I J P 235 (2002) 247 265

international journal of pharmaceutics

/ J

P - (SNEDDS) :

S. N , I.I. S , O.D. L , M A. K ,*

Department of Pharmaceutical Sciences, School of Pharmacy, Texas Tech University Health Science Center, 1300 Coulter, Suite 400, Amarillo, TX 79106, USA

Chemical Physics Interdisciplinary Program and Liquid Crystal Institute, Kent State University, Kent, OH 44242, USA

R 29 O 2001; 20 D 2001; 21 D 2001

Abstract

T J , - (SNEDDS) (C Q10); , . B C Q10 - . P - . R . T : , , . L . P . L 100 . E . S F (FT-IR) (ATR) . T - . 2002 E S B.V. A .

Keywords: C Q10; E ; S - ; SNEDDS; T ; B

1. Introduction

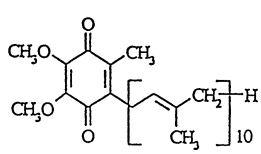
U , C Q10 (C Q10) (F . 1),

* C . T .: +1-806-356-4000 285; : +1-806-356-4034.
E-mail address: @ . . (M.A. K).

0378-5173/02/$ - 2002 E S B.V. A .
PII: S0378-5173(02)00003-0

(G ., 1992).

D



2.2. Methods

2.2.1. Differential scanning calorimetry (DSC) of CoQ_{10}-menthol and CoQ_{10}-essential oil binary systems.

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

2.2.2. Determination of CoQ_{10} melting time

C Q_{10} 50 60% / , , - . M 37 C (I R -G, T S , 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 Q_{10} 50:50. C Q_{10} - 37 C. C EL MCM-C8 - . W , - , - , , C Q_{10} 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 .

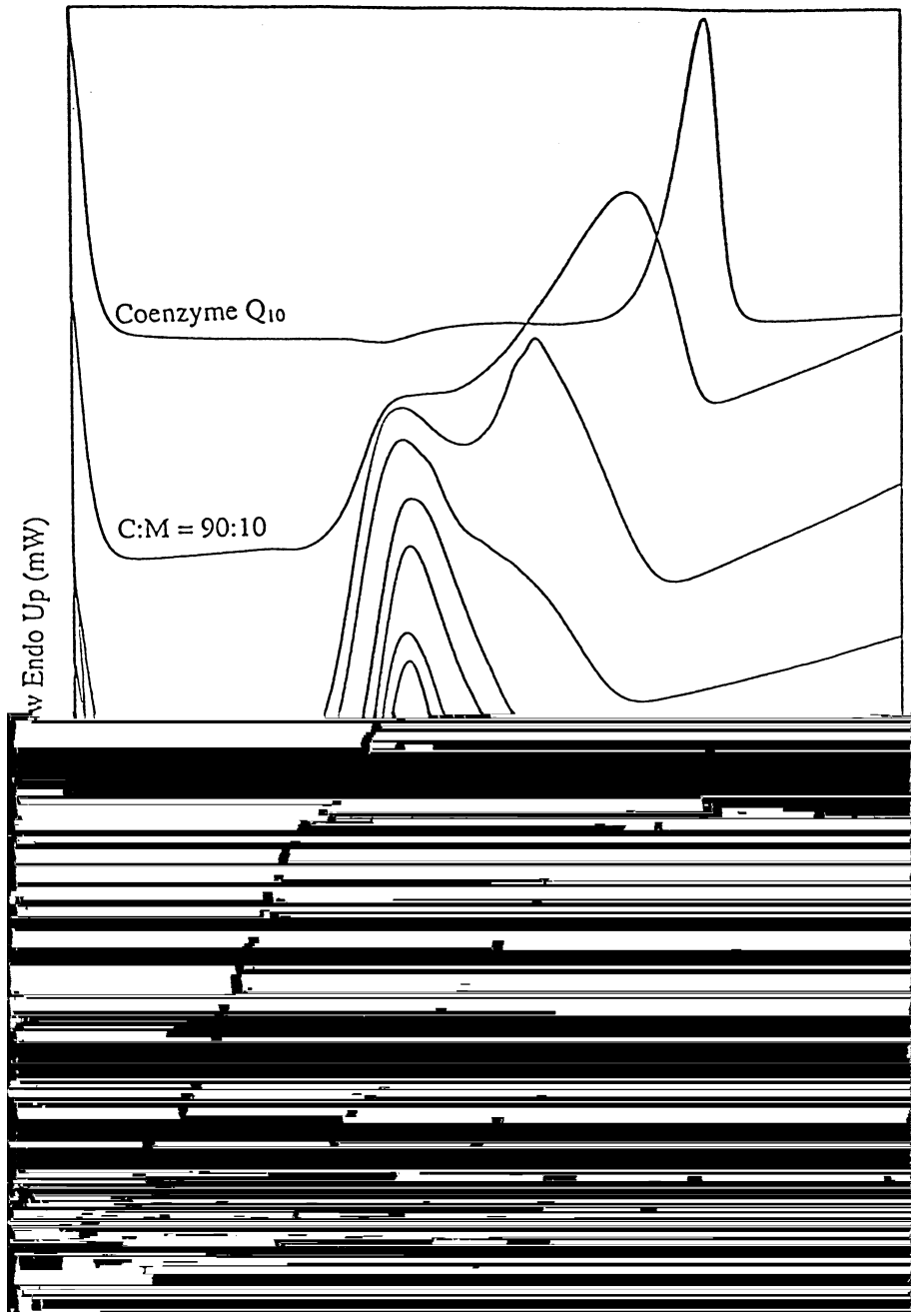
2.2.5.1. Droplet size analysis.

