



Preparation and characterization of polymeric micelles (SNEDDS) containing curcumin

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Abstract

The polymeric micelles (SNEDDS) containing curcumin (C_{Q10}) were prepared by solvent evaporation method. The micelles were characterized by UV–vis, FT-IR, ATR, and DSC. The micelles were found to be spherical in shape and the size of the micelles was in the range of 100–200 nm. The micelles were found to be stable in water and the stability was studied by UV–vis and DSC. The micelles were found to be stable in water and the stability was studied by UV–vis and DSC. The micelles were found to be stable in water and the stability was studied by UV–vis and DSC.

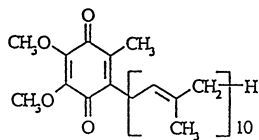
Keywords: C_{Q10}; E_{Q10}; S_{Q10}; SNEDDS; T_{Q10}; B_{Q10}

1. Introduction

Curcumin (C_{Q10}) (Fig. 1), a natural polyphenolic compound, has been found to have a wide range of biological activities. It is a powerful antioxidant and has been shown to have anti-inflammatory, anti-cancer, and anti-aging properties.

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D (G. . . ., 1992).



2.2. Methods

2.2.1. Differential scanning calorimetry (DSC) of CoQ₁₀-menthol and CoQ₁₀-essential oil binary systems.

C Q₁₀ L- 90:10 10:90 (/). A
 5
 (DSC 7, P E
 N (CT). T
 25 60 C
 10 C -1. S
 C Q₁₀ 80:20
 20:80 (/) 37 C.
 R 4 C 24
 C Q₁₀. T
 10
 DSC
 DSC. F C Q₁₀
 80:20 60 40 (/),
 25 55 C.
 S
 10 C -1. L
 10 C -1. L
 (I 2, P E).

2.2.2. Determination of CoQ₁₀ melting time

C Q₁₀
 50 60% /
 M (I R -G, T 37 C
 T, C). C EL
 20, 40 60% /
 (M, G I, M, WI)
 V.
 A 24
 37 C. S

2.2.3. Formulation of the self-emulsified systems

A
 (37.5 60%), EL (0 62.5%),
 MCM-C8 (0 62.5%). T
 C Q₁₀ 50:50. C Q₁₀
 37 C. C EL MCM-C8
 W
 C Q₁₀
 30 4 HPMC
 F

2.2.4. Visual observations

T
 (50) 37 C
 100 E
 25 C
 T
 J
 J (C, 1995; K
 2001). P
 A

2.2.5. Emulsion droplet size analysis and turbidity measurements

F (50) 37 C
 37 C, 100
 E
 T

2.2.5.1. Droplet size analysis. T

C
 (M LS230, M, FL),
 0.04 2000 μ . T
 S

6 (U(286. (6 .U(286.P)087..)-7()-286.)-286.9 7) T0 -1.2 0 TD

(New England
E600 P, New England
CCD (H... HV-C20, H...
A... L... S... D... CA). T...
T...
(C...
MP4R, I... E... C...
N... H... MA) 0.5–1... 3000
(RCF... 500 × g). U...
16 MΩ... H... 4... T...
100 μ... 1... 5...
B...

2.2.

