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APPENDICES

APPENDIX A

Physicochemical Properties of Lipid Emulsions

1. Lipid emulsions containing 10% oil

1.1 Particle size measurement

Table a1. Particle sizes of lipid emulsions formulated using 10% oil with various cycles of homogenization (15,000 psi) by Emulsiflex C-50.

Formulation	Cycle	D[4,3] (μm)					d(0..5) (μm)					Span	Figure
		1	2	3	mean	S.D.	1	2	3	mean	S.D.		
1.2% Lipoid E80	cycle 3	0.492	0.496	0.491	0.493	0.003	0.372	0.375	0.370	0.372	0.003	2.115	a1
(EPC)	cycle 5	0.375	0.373	0.372	0.373	0.002	0.306	0.307	0.307	0.307	0.001	1.412	a2
	cycle 7	0.372	0.371	0.372	0.372	0.001	0.297	0.296	0.297	0.297	0.001	1.410	a3
	cycle 10	0.367	0.367	0.368	0.367	0.001	0.280	0.280	0.280	0.280	0.000	1.366	a4
1.2% Lipoid E80	cycle 3	0.529	0.537	0.529	0.532	0.005	0.386	0.394	0.386	0.389	0.005	2.342	a5
0.03% Na oleate	cycle 5	0.445	0.441	0.444	0.443	0.002	0.338	0.334	0.337	0.336	0.002	2.056	a6
	cycle 7	0.375	0.405	0.390	0.390	0.015	0.297	0.308	0.311	0.305	0.007	1.710	a7
	cycle 10	0.375	0.375	0.376	0.375	0.001	0.287	0.288	0.288	0.288	0.001	1.529	a8
1.2% Lipoid E80	cycle 3	0.211	0.210	0.211	0.211	0.001	0.197	0.197	0.197	0.197	0.000	0.787	a9
0.9% Tween80	cycle 5	0.205	0.205	0.205	0.205	0.000	0.194	0.194	0.194	0.194	0.000	0.752	a10
	cycle 7	0.198	0.199	0.199	0.199	0.001	0.189	0.189	0.189	0.189	0.000	0.717	a11
	cycle 10	0.203	0.202	0.202	0.202	0.001	0.192	0.192	0.192	0.192	0.000	0.738	a12
1.2% Lipoid E80	cycle 3	0.204	0.204	0.204	0.204	0.000	0.193	0.193	0.193	0.193	0.000	0.749	a13
1.2% Vit E-TPGS	cycle 5	0.198	0.198	0.198	0.198	0.000	0.189	0.188	0.189	0.189	0.001	0.718	a14
	cycle 7	0.195	0.195	0.195	0.195	0.000	0.186	0.187	0.186	0.186	0.001	0.700	a15
	cycle 10	0.195	0.195	0.195	0.195	0.000	0.187	0.187	0.186	0.187	0.001	0.701	a16

Table a2. Particle sizes of lipid emulsions formulated using 10% oil with various pressures of homogenization (5 cycles) by Emulsiflex C-50.

Formulation	Pressure	D[4,3] (μm)					d(0..5) (μm)					Span	Figure
	(psi)	1	2	3	mean	S.D.	1	2	3	mean	S.D.		
1.2% Lipoid E80	10000	0.707	0.706	0.713	0.709	0.004	0.616	0.615	0.622	0.618	0.004	1.730	a17
	15000	0.375	0.373	0.372	0.373	0.002	0.306	0.307	0.307	0.307	0.001	1.412	a2
	20000	0.446	0.441	0.451	0.446	0.005	0.299	0.294	0.302	0.298	0.004	2.549	a18
1.2% Lipoid E80	10000	0.665	0.667	0.666	0.666	0.001	0.519	0.523	0.52	0.521	0.002	2.181	a19
0.03% Na oleate	15000	0.445	0.441	0.444	0.443	0.002	0.338	0.334	0.337	0.336	0.002	2.056	a6
	20000	0.344	0.342	0.34	0.342	0.002	0.268	0.267	0.267	0.267	0.001	1.310	a20
1.2% Lipoid E80	10000	0.222	0.223	0.221	0.222	0.001	0.204	0.205	0.204	0.204	0.001	0.860	a21
0.9% Tween80	15000	0.205	0.205	0.205	0.205	0.000	0.194	0.194	0.194	0.194	0.000	0.752	a10
	20000	0.201	0.201	0.201	0.201	0.000	0.191	0.191	0.19	0.191	0.001	0.730	a22
1.2% Lipoid E80	10000	0.254	0.255	0.253	0.254	0.001	0.211	0.211	0.21	0.211	0.001	1.015	a23
1.2% Vit E-TPGS	15000	0.198	0.198	0.198	0.198	0.000	0.189	0.188	0.189	0.189	0.001	0.718	a14
	20000	0.196	0.196	0.196	0.196	0.000	0.187	0.187	0.187	0.187	0.000	0.705	a24

Table a3. Particle sizes of lipid emulsions formulated using 10% oil with various cycles of homogenization (15,000 psi) by Emulsiflex C-5.

Formulation	Cycle	D[4,3] (μm)					d(0..5) (μm)					Span	Figure
		1	2	3	mean	S.D.	1	2	3	mean	S.D.		
1.2% Lipoid E80	cycle 3	0.700	0.683	0.680	0.688	0.011	0.383	0.382	0.382	0.382	0.001	2.838	a25
	cycle 5	0.462	0.459	0.460	0.460	0.002	0.324	0.323	0.323	0.323	0.001	2.152	a26
	cycle 7	0.709	0.730	0.707	0.715	0.013	0.320	0.322	0.319	0.320	0.002	3.813	a27
	cycle 10	0.517	0.518	0.518	0.518	0.001	0.309	0.311	0.311	0.310	0.001	3.492	a28
1.2% Lipoid E80	cycle 3	0.465	0.468	0.465	0.466	0.002	0.328	0.332	0.329	0.330	0.002	2.405	a29
0.03% Na oleate	cycle 5	0.428	0.433	0.439	0.433	0.006	0.306	0.308	0.314	0.309	0.004	2.106	a30
	cycle 7	0.424	0.422	0.417	0.421	0.004	0.298	0.299	0.296	0.298	0.002	1.919	a31
	cycle 10	0.531	0.535	0.533	0.533	0.002	0.313	0.315	0.314	0.314	0.001	3.581	a32
1.2% Lipoid E80	cycle 3	0.229	0.230	0.230	0.230	0.001	0.209	0.209	0.209	0.209	0.000	0.917	a33
0.9% Tween80	cycle 5	0.217	0.217	0.216	0.217	0.001	0.201	0.201	0.201	0.201	0.000	0.818	a34
	cycle 7	0.210	0.211	0.211	0.211	0.001	0.197	0.198	0.198	0.198	0.001	0.783	a35
	cycle 10	0.214	0.213	0.214	0.214	0.001	0.200	0.199	0.200	0.200	0.001	0.800	a36
1.2% Lipoid E80	cycle 3	0.227	0.227	0.227	0.227	0.000	0.208	0.207	0.207	0.207	0.001	0.895	a37
1.2% Vit E-TPGS	cycle 5	0.215	0.215	0.215	0.215	0.000	0.200	0.201	0.201	0.201	0.001	0.811	a38
	cycle 7	0.210	0.210	0.209	0.210	0.001	0.197	0.197	0.196	0.197	0.001	0.780	a39
	cycle 10	0.214	0.214	0.214	0.214	0.000	0.200	0.200	0.200	0.200	0.000	0.803	a40

Table a4. Particle sizes of lipid emulsions formulated using 10% oil with various pressures of homogenization (5 cycles) by Emulsiflex C-5.