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

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

(N E
E600 P , N I C ., J)
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 .

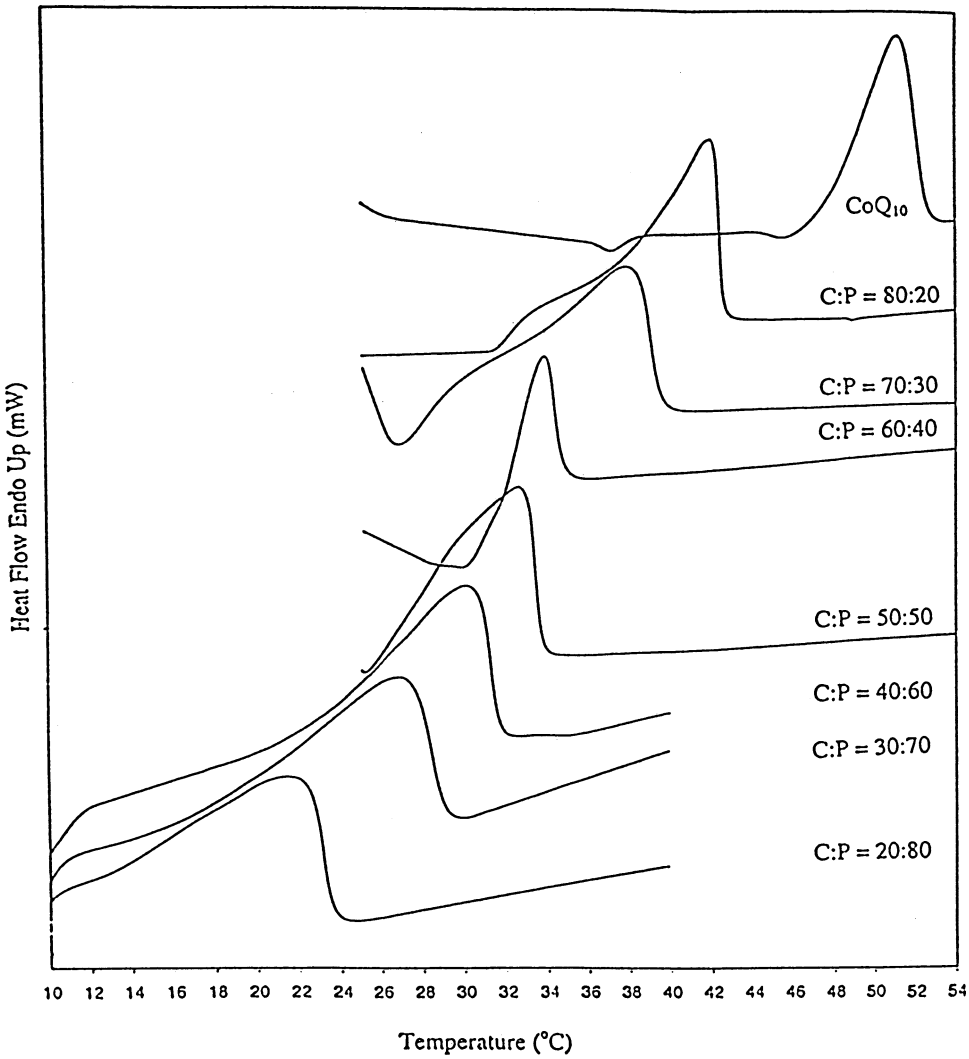
2.2.