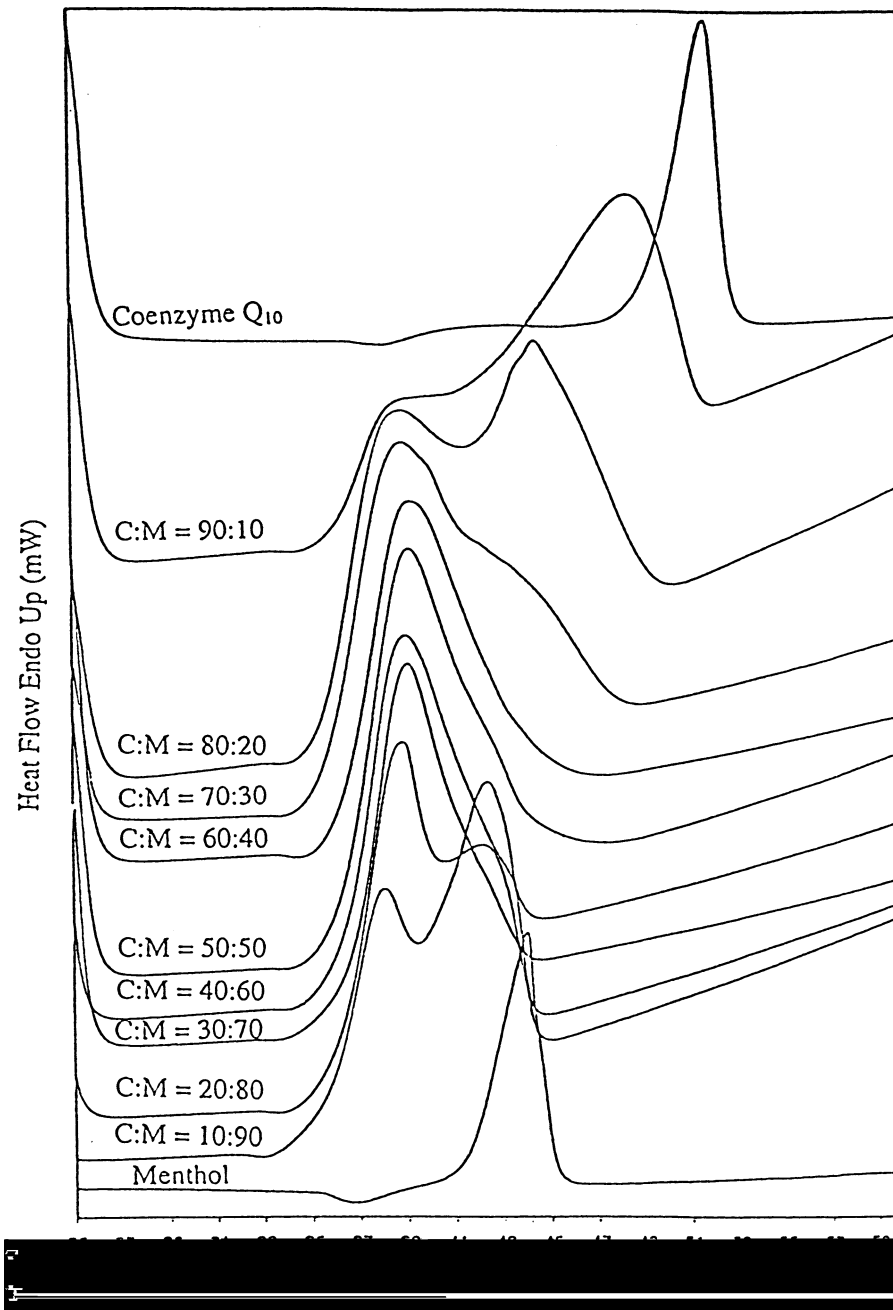


Fig. 2. DSC thermograms of Coenzyme Q₁₀ and Menthol mixtures. R = 10°C/min.

