HYDROXYPROPYL β -CYCLODEXTRIN INCLUSION COMPLEX OF CURCUMIN USING FLUORESCENCE LIFETIME MEASUREMENT.

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Abstract:

Although safe in most cases, ancient treatments are ignored neither their active components nor their molecular targets are well defined. This is not the case, however, with curcumin, a yellow pigment substance and component of turmeric. Curcumin, an ancient Indian herb used in curry powder has been extensively studied in modern medicine for the treatment of various medical conditions. In this paper, the formation of inclusion complex of hydroxyl β cyclodextrin with curcumin has been studied using fluorescence life time and SEM analysis.

Keywords: Fluorescence life time, curcumin, HβCD, SEM.

1. Introduction

Curcumin, is found to be an active component of turmeric, which is a yellow pigment that has been isolated from the ground rhizome part of the curcuma plant species, zingiberaceae and is of immense importance. It has mustardy smell and a slightly bitter taste [1,2]. Curcumin has several biological effects, exhibiting anti-inflammatory [3-6], antioxidant [7-10] and hypolipderic activities [11-13]. Curcumin shows its significance in lowering the rate of colorectal cancer [14].

The enhanced effect of HβCD in curcumin has been discussed in this paper using fluorescence life time measurement and SEM analysis.

2. Materials and Methods

2.1 Methods

2.1.1 Fluorescence lifetime measurements

Fluorescence lifetime measurements were carried out in a **Hariba – Jobin Yvon [spex-sf 13-11] spectrofluorimeter**. The interchangeable nano LED (280 nm) was used as excitation source. The fluorescence decay of GA was measured with a monochromator – Photo multiplier setup. The data points were fitted by mono exponential decay functions. The data analysis was carried out by the software.

2.1.2. SEM analysis

Joel Sem Model, Jsm – 5610 Lv Scanning Electron Microscope was used to record the SEM photographs of Curcumin with different concentrations of Hβ-Cyclodextrin.

2.2 Reagents

Curcumin and Hβ-cyclodextrin were purchased from Sigma-Aldrich Company (Bangalore). The double distilled water was used to prepare the solutions.

3. Results and Discussion

3.1 Fluorescence Lifetime measurements

Initial literature reports on the fluorescence of curcumin in turmeric were mainly aimed at assaying curcumin in turmeric, food items or for detecting trace elements like boron in soils [15]. Tonnesen and Karlsen [16] first reported systematic fluorescence studies of curcumin. Much later, detailed investigations on the excited state properties of curcumin in different organic solvents have been reported [17-21].

Unlike the steady state fluorescence measurements, there are not many reports on the fluorescence lifetimes of curcumin. The competing non-radiative processes shortened the fluorescence lifetimes considerably. The fluorescence decay profiles, obtained from time correlated single photon counting (TCSPC) studies, in most of the organic solvents showed multi-exponential f is and the fluorescence lifetime values as well as their relative amplitudes varied significantly with the nature of the solvent [21,22]. Fig. 1 shows the decay curve of curcumin without and with different concentrations of β cyclodextrin.

Table1 comprises the lifetime data and the calculated average lifetime values. Relative amplitude values have also been given in Table 1.

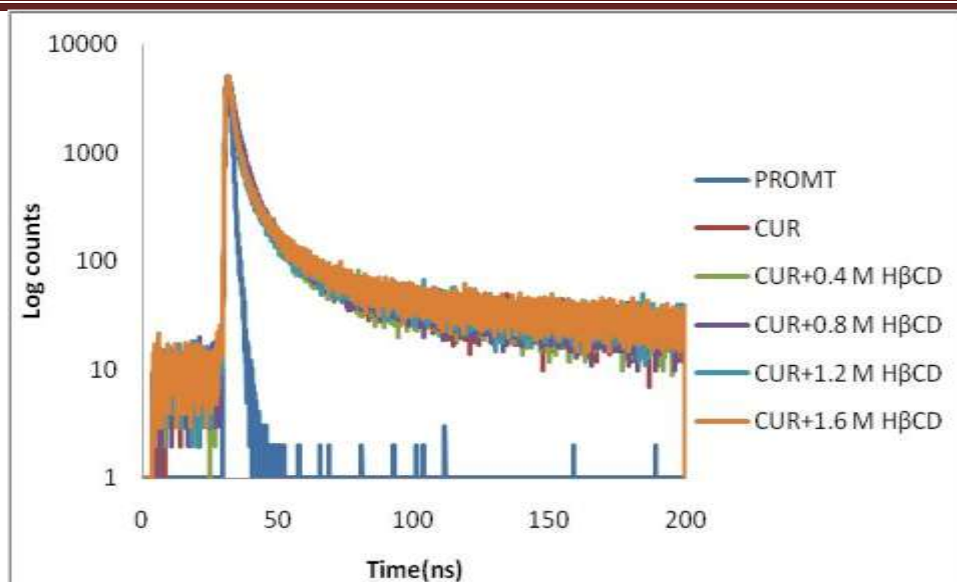

Fig.1.Decay curves of Gallic acid in different of concentrations of Hβ-Cyclodextrin