F . 2. DSC C Q_{10}, L- , . R .

P450 (B ., 1998). A - C Q_{10} 37 C. E , , , C Q_{10}

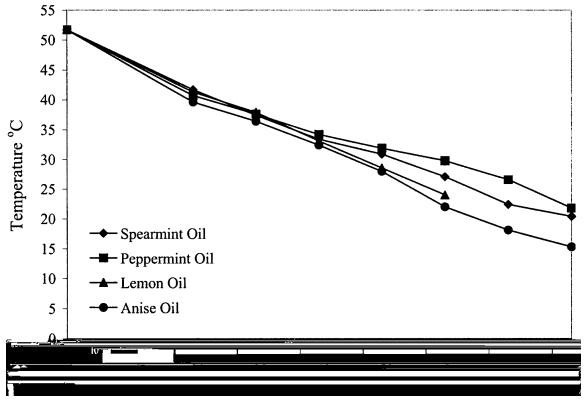
. T 1 . F , , , , , . D C Q_{10} (K - ., 2001) EL C Q_{10} - . T C Q_{10}, EL 37 C . W 60% / EL , 50 60% / C Q_{10} 5.3 1.8 , . P - C Q_{10} EL - , , . T . A 50% / C Q_{10}, 5 . I , C Q_{10}



F . 4. DSC C Q10, , , . R .

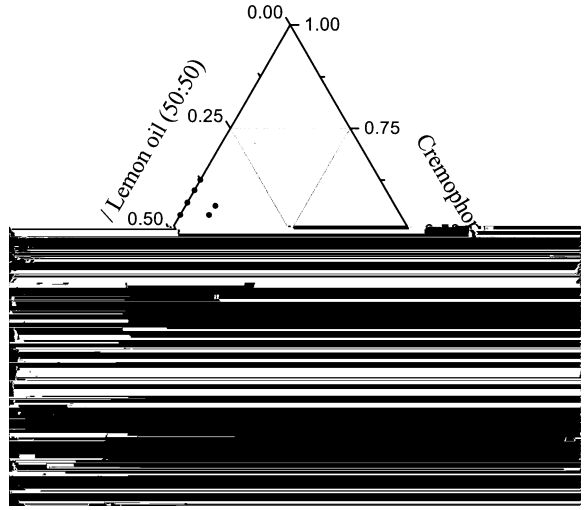
. W - 37.5%
. T - T 1, 63%
- C Q10 .
- (R , 1975).
F , -
(C S , 1997). C

3.4. Droplet size analysis and turbidity measurements



F . 5. T / C Q_{10} DSC.

T - F . 7. A 0.5, 100 - . I 0.5 EL MCM-C8



F . 6. P - (, - - ;).

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

T. 2
E SNEDDS \ \ \ \ \ \ \ \

F \	SNEDDS \ \ (% /)					SNEDDS \ \ (μ)					
	C Q10	L \	C	C	M	S	*D*(0.1)	*D*(0.25)	*D*(0.5)	*D*(0.75)	*D*(0.9)
1	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	50.0	12.5	0.402	0.277	0.845	0.572	0.323	0.117	0.110
3	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	37.5	25.0	0.112	0.037	0.165	0.135	0.106	0.084	0.070
5	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	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	43.8	<0.040						
8	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	46.7	13.3	0.725	0.213	1.031	0.862	0.693	0.558	0.472
10	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	33.3	26.7	0.089	0.026	0.107	0.098	0.089	0.081	0.074
12	20.0	20.0	26.7	33.3							
13						0.025	0.117	0.107	0.099	0.091	