P450 (B, 1998). A

E

C Q₁₀

37 C.

T 1 F
D
C Q₁₀ (K
EL
, 2001)
C Q₁₀
T
C Q₁₀
EL 37 C W 60%
EL
50 60% / C Q₁₀
5.3 1.8 P
C Q₁₀ EL
T
A
50% / C Q₁₀
5
I
C Q₁₀

54



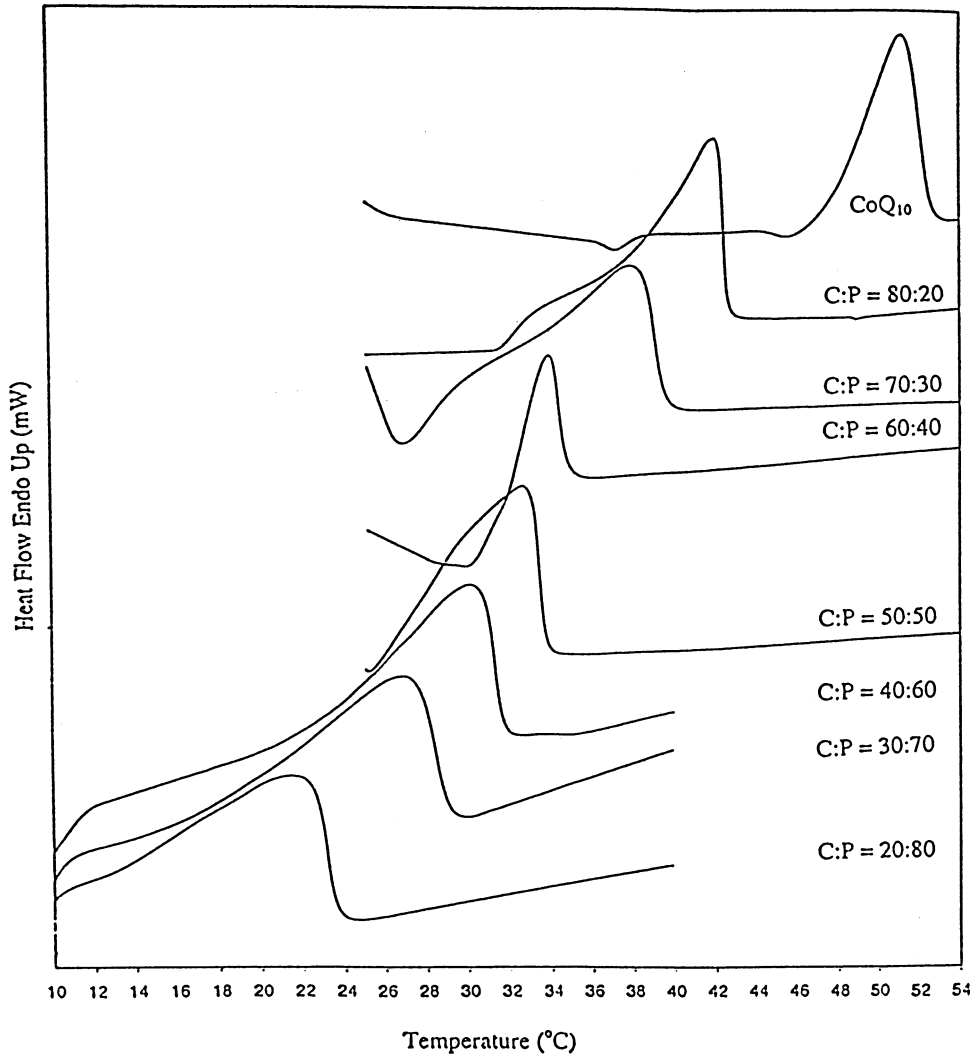


Fig. 4. DSC

CoQ₁₀

R

W
T
37.5%
T
1,
C Q₁₀ 63%
(R, 1975).
F
(C, S, 1997). C

3.4. Droplet size analysis and turbidity measurements

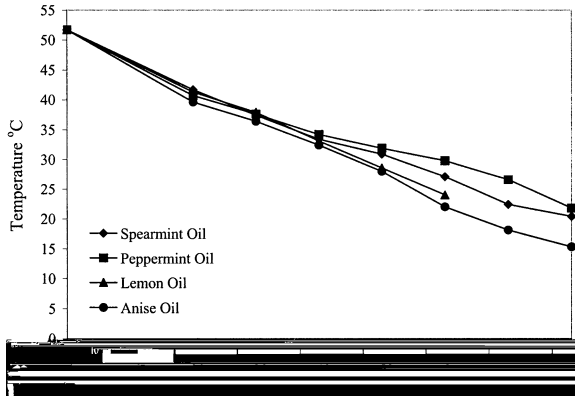


Fig. 5. Thermogram of the essential oils (DSC, Q10).

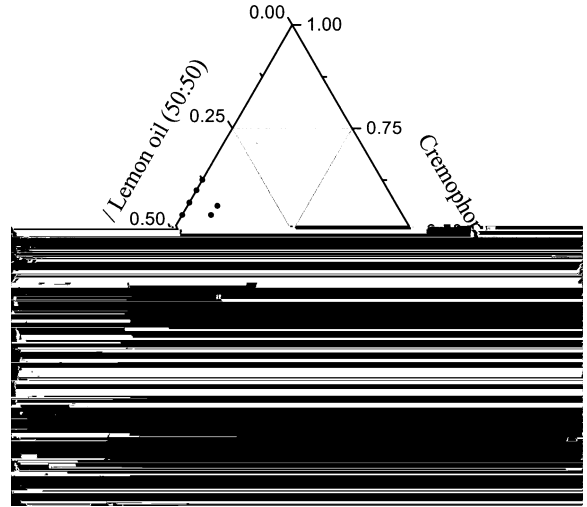


Fig. 6. Phase diagram of the essential oils and Cremophor.