Table.1 Fluorescence life time and amplitudes of Curcumin without and with different concentration HβCD

Concentration of βCD (M)	*Lifetime (ns)*		*Average life time x 10^{-9} sec*	*Relative amplitude*		χ^2	*S.D 10^{-11} sec*	
	τ_1	τ_2		B_1	B_2		τ_1	τ_2
0	1.33	7.35	3.40	64.94	35.06	1.47	0.99	6.07
0.4	1.38	7.83	3.65	64.78	35.22	1.47	0.97	6.35
0.8	1.75	10.01	3.97	73.70	26.30	1.40	0.98	9.66
1.2	1.07	7.03	3.24	63.51	36.49	1.57	0.88	6.26
1.6	1.32	8.25	3.73	65.10	34.90	1.54	0.90	7.45

3.2 SEM analysis

Scanning electron microscopy is used to study the microscopic aspects of the raw material (β cyclodextrin, curcumin) and the product obtained by co-precipitation / evaporation [23-26]. The difference in crystallization state of the raw material and the product seen under electron microscope indicates the formation of the inclusion complexes [27-29], even if there is a clear difference in crystallization state of the raw material and the product obtained by co-precipitation. This method is inadequate to affirm inclusion complex formation [30-33].

SEM images of pure curcumin, pure Hβ cyclodextrin and the complex of (curcumin + Hβ cyclodextrin) are shown in Figs 2, 3 & 4 respectively.

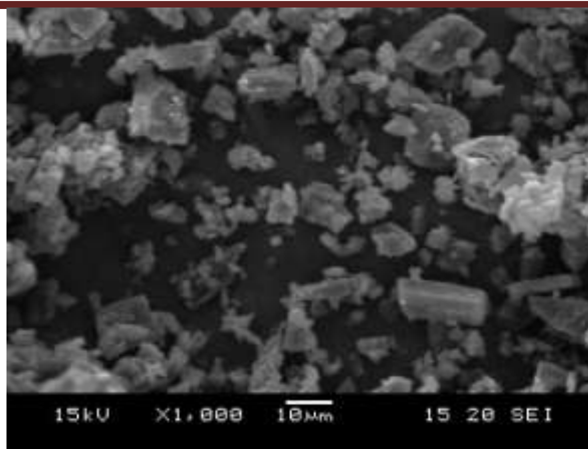

Fig.2.SEM image of Curcumin

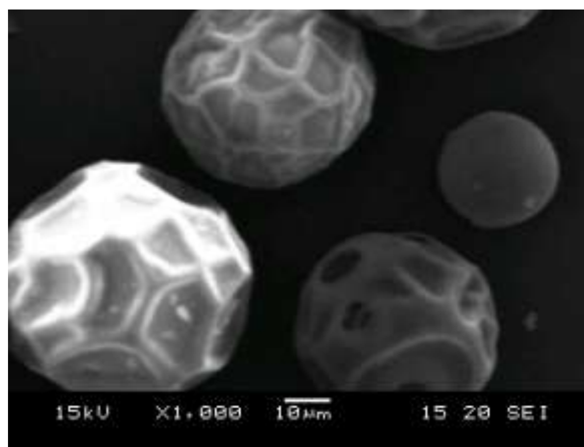

Fig.3.SEM image of Hβ-Cyclodextrin

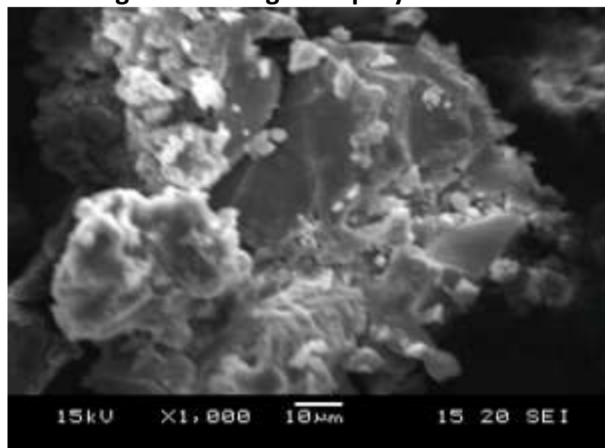

Fig.4.SEM image of Curcumin- Hβ Cyclodextrin complex

4. Conclusion

The fluorimetric method developed and validated proved to be specific, linear, accurate, precise and sensitive. The inclusion complex formed was proved by fluorescence life time spectral data and SEM analysis.

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