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).
L R
, τ

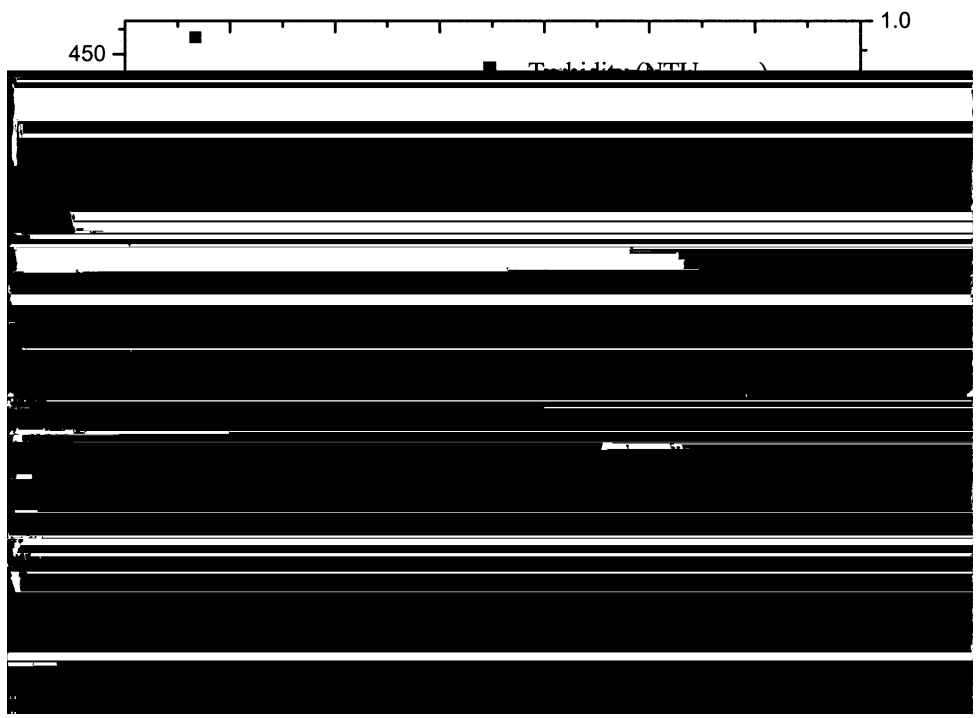
$$\tau = Knv^2$$

K , v
n (G
M , 1974; P , 1985).
T -
NTU
NTU F . 7. A
, . P (1985)
. H , NTU
-
. T

0 1 NTU (H A , 1998).

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

T
J -
ATR FT-IR
(H J , 1999). C Q_{10} -
- -
FT-IR.
A C Q_{10}
F . 8. C Q_{10} -
(29) . T
50:50 C Q_{10} , ,
F . 8,
C Q_{10} . L
C Q_{10} -