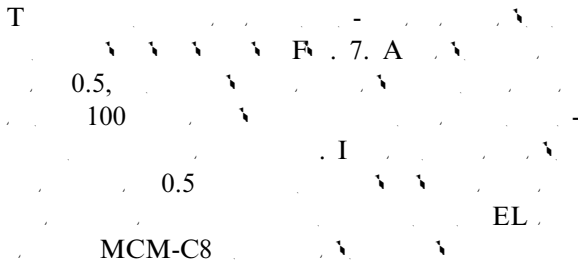


Fig. 7. A

(1998).
 G. (1998)
 -355, EL,
 2:1. I
 (C
 S., 1997; G., 1998). C
 .6()-3 .6()4763.1()-.8() T6S

T.E.F.	2	SNEDDS		C (%) /		C		M.		S.		SNEDDS		D (μ)		D(0.9)
		C	Q10	L	W	C	C	M	S	D(0.1)	D(0.25)	D(0.5)	D(0.75)			
1	18.8	18.8	18.8	56.3	6.3	2.817	0.270	3.179	3.014	2.806	2.619	2.468				
2	18.8	18.8	18.8	50.0	12.5	0.402	0.277	0.845	0.572	0.323	0.117	0.110				
3	18.8	18.8	18.8	43.8	18.8	0.121	0.015	0.142	0.130	0.119	0.100	0.101				
4	18.8	18.8	18.8	37.5	25.0	0.112	0.037	0.165	0.135	0.106	0.084	0.070				
5	18.8	18.8	18.8	31.3	31.3	0.090	0.012	0.107	0.099	0.089	0.081	0.045				
6	18.8	18.8	18.8	25.0	37.5	0.113	0.017	0.137	0.125	0.112	0.100	0.092				
7	18.8	18.8	18.8	18.8	43.8	<0.040										
8	20.0	20.0	20.0	53.3	6.7	0.845	0.308	1.287	1.027	0.786	0.607	0.499				
9	20.0	20.0	20.0	46.7	13.3	0.725	0.213	1.031	0.862	0.693	0.558	0.472				
10	20.0	20.0	20.0	40.0	20.0	0.121	0.048	0.170	0.141	0.110	0.083	0.067				
11	20.0	20.0	20.0	33.3	26.7	0.089	0.026	0.107	0.098	0.089	0.081	0.074				
12	20.0	20.0	20.0	26.7	33.3											
13																

0.06781735 0 TD20.037.5 0.02.995 0 TD20.0

0.10158.8(3.179)-30002.8(0.862)-3292.4(0.119)-3101.3(0.084) T10-5.024 0 TD 7130.1125

(G... M... 1974).
 $\tau = Kmw^2$
 K... v... (G...
 M... 1974; P... 1985).
 T... NTU... F... 7. A...
 P... (1985)
 H... NTU
 T...

0... 1 NTU (H... A... 1998).

3.5. Fourier transform-infrared spectroscopy (FT-IR)

T... ATR... FT-IR... (H... 1999). C Q₁₀... FT-IR...
 A... C Q₁₀... T...
 (29) F... 8. C Q₁₀... T...
 50:50 C Q₁₀...
 F... 8, C Q₁₀...
 C Q₁₀... L... C Q₁₀...