Formulation	Pressure	D[4,3] (μm)					d(0..5) (μm)					Span	Figure
	(psi)	1	2	3	mean	S.D.	1	2	3	mean	S.D.		
1.2% Lipoid E80	10000	1.236	1.076	1.119	1.144	0.083	0.728	0.663	0.668	0.686	0.036	2.656	a41
	15000	0.462	0.459	0.46	0.460	0.002	0.324	0.323	0.323	0.323	0.001	2.152	a26
	20000	0.509	0.517	0.516	0.514	0.004	0.33	0.335	0.335	0.333	0.003	2.912	a42
1.2% Lipoid E80	10000	0.791	0.802	0.778	0.790	0.012	0.452	0.45	0.453	0.452	0.002	2.905	a43
0.03% Na oleate	15000	0.428	0.433	0.439	0.433	0.006	0.306	0.308	0.314	0.309	0.004	2.106	a30
	20000	0.397	0.397	0.399	0.398	0.001	0.278	0.278	0.279	0.278	0.001	1.608	a44
1.2% Lipoid E80	10000	0.323	0.318	0.318	0.320	0.003	0.235	0.234	0.234	0.234	0.001	1.329	a45
0.9% Tween80	15000	0.217	0.217	0.216	0.217	0.001	0.201	0.201	0.201	0.201	0.000	0.818	a34
	20000	0.206	0.206	0.206	0.206	0.000	0.195	0.195	0.195	0.195	0.000	0.757	a46
1.2% Lipoid E80	10000	0.317	0.316	0.316	0.316	0.001	0.235	0.234	0.234	0.234	0.001	1.325	a47
1.2% Vit E-TPGS	15000	0.215	0.215	0.215	0.215	0.000	0.2	0.201	0.201	0.201	0.001	0.811	a38
	20000	0.205	0.205	0.205	0.205	0.000	0.194	0.193	0.193	0.193	0.001	0.749	a48

Table a5. Particle sizes of lipid emulsions formulated using 10% oil with various surfactants after storage at 25°C.

Formulation	Time	D[4,3] (μm)					d(0.5) (μm)					Span	Figure
		1	2	3	mean	S.D.	1	2	3	mean	S.D.		
1.2% Lipoid E80	a0	0.355	0.360	0.357	0.357	0.003	0.285	0.287	0.285	0.286	0.001	1.400	a49
(Rx1)	a1	0.459	0.430	0.428	0.439	0.017	0.291	0.289	0.290	0.290	0.001	1.680	
	b0	0.394	0.388	0.383	0.388	0.006	0.330	0.321	0.319	0.323	0.006	1.407	a50
	b1	0.384	0.381	0.382	0.382	0.002	0.280	0.275	0.274	0.276	0.003	1.412	
1.5% Lipoid E80	a0	0.330	0.330	0.330	0.330	0.000	0.276	0.276	0.276	0.276	0.000	1.274	a51
(Rx2)	a1	0.343	0.340	0.339	0.341	0.002	0.303	0.300	0.299	0.301	0.002	1.322	
	b0	0.399	0.400	0.400	0.400	0.001	0.344	0.345	0.345	0.345	0.001	1.390	a52
	b1	0.398	0.399	0.399	0.399	0.001	0.319	0.317	0.318	0.318	0.001	1.400	
2.0% Lipoid E80	a0	0.375	0.370	0.371	0.372	0.003	0.299	0.298	0.299	0.299	0.001	1.527	a53
(Rx3)	a1	0.391	0.377	0.375	0.381	0.009	0.341	0.340	0.344	0.342	0.002	1.527	
	b0	0.479	0.492	0.487	0.486	0.007	0.394	0.407	0.402	0.401	0.007	1.747	a54
	b1	0.517	0.490	0.487	0.498	0.017	0.426	0.406	0.400	0.411	0.014	1.741	
1.2% Lipoid E80	a0	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.689	a55
1.2% Tween 80	a1	0.193	0.194	0.193	0.193	0.001	0.185	0.185	0.185	0.185	0.000	0.692	
(Rx4)	a4	0.193	0.193	0.194	0.193	0.001	0.185	0.185	0.185	0.185	0.000	0.692	
	b0	0.193	0.193	0.192	0.193	0.001	0.186	0.186	0.186	0.186	0.000	0.688	a56
	b1	0.192	0.193	0.193	0.193	0.001	0.187	0.186	0.186	0.186	0.001	0.689	
	b4	0.193	0.193	0.193	0.193	0.000	0.185	0.184	0.184	0.184	0.001	0.689	
1.2% Lipoid E80	a0	0.195	0.194	0.194	0.194	0.001	0.188	0.189	0.189	0.189	0.001	0.694	a57
0.9% Tween 80	a1	0.195	0.195	0.194	0.195	0.001	0.189	0.189	0.189	0.189	0.000	0.696	
(Rx5)	a4	0.195	0.195	0.196	0.195	0.001	0.186	0.187	0.187	0.187	0.001	0.699	
	b0	0.193	0.193	0.193	0.193	0.000	0.191	0.191	0.191	0.191	0.000	0.688	a58
	b1	0.193	0.193	0.193	0.193	0.000	0.192	0.191	0.191	0.191	0.001	0.688	
	b4	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.685	
1.2% Lipoid E80	a0	0.197	0.199	0.199	0.198	0.001	0.184	0.185	0.184	0.184	0.001	0.717	a59
0.6% Tween 80	a1	0.198	0.199	0.199	0.199	0.001	0.184	0.185	0.185	0.185	0.001	0.719	
(Rx6)	a4	0.199	0.199	0.199	0.199	0.000	0.190	0.190	0.189	0.190	0.001	0.722	
	b0	0.199	0.199	0.198	0.199	0.001	0.185	0.185	0.185	0.185	0.000	0.705	a60
	b1	0.199	0.198	0.199	0.199	0.001	0.185	0.185	0.185	0.185	0.000	0.708	
	b4	0.198	0.198	0.200	0.199	0.001	0.189	0.189	0.190	0.189	0.001	0.705	
1.2% Lipoid E80	a0	0.201	0.201	0.201	0.201	0.000	0.189	0.190	0.189	0.189	0.001	0.729	
0.4% Tween 80	a1	0.202	0.202	0.201	0.202	0.001	0.190	0.189	0.190	0.190	0.001	0.732	
(Rx7)													

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a5. (cont.) Particle sizes of lipid emulsions formulated using 10% oil with various surfactants after storage at 25^{O}C.