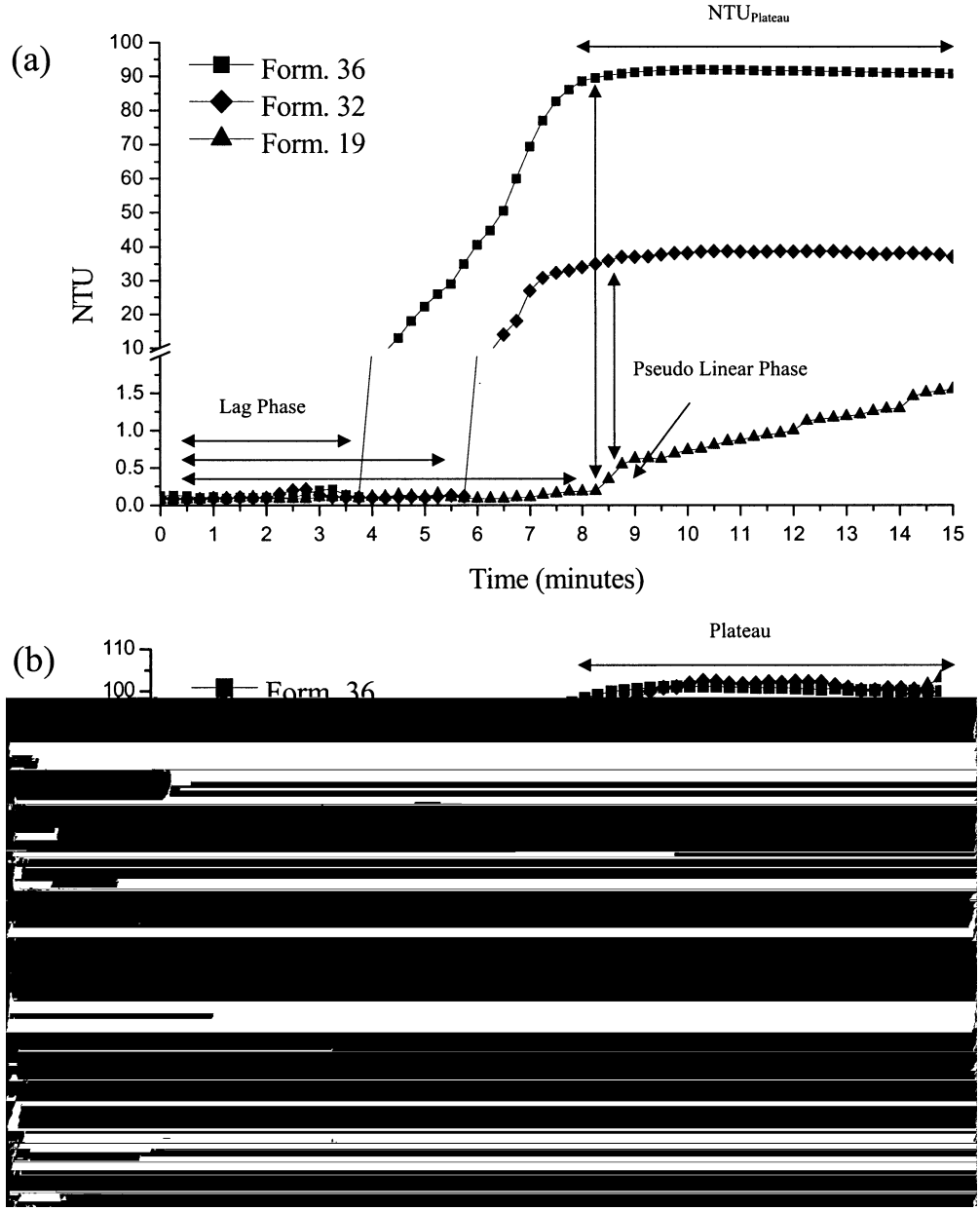


F . 7. E (EL) - (MCM-C8) , NTU NTU .

T 3
E SNEDDS C Q10 15

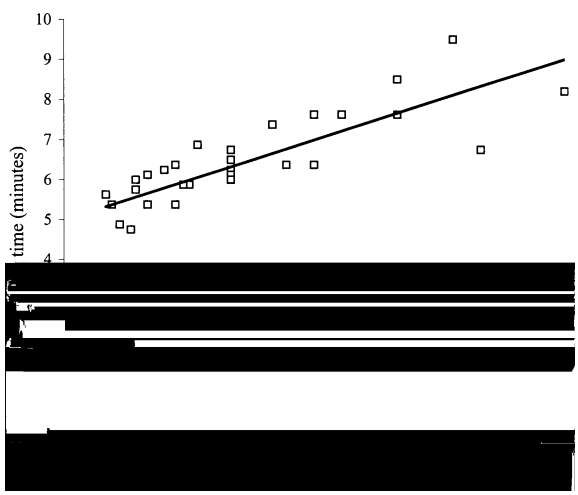
F SNEDDS (% /) SNEDDS C Q10 (15)

	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		


(a)
NTU
Form. 36
Form. 32
Form. 19
NTU Plateau
Lag Phase
Pseudo Linear Phase
Time (minutes)
(b)
Plateau

