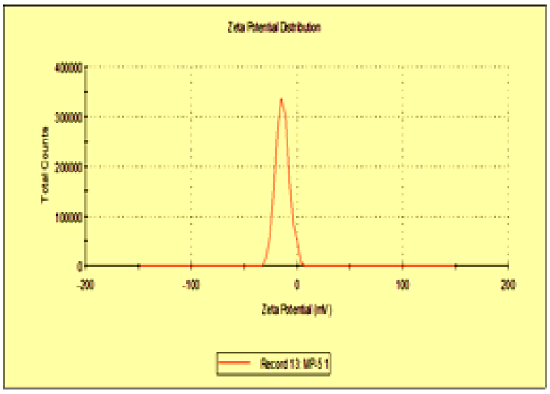



Fig. 3: Zeta potential of Trans-3-(9-Anthryl)-1-phenyl prop - 2-en-1-one

### 3.3 Scanning Electron Microscopy (SEM)

The SEM microphotograph of air dried film of nanoparticles presented in Fig. 4 shows fiber like morphology.

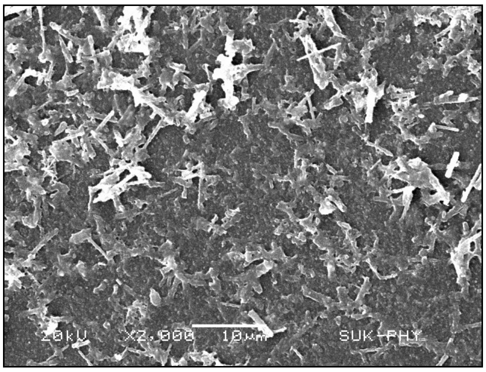


Fig. 4: SEM microphotograph of air dried film of APPO nanoparticles

## 4. PHOTOPHYSICAL PROPERTIES OF NANOPARTICLES

### 4.1 Absorption Spectroscopy

The absorption spectrum of aqueous suspension of APPO nanoparticles presented in Fig. 5 is blue shifted from the corresponding absorption spectrum of dilute solution of sample compound in acetone by 74074.07 $cm^{-1}$. The blue shift led us to consider formation of H- aggregated nanocluster by lateral $\pi$- orbital overlapping of monomer molecules [6].

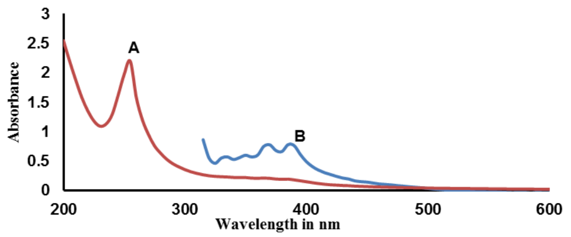



**Fig. 5: UV-visible absorption spectra of APPO Nanoparticles (curve A) and APPO in acetone dilute isolution (curve B).**

### 4.2 Fluorescence Spectroscopy

Aggregation induced enhanced emission(AIEE) of APPO nanoparticles ($\lambda$em = 556 nm, $\lambda$ex = 298 nm) shown in Fig. 6 is red shifted, broad band as compared to emission from monomer ($\lambda$em = 470 nm, $\lambda$ex = 336 nm). The estimated Stoke's shift as a difference between the excitation and fluorescence energy for APPO nanoparticles suspension is $\Delta\bar{\upsilon}$ = 15571.42 $cm^{-1}$ which is larger than for the APPO solution in acetone $\Delta\bar{\upsilon}$ = 8574.14 $cm^{-1}$. Larger Stoke's shifts are indication of aggregation of molecules by $\pi$-stacking effects [16-17].