Formulation	Time	D[4,3] (μm)					d(0.5) (μm)					Span	Figure
		1	2	3	mean	S.D.	1	2	3	mean	S.D.		
1.2% Lipoid E80	a0	0.191	0.191	0.191	0.191	0.000	0.183	0.183	0.183	0.183	0.000	0.683	a61
1.2%Vitamin E-TPGS	a1	0.191	0.192	0.192	0.192	0.001	0.183	0.184	0.184	0.184	0.001	0.687	
(Rx8)	a4	0.192	0.192	0.192	0.192	0.000	0.184	0.184	0.184	0.184	0.000	0.689	
	b0	0.191	0.191	0.191	0.191	0.000	0.183	0.183	0.183	0.183	0.000	0.684	a62
	b1	0.192	0.192	0.192	0.192	0.000	0.184	0.184	0.184	0.184	0.000	0.689	
	b4	0.192	0.192	0.192	0.192	0.000	0.184	0.184	0.184	0.184	0.000	0.689	
1.2% Lipoid E80	a0	0.194	0.194	0.194	0.194	0.000	0.186	0.186	0.186	0.186	0.000	0.696	a63
0.9%Vitamin E-TPGS	a1	0.195	0.195	0.195	0.195	0.000	0.186	0.187	0.187	0.187	0.001	0.701	
(Rx9)	a4	0.196	0.195	0.196	0.196	0.001	0.187	0.187	0.187	0.187	0.000	0.706	
	b0	0.194	0.194	0.195	0.194	0.001	0.186	0.186	0.186	0.186	0.000	0.696	a64
	b1	0.195	0.195	0.195	0.195	0.000	0.187	0.186	0.186	0.186	0.001	0.703	
	b4	0.195	0.195	0.195	0.195	0.000	0.187	0.186	0.186	0.186	0.001	0.704	
1.2% Lipoid E80	a0	0.196	0.196	0.197	0.196	0.001	0.187	0.187	0.188	0.187	0.001	0.699	a65
0.6% Vitamin E-TPGS	a1	0.197	0.198	0.197	0.197	0.001	0.188	0.189	0.188	0.188	0.001	0.709	
(Rx10)	a4	0.197	0.198	0.196	0.197	0.001	0.188	0.188	0.187	0.188	0.001	0.710	
	b0	0.195	0.195	0.195	0.195	0.000	0.186	0.187	0.187	0.187	0.001	0.694	a66
	b1	0.196	0.195	0.195	0.195	0.001	0.187	0.187	0.187	0.187	0.000	0.698	
	b4	0.195	0.195	0.196	0.195	0.001	0.187	0.186	0.187	0.187	0.001	0.699	
1.2% Lipoid E80	a0	0.203	0.202	0.203	0.203	0.001	0.192	0.192	0.193	0.192	0.001	0.739	a67
0.4% Vitamin E-TPGS	a1	0.203	0.204	0.204	0.204	0.001	0.193	0.193	0.193	0.193	0.000	0.745	
(Rx11)	a4	0.202	0.2	0.204	0.202	0.002	0.192	0.19	0.193	0.192	0.002	0.736	
	b0	0.222	0.222	0.221	0.222	0.001	0.207	0.207	0.206	0.207	0.001	0.830	a68
	b1	0.218	0.221	0.224	0.221	0.003	0.204	0.206	0.208	0.206	0.002	0.826	
	b4	0.222	0.22	0.22	0.221	0.001	0.207	0.205	0.205	0.206	0.001	0.820	
1.2% Lipoid E80	a0	0.348	0.342	0.343	0.344	0.003	0.28	0.277	0.276	0.278	0.002	1.458	
0.06% Na oleate	b0	0.318	0.337	0.336	0.330	0.011	0.262	0.276	0.276	0.271	0.008	1.410	
(1:20) (Rx12)													
1.2% Lipoid E80	a0	0.329	0.312	0.316	0.319	0.009	0.277	0.276	0.275	0.276	0.001	1.245	
0.03% Na oleate	b0	0.312	0.314	0.315	0.314	0.002	0.276	0.279	0.281	0.279	0.003	1.192	
(1:40) (Rx13)													
1.2% Lipoid E80	a0	0.384	0.384	0.747	0.505	0.210	0.302	0.302	0.313	0.306	0.006	1.570	
0.02% Na oleate	b0	0.381	0.382	0.399	0.387	0.010	0.301	0.302	0.304	0.302	0.002	1.540	
(1:60) (Rx14)													
1.2% Lipoid E80	a0	0.376	0.376	0.377	0.376	0.001	0.306	0.304	0.307	0.306	0.002	1.438	
0.015% Na oleate													
(1:80) (Rx15)													

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a6. Particle size of lipid emulsions formulated using 10% oil emulsified with 2:1 Lipoid E80 to Tween® 80 at various total emulsifier concentrationss.

Total emulsifier	Time	Temp	D [4,3] (μm)					d (0.5) (μm)					Span	Figure
(%w/w)		(°C)	1	2	3	mean	S.D.	1	2	3	mean	S.D.		
1.5	a0	25	0.200	0.201	0.200	0.200	0.001	0.190	0.191	0.190	0.190	0.001	0.725	a83
	b0	25	0.208	0.205	0.207	0.207	0.002	0.196	0.194	0.196	0.195	0.001	0.748	a84
	b1	4	0.210	0.208	0.208	0.209	0.001	0.198	0.196	0.196	0.197	0.001	0.751	a85
		25	0.206	0.208	0.206	0.207	0.001	0.195	0.196	0.195	0.195	0.001	0.742	a86
		40	0.207	0.210	0.205	0.207	0.003	0.195	0.197	0.194	0.195	0.002	0.745	a87
	b4	4	0.209	0.210	0.209	0.209	0.001	0.197	0.198	0.197	0.197	0.001	0.755	a88
		25	0.206	0.208	0.207	0.207	0.001	0.195	0.196	0.196	0.196	0.001	0.748	a89
		40	0.206	0.206	0.207	0.206	0.001	0.195	0.195	0.196	0.195	0.001	0.743	a90
2.0	a0	25	0.194	0.194	0.194	0.194	0.000	0.185	0.185	0.185	0.185	0.000	0.691	
	b0	25	0.194	0.194	0.193	0.194	0.001	0.186	0.186	0.185	0.186	0.001	0.681	
	b1	4	0.194	0.194	0.194	0.194	0.000	0.186	0.186	0.186	0.186	0.000	0.736	
		25	0.194	0.195	0.194	0.194	0.001	0.186	0.186	0.186	0.186	0.000	0.680	
		40	0.193	0.194	0.194	0.194	0.001	0.185	0.186	0.186	0.186	0.001	0.681	
	b4	4	0.194	0.194	0.194	0.194	0.000	0.186	0.186	0.186	0.186	0.000	0.683	
		25	0.194	0.195	0.194	0.194	0.001	0.186	0.186	0.186	0.186	0.000	0.682	
		40	0.194	0.195	0.194	0.194	0.001	0.186	0.186	0.186	0.186	0.000	0.679	
2.5	a0	25	0.191	0.191	0.191	0.191	0.000	0.183	0.183	0.183	0.183	0.000	0.684	
	b0	25	0.260	0.266	0.266	0.264	0.003	0.244	0.248	0.248	0.247	0.002	0.929	
	b1	4	0.281	0.281	0.306	0.289	0.014	0.265	0.265	0.290	0.273	0.014	0.914	
		25	0.278	0.285	0.265	0.276	0.010	0.262	0.269	0.248	0.260	0.011	0.912	
		40	0.286	0.263	0.265	0.271	0.013	0.270	0.246	0.248	0.255	0.013	0.923	
	b4	4	0.286	0.300	0.281	0.289	0.010	0.270	0.286	0.265	0.274	0.011	0.908	
3.0	a0	25	0.190	0.190	0.190	0.190	0.000	0.182	0.182	0.182	0.182	0.000	0.678	
	b0	25	0.364	0.362	0.361	0.362	0.002	0.341	0.341	0.340	0.341	0.001	1.609	
	b1	4	0.331	0.328	0.376	0.345	0.027	0.312	0.311	0.351	0.325	0.023	0.961	
	b4	4	0.337	0.339	0.330	0.335	0.005	0.322	0.324	0.313	0.320	0.006	0.924	

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a7. Particle size of lipid emulsions formulated using 10% oil emulsified with 2:1 Lipoid E80 to Vitamin E-TPGS at various total emulsifier concentrations.