F . 9. ( ) T

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

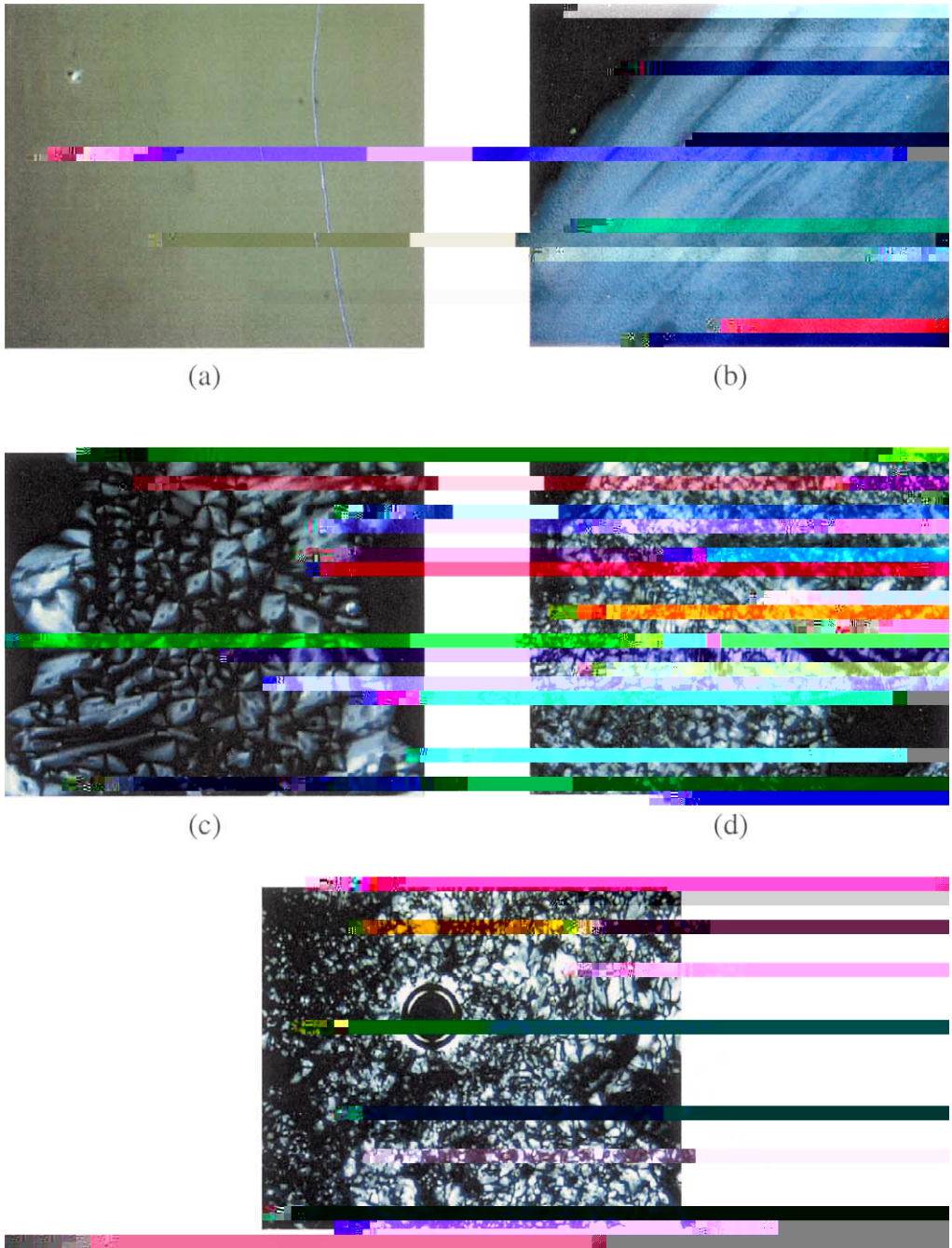


F . 10. E (EL)

$t_{NTU} \times 100/$
NTU ,
NTU 100%
C Q_{10} (F . 9). t_{NTU}
t. G
. A
F . 9 ,
T ,
(*E*) . T
. F . 12
. M
1 42.6%. T
HLB . B
. (1997) HLB
. H ,
(S ., 1994). A
,
(H .,
1996). T ,

4. Conclusion

T
SNEDDS. P SNEDDS
C Q_{10}. R
HPMC . T



F . 11. ( ) O , - ; .
P ( ) : 1:3, ( ) : - : 1:1:3, ( ) 1:1:3, ( ) 1:1:3 .

J , G.H., 1952. O . I : K , H.R. (E .), C S . E , A - , . 90–114.
K , L., J , H.W., M C , J.W., 2000. P . I . J. P . 206, 35–42.
K , M., 1983. P , L W. L C , M S , V. O M . W , C , . 322.
K , T.R., A , M., K , M.A., R , I.K., 1999. S Q10 . C . P . B . 47 (7), 1024–1028.
K , T.R., G , B., K , M.A., R , I.K., 2001. S - (SEDDS) - Q10: . I . J. P . 212, 233–246.
K , M.V., L , O.D., 1983. M C. . E . T . F . 85, 511–526 E : S . P . JETP, 58, 299–307.
L , J., 1995. T I E E O . B & N , . 120.
L , A., P , J., 1995. I Q10 . A P . P . 52 (5), 379–386.
N , S., , A.A., R , I.K., K , M.A., 2001. A (C Q10) . D P . 56 (5), 394–396.
N , S., G , N., R , I.K., K , M.A., 2002. P - Q10 E . D . D . I . P . 2.1(56) TJ G