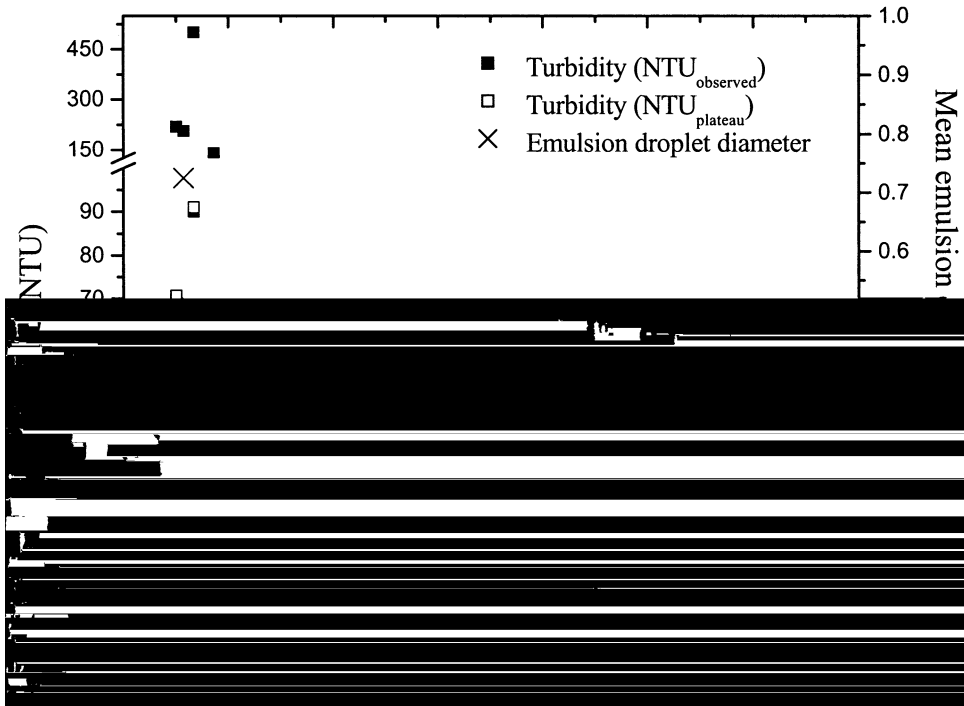


Fig. 7. E... (EL) ... (MCM-C8) ... NTU ... NTU ...

T	3								C Q10	15
E	SNEDDS									
F	SNEDDS	(% /)	SNEDDS			C Q10			(15	
	C Q10	L	C	C	NTU	NTU	NTU	P	STD	
1	18.8	18.8	56.3	6.3	605.5					
2	18.8	18.8	50.0	12.5	220.0	78.2	70.7	94.0	2.18	
3	18.8	18.8	43.8	18.8	25.1	8.9	19.5	90.3	7.87	
4	18.8	18.8	37.5	25.0	9.0	3.2	6.0	92.8	2.52	
5	18.8	18.8	31.3	31.3	6.9	2.5	4.8	88.8	2.52	
6	18.8	18.8	25.0	37.5	5.3	1.9	4.1	88.0	2.84	
7	18.8	18.8	18.8	43.8	2.4	0.8	3.1	87.4	4.42	
8	20.0	20.0	53.3	6.7	513.0					
9	20.0	20.0	46.7	13.3	207.0	69.0	51.7	85.0	1.14	
10	20.0	20.0	40.0	20.0	32.7	10.9	13.8	87.3	1.14	
11	20.0	20.0	33.3	26.7	12.0	4.0	5.7	91.0	5.35	
12	20.0	20.0	26.7	33.3	7.0	2.3	3.5	96.3	1.28	
13	20.0	20.0	20.0	40.0	4.5	1.5	3.0	99.5	0.64	
14	21.4	21.4	50.0	7.1	510.5					
15	21.4	21.4	42.9	14.3	90.1	28.0	52.0	89.8	3.98	
16	21.4	21.4	35.7	21.4	20.1	6.2	10.3	94.7	0.05	
17	21.4	21.4	28.6	28.6	10.6	3.3	4.1	94.7	1.12	
18		21.4	21.4	35.7	5.9	1.8	2.7			