Total emulsifier (%w/w)	Time	Temp (°C)	D [4,3] (μm)					d (0.5) (μm)					Span	Figure
			1	2	3	mean	S.D.	1	2	3	mean	S.D.		
1.5	a0	25	0.201	0.201	0.202	0.201	0.001	0.191	0.191	0.191	0.191	0.000	0.725	a91
	b0	25	0.199	0.199	0.199	0.199	0.000	0.190	0.189	0.189	0.189	0.001	0.716	a92
	b1	4	0.201	0.200	0.200	0.200	0.001	0.191	0.190	0.190	0.190	0.001	0.721	a93
		25	0.200	0.190	0.201	0.197	0.006	0.190	0.200	0.190	0.193	0.006	0.722	a94
		40	0.200	0.200	0.200	0.200	0.000	0.190	0.190	0.190	0.190	0.000	0.721	a95
	b4	4	0.200	0.200	0.200	0.200	0.000	0.190	0.190	0.190	0.190	0.000	0.718	a96
		25	0.199	0.189	0.200	0.196	0.006	0.190	0.197	0.188	0.192	0.005	0.714	a97
		40	0.200	0.199	0.199	0.199	0.001	0.190	0.189	0.189	0.189	0.001	0.715	a98
2.0	a0	25	0.196	0.196	0.196	0.196	0.000	0.187	0.187	0.187	0.187	0.000	0.705	
	b0	25	0.194	0.194	0.194	0.194	0.000	0.186	0.186	0.186	0.186	0.000	0.691	
	b1	4	0.195	0.195	0.194	0.195	0.001	0.186	0.187	0.186	0.186	0.001	0.694	
		25	0.195	0.186	0.195	0.192	0.005	0.186	0.194	0.186	0.189	0.005	0.693	
		40	0.195	0.194	0.194	0.194	0.001	0.186	0.186	0.186	0.186	0.000	0.692	
	b4	4	0.194	0.194	0.194	0.194	0.000	0.186	0.186	0.186	0.186	0.000	0.692	
		25	0.194	0.186	0.194	0.191	0.005	0.186	0.194	0.186	0.189	0.005	0.690	
		40	0.194	0.194	0.193	0.194	0.001	0.186	0.186	0.185	0.186	0.001	0.690	
2.5	a0	25	0.196	0.195	0.195	0.195	0.001	0.187	0.186	0.187	0.187	0.001	0.702	
	b0	25	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.687	
	b1	4	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.689	
		25	0.193	0.185	0.193	0.190	0.005	0.185	0.193	0.185	0.188	0.005	0.687	
		40	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.184	0.185	0.001	0.687	
	b4	4	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.688	
		25	0.193	0.185	0.193	0.190	0.005	0.185	0.192	0.184	0.187	0.004	0.687	
		40	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.686	
3.0	a0	25	0.195	0.196	0.195	0.195	0.001	0.186	0.187	0.187	0.187	0.001	0.703	
	b0	25	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.689	
	b1	4	0.193	0.193	0.193	0.193	0.000	0.184	0.184	0.185	0.184	0.001	0.688	
		25	0.193	0.185	0.193	0.190	0.005	0.185	0.193	0.185	0.188	0.005	0.690	
		40	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.691	
	b4	4	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.689	
		25	0.193	0.184	0.192	0.190	0.005	0.184	0.192	0.184	0.187	0.005	0.687	
		40	0.192	0.192	0.193	0.192	0.001	0.184	0.184	0.185	0.184	0.001	0.687	

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a8. Particle size of lipid emulsions formulated using 10% oil emulsified with 3:1 Lipoid E80 to Vitamin E-TPGS at various total emulsifier concentrations.

Total emulsifier	Time	Temp	D [4,3] (μm)					d (0.5) (μm)					Span
(%w/w)		(°C)	1	2	3	mean	S.D.	1	2	3	mean	S.D.	
2.0	a0	25	0.197	0.197	0.197	0.197	0.000	0.187	0.188	0.188	0.188	0.001	0.710
	b0	25	0.217	0.213	0.215	0.215	0.002	0.203	0.200	0.202	0.202	0.002	0.790
	b1	4	0.212	0.211	0.211	0.211	0.001	0.199	0.198	0.198	0.198	0.001	0.764
		25	0.212	0.213	0.215	0.213	0.002	0.199	0.200	0.202	0.200	0.002	0.780
		40	0.210	0.209	0.208	0.209	0.001	0.198	0.197	0.197	0.197	0.001	0.756
	b4	4	0.213	0.218	0.209	0.213	0.005	0.200	0.204	0.197	0.200	0.004	0.777
		25	0.218	0.217	0.214	0.216	0.002	0.204	0.203	0.201	0.203	0.002	0.798
		40	0.211	0.212	0.212	0.212	0.001	0.198	0.199	0.199	0.199	0.001	0.770
2.5	a0	25	0.194	0.194	0.194	0.194	0.000	0.186	0.186	0.186	0.186	0.000	0.697
	b0	25	0.333	0.334	0.345	0.337	0.007	0.317	0.319	0.326	0.321	0.005	0.918
	b1	4	0.331	0.328	0.340	0.333	0.006	0.315	0.311	0.321	0.316	0.005	0.932
		25	0.331	0.333	0.335	0.333	0.002	0.313	0.316	0.317	0.315	0.002	0.936
	b4	4	0.353	0.344	0.337	0.345	0.008	0.337	0.327	0.323	0.329	0.007	0.937
3.0	a0	25	0.193	0.193	0.193	0.193	0.000	0.185	0.185	0.185	0.185	0.000	0.694
	b0	25	0.258	0.247	0.258	0.254	0.006	0.240	0.228	0.241	0.236	0.007	0.918
	b1	4	0.256	0.263	0.264	0.261	0.004	0.239	0.245	0.247	0.244	0.004	0.923
		25	0.240	0.264	0.242	0.249	0.013	0.222	0.246	0.224	0.231	0.013	0.907
		40	0.276	0.276	0.264	0.272	0.007	0.260	0.260	0.246	0.255	0.008	0.917
	b4	4	0.280	0.265	0.265	0.270	0.009	0.264	0.247	0.247	0.253	0.010	0.917

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

1.2 Zeta potential measurement

Table a9. Zeta potential of lipid emulsions formulated using 10% oil with various surfactants after storage at 25°C.