## 5. CONCLUSION

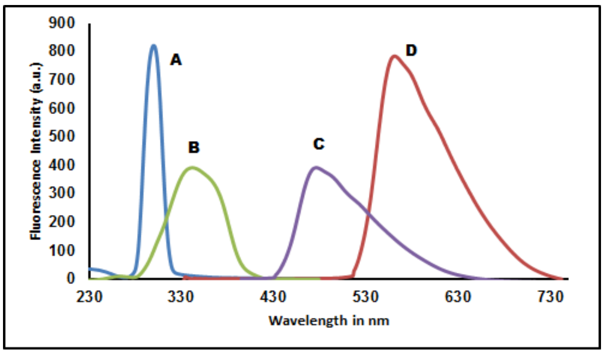



**Fig. 6: Excitation spectra of Nanoparticle suspension (A), dilute solution of Trans-3-(9-Anthryl)-1-phenylprop-2-en-1-one in acetone (B) and Emission Spectra of Nanoparticles suspension (D), dilute solution of trans-3-(9-Anthryl)-1-phenylprop-2-en-1-one in acetone (C).**

Functionalized fluorescent organic molecule designed and prepared for nanoparticles are highly fluorescent and the surface modified nanoparticles found useful for sensing of metal ion.

## REFERENCES

[1] L. Wang, T.T. Xia, G.R. Bian, Spectrochim.Acta Part A: Mol. Biomol. Spectrosc. 62 (2005) 565–569;

[2] H.B. Li, J. Xu, H. Yan, J. Sens. Actuators B 139 (2009) 483–487.

[3] L.Y. Wang, L. Dong, L. Wang, Anal. Lett. 37 (2004) 1811–1822

[4] H. AlQahtani, M. Sugden, D. Puzzovio, L. Hague, M. Grell, Sensors and Actuators B, 160 (2011) 399-404.

[5] J. Sapunar-Postruznik, D. Bazulic, H. Kubala, L. Balint, Sci. Total. Environ., 177 (1996) 31.

[6] P. G. Mahajan, N. K.Desai, D. K. Dalavi, D. P. Bhopate, G. B. Kolekar, S. R. Patil; J Fluoresc, DOI 10.1007/s10895-014-1451-7

[7] H. Kasai, H. Kamatani, S. Okada, H. Oikawa, H. Matsuda, H. Nakaninishi, Jpn. J. Appl. Phys., 34 (1996) 221

[8] K. Kaur, V. Bhardwaj, N. Kaur, N. Singh; Inorg. Chem.. comm., 18 (2012) 79-82

[9] U. Patel, S. Gandhi, V. Barot, M. Patel; Crystal Structure Theory and Applications; 2 (2013) 167-175.

[10] J. Ballesteros; M. Sanz,, A. Ubeda,, M. Miranda, S. Iborra,, M. Paya, M. Alcaraz; Med. Chem. 38, (1995) 2794.

[11] U. Liu, P. Wilairat, S. Croft, A. Tan, M. Go, Bioorg. Med. Chem. 11, (2003) 2729.

[12] P. Sivakumar, S. Geetha Babu, D. Mukesh, Chem. Pharm. Bull. 55, (2007) 44.

[13] N. Tiwari, B. Dwivedi, K. Nizamuddin,, Y. Nakanshi, K. Lee, Bioorg. Med. Chem. 10, (2000) 699.

[14] S. Ducki, R. Forrest, J. Hadfield, A. Kendall, N. Lawrence, A. Mc-Gown, D. Rennison, Bioorg. Med. Chem. 8, (1998) 1051.

[15] A. Chodhary, V. Juyal; Int J Pharm Pharm Sci, 3 (2011) 125-128

[16] D. K. Dalavi, D. P. Bhopate, A. S. Bagawan, A. H. Gore, N. K. Desai, A. A. Kamble, P. G. Mahajan, G. B. Kolekar and S. R. Patil; Anal. Methods,2014,6, 6948

[17] D. P. Bhopate, P. G. Mahajan, K. M. Garadkar, G. B. Kolekar and S. R. Patil; RSC Adv.,2014,4, 63866