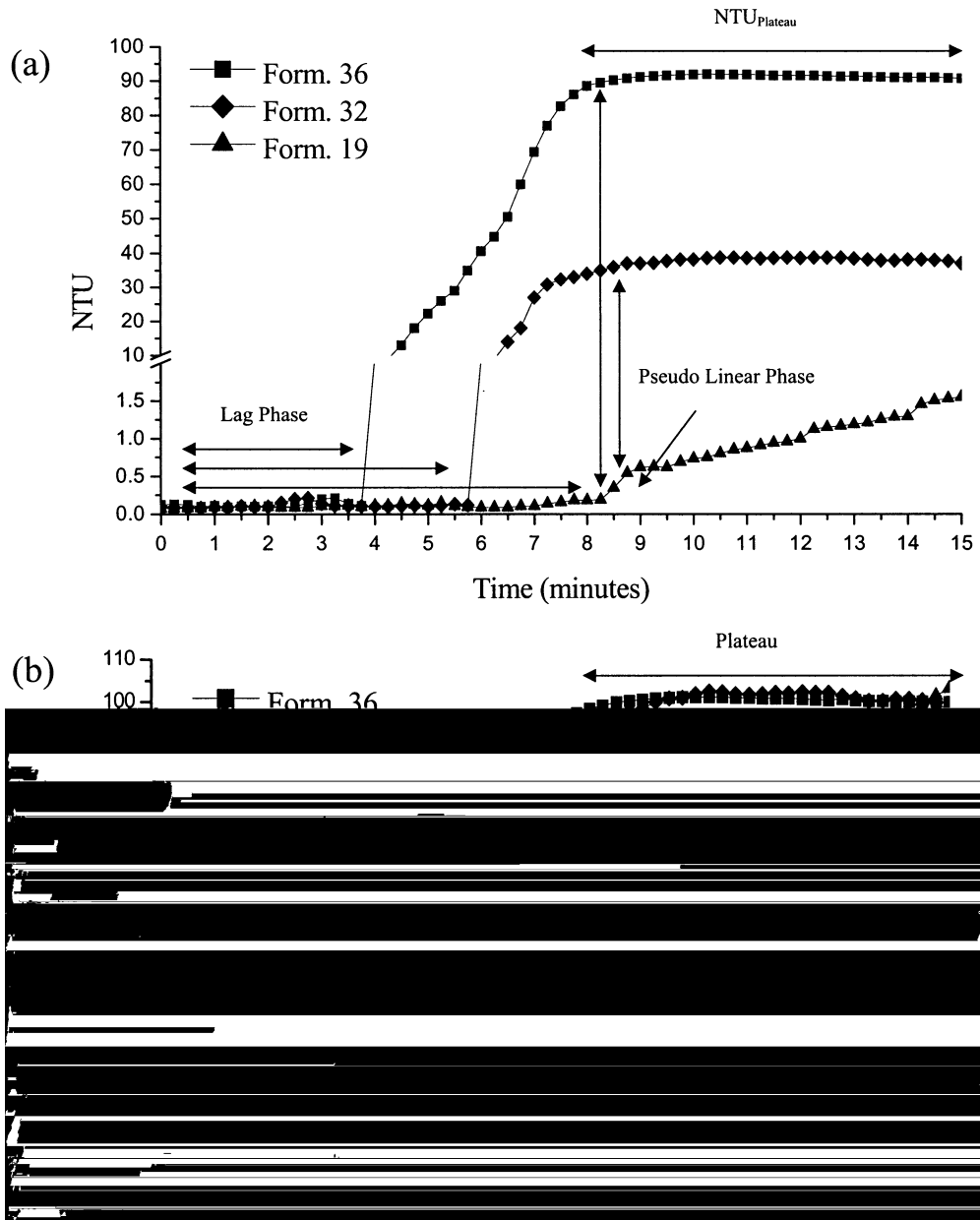
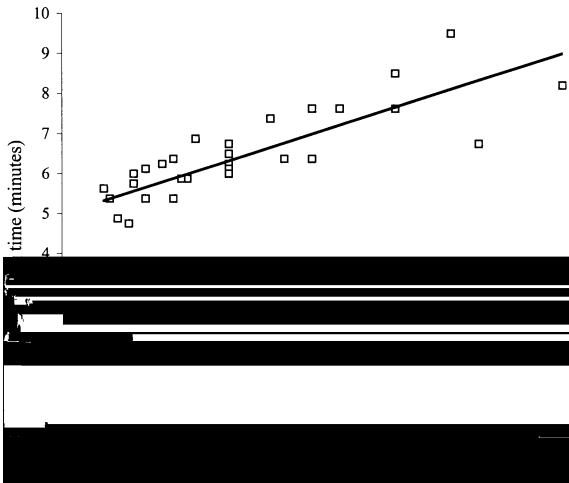


Fig. 9. (a) T₉₀ vs Time.

A 1:1:3
 F . 11
 (K , 1983). F . 11
 (B , 1991). F . 11
 T
 P
 (K L , 1983). H
 (G G , 1976).