Formulation	Time	Zeta potential (mV)									
		Unautoclaved					Autoclaved				
		1	2	3	mean	S.D.	1	2	3	mean	S.D.
1.2% Lipoid E80	24 hr	-37.7	-36.2	-38.1	-37.3	1.0	-37.1	-38.7	-38.5	-38.1	0.9
	1 wk	-39.6	-41.2	-40.8	-40.5	0.8	-40.1	-40.2	-40.2	-40.2	0.1
1.5% Lipoid E80	24 hr	-38.9	-38.2	-38.3	-38.5	0.4	-39.9	-38.6	-41.0	-39.8	1.2
	1 wk	-40.6	-40.6	-41.2	-40.8	0.3	-40.2	-39.1	-40.3	-39.9	0.7
2.0% Lipoid E80	24 hr	-36.6	-39.4	-39.8	-38.6	1.7	-39.7	-41.2	-41.1	-40.7	0.8
	1 wk	-39.2	-39.8	-39.4	-39.5	0.3	-40.6	-40.1	-39.4	-40.0	0.6
1.2% Lipoid E80	24 hr	-33.9	-35.7	-34.1	-34.6	1.0	-38.0	-38.2	-38.5	-38.2	0.3
1.2% Tween 80	1 wk	-33.8	-33.4	-34.6	-33.9	0.6	-36.4	-36.5	-36.5	-36.5	0.1
	4 wk	-38.0	-41.7	-39.8	-39.8	1.9	-41.4	-41.5	-41.7	-41.5	0.2
1.2% Lipoid E80	24 hr	-35.2	-36.0	-34.6	-35.3	0.7	-38.6	-34.9	-39.0	-37.5	2.3
0.9% Tween 80	1 wk	-33.7	-35.6	-34.3	-34.5	1.0	-38.3	-36.8	-38.1	-37.7	0.8
	4 wk	-41.2	-41.3	-40.6	-41.0	0.4	-41.8	-41.3	-41.8	-41.6	0.3
1.2% Lipoid E80	24 hr	-36.4	-37.6	-38.1	-37.4	0.9	-40.1	-40.1	-40.6	-40.3	0.3
0.6% Tween 80	1 wk	-35.8	-35.8	-37.2	-36.3	0.8	-39.2	-39.2	-38.6	-39.0	0.3
	4 wk	-41.9	-43.8	-40.9	-42.2	1.5	-42.3	-42.8	-42.4	-42.5	0.3
1.2% Lipoid E80	24 hr	-38.1	-37.5	-37.7	-37.8	0.3	creaming				
0.4% Tween 80	1 wk	-35.4	-34.0	-35.0	-34.8	0.7					
1.2% Lipoid E80	24 hr	-35.9	-36.1	-36.0	-36.0	0.1	-37.6	-36.8	-37.2	-37.2	0.4
1.2% Vitamin E-TPGS	1 wk	-34.6	-34.6	-34.0	-34.4	0.3	-36.1	-35.3	-36.3	-35.9	0.5
	4 wk	-38.7	-37.8	-41.6	-39.4	2.0	-43.8	-42.5	-43.8	-43.4	0.8
1.2% Lipoid E80	24 hr	-36.4	-37.3	-37.4	-37.0	0.6	-38.7	-38.9	-38.7	-38.8	0.1
0.9% Vitamin E-TPGS	1 wk	-36.2	-33.7	-33.2	-34.4	1.6	-38.6	-37.7	-36.7	-37.7	1.0
	4 wk	-38.3	-37.5	-40.9	-38.9	1.8	-48.1	-46.9	-47.9	-47.6	0.6
1.2% Lipoid E80	24 hr	-35.6	-35.2	-35.5	-35.4	0.2	-36.7	-36.1	-37.1	-36.6	0.5
0.6% Vitamin E-TPGS	1 wk	-36.8	-35.6	-36.2	-36.2	0.6	-36.6	-37.1	-37.0	-36.9	0.3
	4 wk	-36.8	-37.7	-40.7	-38.4	2.0	-48.8	-47.2	-47.7	-47.9	0.8
1.2% Lipoid E80	24 hr	-35.8	-35.9	-36.0	-35.9	0.1	-38.0	-38.1	-38.1	-38.1	0.1
0.4% Vitamin E-TPGS	1 wk	-34.0	-34.9	-36.3	-35.1	1.2	-36.9	-36.7	-37.1	-36.9	0.2
	4 wk	-42.7	-43.1	-43.3	-43.0	0.3	-46.2	-47.1	-48.3	-47.2	1.1

Table a10. Zeta potential of lipid emulsions formulated using 10% oil emulsified with 2:1 Lipoid E80 to Tween® 80 at various total emulsifier concentrations.

Total emulsifier (%w/w)	Time	Temperature (° C)	Zeta potential (mV)				
			sample 1	sample 2	sample 3	mean	S.D.
1.5	a0	25	-36.8	-37.6	-39.1	-37.8	1.2
	b0	25	-41.9	-42.1	-41.9	-42.0	0.1
	b1	4	-37.8	-38.8	-45.0	-40.5	3.9
		40	-46.6	-48.8	-48.1	-47.8	1.1
	b4	4	-42.0	-40.2	-41.0	-41.1	0.9
		40	-49.6	-58.9	-48.9	-52.5	5.6
2.0	a0	25	-36.1	-35.4	-36.6	-36.0	0.6
	b0	25	-42.0	-42.0	-42.3	-42.1	0.2
	b1	4	-47.2	-46.2	-46.7	-46.7	0.5
		40	-55.6	-53.0	-53.6	-54.1	1.4
	b4	4	-46.8	-49.1	-46.2	-47.4	1.5
		40	-56.8	-59.4	-62.3	-59.5	2.8
2.5	a0	25	-34.8	-34.2	-35.1	-34.7	0.5
	b0	25	-41.6	-41.3	-41.6	-41.5	0.2
	b1	4	-53.6	-53.3	-54.1	-53.7	0.4
		40	-56.6	-56.8	-55.9	-56.4	0.5
	b4	4	-64.1	-59.6	-54.2	-59.3	5.0
3.0	a0	25	-36.1	-35.9	-35.8	-35.9	0.2
	b0	25	-52.4	-51.8	-52.2	-52.1	0.3
	b1	4	-37.7	-36.2	-40.8	-38.2	2.3
	b4	4	-57.9	-53.2	-59.9	-57.0	3.4

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a11. Zeta potential of lipid emulsions formulated using 10% oil emulsified with 2:1 Lipoid E80 to Vitamin E-TPGS at various total emulsifier concentrations.

Total emulsifier (%w/w)	Time	Temperature (° C)	Zeta potential (mV)				
			sample 1	sample 2	sample 3	mean	S.D.
1.5	a0	25	-36.9	-39.2	-39.8	-38.6	1.5
	b0	25	-41.4	-41.7	-42.2	-41.8	0.4
	b1	4	-47.4	-47.8	-45.7	-47.0	1.1
		40	-47.6	-49.1	-48.3	-48.3	0.8
	b4	4	-37.6	-38.0	-45.3	-40.3	4.3
		40	-55.7	-48.5	-52.5	-52.2	3.6
2.0	a0	25	-39.3	-39.1	-40.2	-39.5	0.6
	b0	25	-42.6	-43.9	-42.3	-42.9	0.9
	b1	4	-50.2	-48.5	-50.0	-49.6	0.9
		40	-50.2	-49.2	-51.1	-50.2	1.0
	b4	4	-52.4	-52.5	-52.8	-52.6	0.2
		40	-55.1	-54.5	-54.5	-54.7	0.3
2.5	a0	25	-41.5	-42.1	-41.8	-41.8	0.3
	b0	25	-46.3	-47.4	-47.4	-47.0	0.6
	b1	4	-55.8	-52.4	-52.8	-53.7	1.9
		40	-55.8	-51.2	-55.9	-54.3	2.7
	b4	4	-54.7	-56.5	-55.8	-55.7	0.9
		40	-57.1	-64.1	-60.8	-60.7	3.5
3.0	a0	25	-42.2	-43.4	-43.6	-43.1	0.8
	b0	25	-46.1	-49.2	-46.5	-47.3	1.7
	b1	4	-53.2	-52.7	-52.9	-52.9	0.3
		40	-62.5	-63.3	-64.8	-63.5	1.2
	b4	4	-52.7	-52.8	-55.4	-53.6	1.5
		40	-58.7	-64.4	-69.4	-64.2	5.4

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a12. Zeta potential of lipid emulsions formulated using 10% oil emulsified with 3:1 Lipoid E80 to Vitamin E-TPGS at various total emulsifier concentrations.

Total emulsifier (%w/w)	Time	Temperature (°C)	Zeta potential (mV)				
			sample 1	sample 2	sample 3	mean	S.D.
2.0	a0	25	-41.6	-40.5	-41.9	-41.3	0.7
	b0	25	-45.8	-46.8	-46.2	-46.3	0.5
	b1	4	-48.2	-47.5	-48.8	-48.2	0.7
		40	-48.3	-47.8	-49.4	-48.5	0.8
	b4	4	-69.3	-65.4	-59.1	-64.6	5.1
		40	-63.0	-60.4	-67.5	-63.6	3.6
2.5	a0	25	-39.6	-39.5	-40.0	-39.7	0.3
	b0	25	-45.7	-45.3	-45.6	-45.5	0.2
	b1	4	-52.4	-52.3	-52.6	-52.4	0.2
	b4	4	-63.6	-62.2	-67.0	-64.3	2.5
3.0	a0	25	-39.1	-40.5	-40.6	-40.1	0.8
	b0	25	-52.1	-51.9	-50.8	-51.6	0.7
	b1	4	-42.6	-43.2	-43.3	-43.0	0.4
	b4	4	-44.7	-44.8	-45.2	-44.9	0.3
		40	-57.3	-61.2	-55.3	-57.9	3.0

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

1.3 Osmolality measurement

Table a13. Osmolality of lipid emulsions formulated using 10% oil with various surfactants after storage at 25°C.

Formulation	Time	Osmolality (mOsm/kg)									
		Unautoclaved					Autoclaved				
		1	2	3	mean	S.D.	1	2	3	mean	S.D.
1.2% Lipoid E80	24 hr	324	323	326	324	2	318	314	314	315	2
	1 wk	314	318	315	316	2	282	294	286	287	6
1.5% Lipoid E80	24 hr	318	323	323	321	3	316	311	308	312	4
	1 wk	316	312	313	314	2	298	332	331	320	19
2.0% Lipoid E80	24 hr	333	335	331	333	2	309	312	307	309	3
	1 wk	317	323	318	319	3	351	351	350	351	1
1.2% Lipoid E80	24 hr	325	324	322	324	2	319	310	319	316	5
1.2% Tween 80	1 wk	343	343	349	345	3	342	339	339	340	2
	4 wk	343	340	339	341	2	333	330	329	331	2
1.2% Lipoid E80	24 hr	320	321	319	320	1	319	319	318	319	1
0.9% Tween 80	1 wk	317	318	317	317	1	314	314	313	314	1
	4 wk	339	340	337	339	2	332	334	335	334	2
1.2% Lipoid E80	24 hr	342	341	349	344	4	339	342	340	340	2
0.6% Tween 80	1 wk	360	363	359	361	2	360	359	359	359	1
	4 wk	359	355	354	356	3	347	350	343	347	4
1.2% Lipoid E80	24 hr	315	315	308	313	4	creaming				
0.4% Tween 80	1 wk	316	313	313	314	2					
1.2% Lipoid E80	24 hr	322	325	320	322	3	319	318	320	319	1
1.2% Vitamin E-TPGS	1 wk	322	320	319	320	2	339	332	330	334	5
	4 wk	330	327	325	327	3	324	324	325	324	1
1.2% Lipoid E80	24 hr	324	322	321	322	2	323	320	321	321	2
0.9% Vitamin E-TPGS	1 wk	329	321	330	327	5	340	340	331	337	5
	4 wk	329	334	329	331	3	323	325	350	333	15
1.2% Lipoid E80	24 hr	322	322	319	321	2	321	319	311	317	5
0.6% Vitamin E-TPGS	1 wk	321	326	319	322	4	318	318	318	318	0
	4 wk	321	320	321	321	1	319	320	320	320	1
1.2% Lipoid E80	24 hr	324	328	326	326	2	326	310	325	320	9
0.4% Vitamin E-TPGS	1 wk	328	325	326	326	2	324	322	322	323	1
	4 wk	326	328	325	326	2	322	325	325	324	2

Table a14. Osmolality of lipid emulsions formulated using 10% oil emulsified with 2:1 Lipoid E80 to Tween® 80 at various total emulsifier concentrations.

Total emulsifier (%w/w)	Time	Temperature (°C)	Osmolality (mOsm/kg)				
			sample 1	sample 2	sample 3	mean	S.D.
1.5	a0	25	326	330	327	328	2
	b0	25	325	325	326	325	1
	b1	4	323	323	320	322	2
		40	322	321	323	322	1
	b4	4	329	328	325	327	2
		40	327	327	325	326	1
2.0	a0	25	327	329	327	328	1
	b0	25	330	326	331	329	3
	b1	4	324	323	325	324	1
		40	326	324	322	324	2
	b4	4	328	331	329	329	2
		40	325	323	325	324	1
2.5	a0	25	332	336	335	334	2
	b0	25	336	336	336	336	0
	b1	4	322	331	330	328	5
		40	333	326	327	329	4
	b4	4	331	329	328	329	2
3.0	a0	25	339	337	336	337	2
	b0	25	337	335	334	335	2
	b1	4	354	355	355	355	1
	b4	4	343	348	344	345	3

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a15. Osmolality of lipid emulsions formulated using 10% oil emulsified with 2:1 Lipoid E80 to Vitamin E-TPGS at various total emulsifier concentrations.

Total emulsifier (%w/w)	Time	Temperature (° C)	Osmolality (mOsm/kg)				
			sample 1	sample 2	sample 3	mean	S.D.
1.5	a0	25	330	330	328	329	1
	b0	25	322	324	326	324	2
	b1	4	333	332	329	331	2
		40	332	332	327	330	3
	b4	4	327	328	327	327	1
		40	320	317	316	318	2
2.0	a0	25	331	328	330	330	2
	b0	25	325	328	329	327	2
	b1	4	331	331	329	330	1
		40	328	328	325	327	2
	b4	4	324	323	326	324	2
		40	321	326	327	325	3
2.5	a0	25	338	339	342	340	2
	b0	25	334	330	333	332	2
	b1	4	334	337	334	335	2
		40	330	331	327	329	2
	b4	4	330	328	330	329	1
		40	331	330	326	329	3
3.0	a0	25	335	330	329	331	3
	b0	25	325	326	324	325	1
	b1	4	319	319	318	319	1
		40	322	325	321	323	2
	b4	4	321	320	320	320	1
		40	324	325	326	325	1

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a16. Osmolality of lipid emulsions formulated using 10% oil emulsified with EPC and Vitamin E-TPGS at 3:1

Total emulsifier (%w/w)	Time	Temperature (° C)	Osmolality (mOsm/kg)				
			sample 1	sample 2	sample 3	mean	S.D.
2.0	a0	25	326	326	323	325	2
	b0	25	319	316	318	318	2
	b1	4	323	322	321	322	1
		40	318	319	317	318	1
	b4	4	330	332	333	332	2
		40	329	326	327	327	2
2.5	a0	25	330	328	322	327	4
	b0	25	324	325	328	326	2
	b1	4	326	325	325	325	1
	b4	4	330	329	330	330	1
3.0	a0	25	361	363	362	362	1
	b0	25	360	360	359	360	1
	b1	4	378	381	380	380	2
		40	378	377	377	377	1
	b4	4	368	375	384	376	8

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

1.4 pH measurement

Table a17. pH of lipid emulsions formulated using 10% oil with various surfactants after storage at 25°C.