F . 10. E (EL)

NTU
 NTU 100%
 $t_{NTU} \times 100/$
 C Q₁₀ (F . 9).
 t. G
 F . 9 ,
 T
 (E) T
 F . 12
 M
 1 HLB 42.6%. T B
 (1997) HLB
 H
 (S , 1994). A
 1996). T (H

4. Conclusion

T
 SNEDDS. P SNEDDS
 C Q₁₀. R
 HPMC T

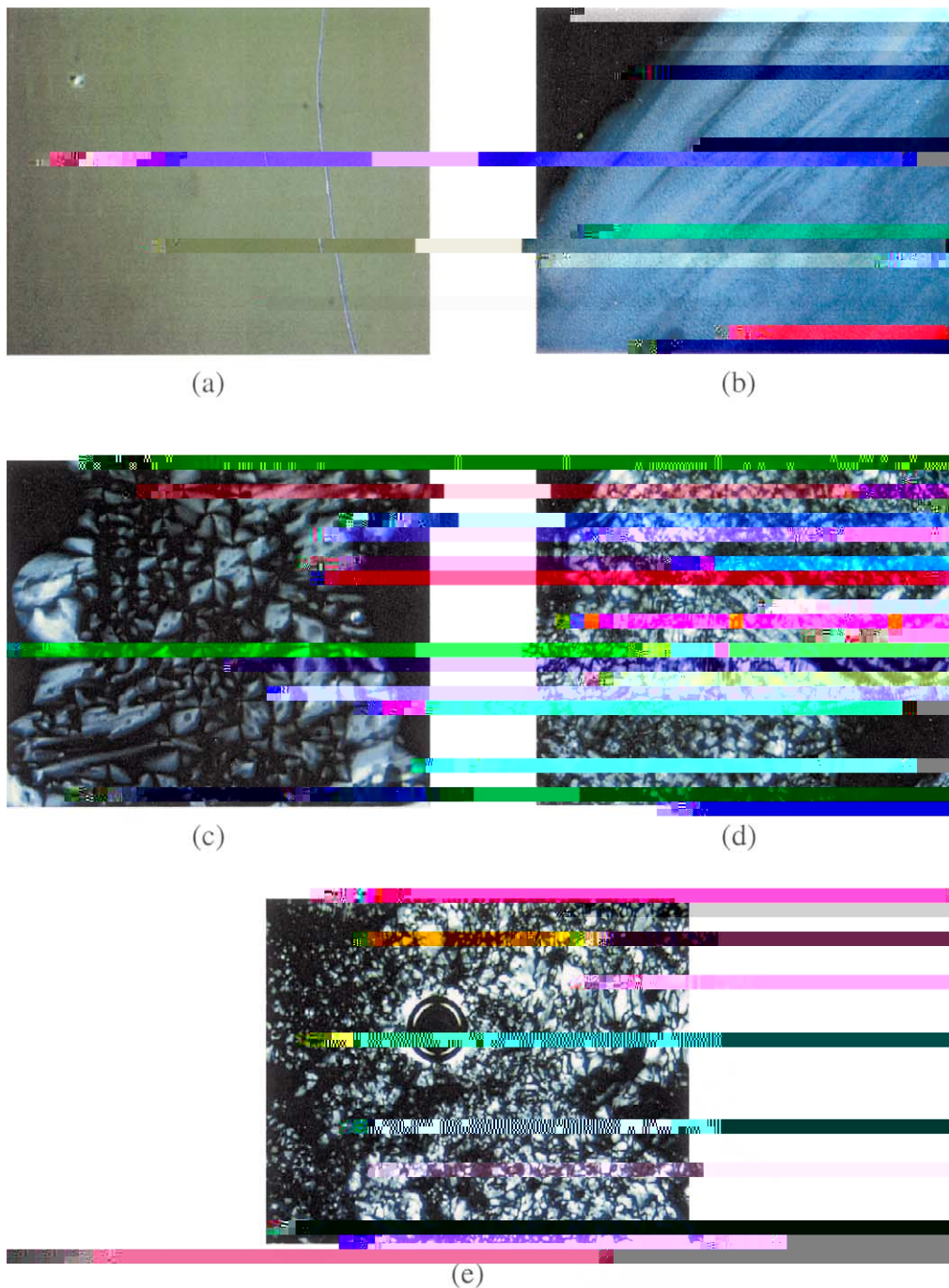


Fig. 11. (a) OVA microspheres prepared by the solvent evaporation method, (b) PAA microspheres prepared by the solvent evaporation method, (c) OVA microspheres prepared by the solvent evaporation method, (d) PAA microspheres prepared by the solvent evaporation method, (e) PAA microspheres prepared by the solvent evaporation method.

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