Formulation	Time	pH value									
		Unautoclaved					Autoclaved				
		1	2	3	mean	S.D.	1	2	3	mean	S.D.
1.2% Lipoid E80	24 hr	8.05	8.03	8.07	8.05	0.02	6.29	6.11	5.96	6.12	0.17
	1 wk	5.79	5.66	5.62	5.69	0.09	5.63	5.67	5.63	5.64	0.02
1.5% Lipoid E80	24 hr	8.02	8.03	8.06	8.04	0.02	5.74	5.60	5.63	5.66	0.07
	1 wk	5.61	5.54	5.49	5.55	0.06	5.27	5.31	5.28	5.29	0.02
2.0% Lipoid E80	24 hr	8.08	8.04	8.00	8.04	0.04	5.28	5.31	5.42	5.34	0.07
	1 wk	5.29	5.50	5.55	5.45	0.14	5.27	5.26	5.32	5.28	0.03
1.2% Lipoid E80	24 hr	8.02	8.04	8.04	8.03	0.01	6.95	7.04	7.21	7.07	0.13
1.2% Tween 80	1 wk	6.94	6.89	7.22	7.02	0.18	6.71	6.67	6.63	6.67	0.04
	4 wk	6.61	6.99	6.48	6.69	0.27	6.58	6.62	6.54	6.58	0.04
1.2% Lipoid E80	24 hr	8.01	8.04	8.03	8.03	0.02	6.92	6.84	6.79	6.85	0.07
0.9% Tween 80	1 wk	6.80	6.75	6.70	6.75	0.05	6.57	6.61	6.60	6.59	0.02
	4 wk	6.66	6.47	6.97	6.70	0.25	6.84	6.78	6.52	6.71	0.17
1.2% Lipoid E80	24 hr	8.10	8.08	8.07	8.08	0.02	7.24	7.23	7.25	7.24	0.01
0.6% Tween 80	1 wk	7.53	7.00	7.05	7.19	0.29	6.85	6.99	6.93	6.92	0.07
	4 wk	6.76	6.98	6.95	6.90	0.12	7.00	6.94	7.10	7.01	0.08
1.2% Lipoid E80	24 hr	8.03	8.00	8.01	8.01	0.02	creaming				
0.4% Tween 80	1 wk	6.61	6.16	6.08	6.28	0.29					
1.2% Lipoid E80	24 hr	8.10	8.12	8.01	8.08	0.06	7.00	6.87	6.81	6.89	0.10
1.2% Vitamin	1 wk	6.83	6.91	6.71	6.82	0.10	6.68	6.72	6.63	6.68	0.05
E-TPGS	4 wk	6.65	6.56	6.68	6.63	0.06	6.67	6.65	6.70	6.67	0.03
1.2% Lipoid E80	24 hr	8.02	8.09	8.12	8.08	0.05	6.78	6.73	6.72	6.74	0.03
0.9% Vitamin	1 wk	6.55	6.04	5.96	6.18	0.32	6.65	6.67	6.71	6.68	0.03
E-TPGS	4 wk	6.52	6.45	6.42	6.46	0.05	6.65	6.58	6.63	6.62	0.04
1.2% Lipoid E80	24 hr	8.03	8.01	8.02	8.02	0.01	6.90	6.86	6.76	6.84	0.07
0.6% Vitamin	1 wk	6.29	6.34	6.21	6.28	0.07	6.57	6.60	6.60	6.59	0.02
E-TPGS	4 wk	5.91	6.13	6.02	6.02	0.11	6.10	6.22	6.38	6.23	0.14
1.2% Lipoid E80	24 hr	8.04	8.06	8.05	8.05	0.01	6.66	6.70	6.66	6.67	0.02
0.4% Vitamin	1 wk	6.29	6.36	6.28	6.31	0.04	6.61	6.63	6.60	6.61	0.02
E-TPGS	4 wk	6.10	6.24	6.10	6.15	0.08	6.50	6.54	6.50	6.51	0.02

Table a18. pH of lipid emulsions formulated using 10% oil emulsified with 2:1 Lipoid E80 to Tween® 80 at various total emulsifier concentrations.

Total emulsifier (%w/w)	Time	Temperature (° C)	pH value				
			sample 1	sample 2	sample 3	mean	S.D.
1.5	a0	25	8.06	8.02	8.02	8.03	0.02
	b0	25	7.10	7.08	7.08	7.09	0.01
	b1	4	7.16	7.05	7.13	7.11	0.06
		40	6.86	6.85	6.87	6.86	0.01
	b4	4	7.30	7.14	7.28	7.24	0.09
		40	7.14	7.20	7.16	7.17	0.03
2	a0	25	8.04	8.00	8.03	8.02	0.02
	b0	25	7.26	7.25	7.28	7.26	0.02
	b1	4	7.24	7.25	7.35	7.28	0.06
		40	7.34	7.20	7.18	7.24	0.09
	b4	4	7.28	7.33	7.30	7.30	0.03
		40	6.50	6.61	6.63	6.58	0.07
2.5	a0	25	8.10	8.08	8.06	8.08	0.02
	b0	25	7.03	6.98	6.97	6.99	0.03
	b1	4	6.93	6.91	6.82	6.89	0.06
		40	6.83	6.89	7.00	6.91	0.09
	b4	4	6.74	6.78	6.82	6.78	0.04
3	a0	25	8.13	8.10	8.15	8.13	0.03
	b0	25	6.95	6.91	6.89	6.92	0.03
	b1	4	7.05	7.03	6.89	6.99	0.09
	b4	4	7.22	7.05	7.08	7.12	0.09

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a19. pH of lipid emulsions formulated using 10% oil emulsified with 2:1 Lipoid E80 to E-TPGS at various total emulsifier concentrations.

Total emulsifier (%w/w)	Time	Temperature (° C)	pH value				
			sample 1	sample 2	sample 3	mean	S.D.
1.5	a0	25	8.00	8.02	8.01	8.01	0.01
	b0	25	7.03	6.99	6.89	6.97	0.07
	b1	4	6.64	6.68	6.66	6.66	0.02
		40	6.69	6.65	6.60	6.65	0.05
	b4	4	6.86	6.90	6.88	6.88	0.02
		40	6.61	6.70	6.68	6.66	0.05
2	a0	25	8.05	8.04	8.08	8.06	0.02
	b0	25	6.75	6.74	6.83	6.77	0.05
	b1	4	6.61	6.65	6.70	6.65	0.05
		40	6.53	6.50	6.60	6.54	0.05
	b4	4	6.68	6.62	6.64	6.65	0.03
		40	6.50	6.55	6.52	6.52	0.03
2.5	a0	25	8.04	8.06	8.02	8.04	0.02
	b0	25	6.69	6.66	6.67	6.67	0.02
	b1	4	6.57	6.55	6.60	6.57	0.03
		40	6.42	6.38	6.45	6.42	0.04
	b4	4	6.58	6.66	6.65	6.63	0.04
		40	6.46	6.60	6.55	6.54	0.07
3	a0	25	8.05	8.10	8.09	8.08	0.03
	b0	25	6.61	6.66	6.73	6.67	0.06
	b1	4	6.58	6.60	6.55	6.58	0.03
		40	6.57	6.50	6.64	6.57	0.07
	b4	4	6.59	6.59	6.60	6.59	0.01
		40	6.37	6.54	6.42	6.44	0.09

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a20. pH of lipid emulsions formulated using 10% oil emulsified with 3:1 Lipoid E80 to Vitamin E-TPGS at various total emulsifier concentrations.

Total emulsifier (%w/w)	Time	Temperature (° C)	pH value				
			sample 1	sample 2	sample 3	mean	S.D.
2	a0	25	8.10	8.11	8.07	8.09	0.02
	b0	25	7.08	7.00	6.98	7.02	0.05
	b1	4	6.75	6.68	6.68	6.70	0.04
		40	6.65	6.64	6.57	6.62	0.04
	b4	4	6.84	6.80	6.81	6.82	0.02
		40	6.40	6.43	6.39	6.41	0.02
2.5	a0	25	8.00	8.04	8.06	8.03	0.03
	b0	25	6.48	6.46	6.33	6.42	0.08
	b1	4	6.37	6.32	6.28	6.32	0.05
	b4	4	6.28	6.30	6.33	6.30	0.03
3	a0	25	8.00	8.04	8.10	8.05	0.05
	b0	25	6.72	6.92	6.88	6.84	0.11
	b1	4	6.73	6.69	6.72	6.71	0.02
	b4	40	6.50	6.43	6.45	6.46	0.04
		4	6.68	6.75	6.70	6.71	0.04

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

2. Lipid emulsions containing 20% oil

Table a21. Particle size of lipid emulsions formulated using 20% oil with various surfactants after storage at 25°C.

Formulation	Time	D[4,3] (μm)					d(0.5) (μm)					span	Figure
		1	2	3	mean	S.D.	1	2	3	mean	S.D.		
1.2% Lipoid E80	a0	0.204	0.205	0.203	0.204	0.001	0.194	0.194	0.193	0.194	0.001	0.738	a69
1.2% Tween 80	a1	0.206	0.207	0.207	0.207	0.001	0.195	0.195	0.195	0.195	0.000	0.755	
(Rx16)	a4	0.204	0.206	0.206	0.205	0.001	0.193	0.194	0.194	0.194	0.001	0.747	
	b0	0.205	0.205	0.205	0.205	0.000	0.194	0.194	0.194	0.194	0.000	0.743	a70
	b1	0.206	0.206	0.206	0.206	0.000	0.195	0.194	0.195	0.195	0.001	0.752	
	b4	0.206	0.206	0.204	0.205	0.001	0.195	0.194	0.193	0.194	0.001	0.752	
1.2% Lipoid E80	a0	0.213	0.210	0.213	0.212	0.002	0.200	0.198	0.200	0.199	0.001	0.785	a71
0.9% Tween 80	a1	0.213	0.212	0.214	0.213	0.001	0.200	0.199	0.200	0.200	0.001	0.789	
(Rx17)	a4	0.212	0.213	0.212	0.212	0.001	0.199	0.199	0.199	0.199	0.000	0.786	
	b0	0.213	0.211	0.210	0.211	0.002	0.200	0.198	0.198	0.199	0.001	0.772	a72
	b1	0.215	0.213	0.212	0.213	0.002	0.201	0.199	0.199	0.200	0.001	0.783	
	b4	0.216	0.215	0.213	0.215	0.002	0.202	0.201	0.200	0.201	0.001	0.794	
1.2% Lipoid E80	a0	0.223	0.224	0.224	0.224	0.001	0.207	0.208	0.207	0.207	0.001	0.853	a73
0.6% Tween 80	a1	0.225	0.224	0.226	0.225	0.001	0.208	0.208	0.209	0.208	0.001	0.864	
(Rx18)	a4	0.225	0.224	0.226	0.225	0.001	0.208	0.207	0.209	0.208	0.001	0.861	
	b0	0.309	0.306	0.301	0.305	0.004	0.294	0.292	0.286	0.291	0.004	0.905	a74
	b1	0.316	0.303	0.307	0.309	0.007	0.302	0.288	0.293	0.294	0.007	0.888	
	b4	0.315	0.310	0.307	0.311	0.004	0.300	0.294	0.291	0.295	0.005	0.910	
1.2% Lipoid E80	a0	0.206	0.205	0.205	0.205	0.001	0.195	0.194	0.194	0.194	0.001	0.740	a75
1.2%Vitamin	a1	0.207	0.206	0.206	0.206	0.001	0.195	0.194	0.194	0.194	0.001	0.747	
E-TPGS	a4	0.207	0.205	0.205	0.206	0.001	0.195	0.194	0.194	0.194	0.001	0.741	
(Rx19)	b0	0.207	0.205	0.205	0.206	0.001	0.195	0.194	0.194	0.194	0.001	0.740	a76
	b1	0.207	0.206	0.206	0.206	0.001	0.195	0.195	0.194	0.195	0.001	0.752	
	b4	0.205	0.207	0.205	0.206	0.001	0.194	0.195	0.194	0.194	0.001	0.745	
1.2% Lipoid E80	a0	0.213	0.213	0.214	0.213	0.001	0.200	0.199	0.200	0.200	0.001	0.785	a77
0.9%Vitamin	a1	0.216	0.217	0.217	0.217	0.001	0.202	0.202	0.202	0.202	0.000	0.808	
E-TPGS	a4	0.213	0.212	0.211	0.212	0.001	0.199	0.199	0.198	0.199	0.001	0.781	
(Rx20)	b0	0.214	0.213	0.214	0.214	0.001	0.200	0.200	0.201	0.200	0.001	0.791	a78
	b1	0.214	0.215	0.215	0.215	0.001	0.200	0.201	0.201	0.201	0.001	0.799	
	b4	0.217	0.214	0.216	0.216	0.002	0.202	0.200	0.201	0.201	0.001	0.804	
1.2% Lipoid E80	a0	0.230	0.229	0.231	0.230	0.001	0.213	0.212	0.213	0.213	0.001	0.887	a79
0.6% Vitamin	a1	0.232	0.232	0.232	0.232	0.000	0.213	0.213	0.213	0.213	0.000	0.899	
E-TPGS	a4	0.229	0.229	0.230	0.229	0.001	0.211	0.211	0.212	0.211	0.001	0.889	
(Rx21)	b0	0.230	0.231	0.229	0.230	0.001	0.212	0.213	0.211	0.212	0.001	0.884	a80
	b1	0.231	0.234	0.235	0.233	0.002	0.213	0.215	0.217	0.215	0.002	0.906	
	b4	0.228	0.231	0.229	0.229	0.002	0.210	0.213	0.211	0.211	0.002	0.890	
1.2% Lipoid E80	a0	0.244	0.255	0.253	0.251	0.006	0.224	0.235	0.233	0.231	0.006	0.968	a81
0.4% Vitamin	a1	0.256	0.259	0.259	0.258	0.002	0.235	0.237	0.237	0.236	0.001	0.984	
E-TPGS	b0	0.357	0.355	0.361	0.358	0.003	0.332	0.329	0.335	0.332	0.003	1.074	a82
(Rx22)	b1	0.364	0.367	0.361	0.364	0.003	0.339	0.341	0.335	0.338	0.003	1.057	

a0 = unautoclaved after storage for 24 hrs; a1 = unautoclaved after storage for 1 week; a4 = unautoclaved after storage for 4 weeks; b0 = autoclaved after storage for 24 hrs; b1 = autoclaved after storage for 1 week; b4 = autoclaved after storage for 4 weeks

Table a22. Zeta potential of lipid emulsions formulated using 20% oil with various surfactants after storage at 25°C.

Formulation	Time	Zeta potential (mV)									
		Unautoclaved					Autoclaved				
		1	2	3	mean	S.D.	1	2	3	mean	S.D.
1.2% Lipoid E80	24 hr	-42.9	-36.3	-41.7	-40.3	3.5	-43.4	-43.4	-43.2	-43.3	0.1
1.2% Tween 80	1 wk	-36.0	-36.5	-37.6	-36.7	0.8	-37.3	-37.2	-37.1	-37.2	0.1
	4 wk	-40.9	-40.8	-40.8	-40.8	0.1	-44.7	-39.5	-38.0	-40.7	3.5
1.2% Lipoid E80	24 hr	-39.7	-42.4	-41.6	-41.2	1.4	-44.6	-44.5	-44.7	-44.6	0.1
0.9% Tween 80	1 wk	-36.7	-37.1	-36.5	-36.8	0.3	-37.4	-37.7	-37.1	-37.4	0.3
	4 wk	-41.8	-41.8	-42.0	-41.9	0.1	-45.6	-44.8	-45.0	-45.1	0.4
1.2% Lipoid E80	24 hr	-43.1	-42.9	-43.0	-43.0	0.1	-45.3	-44.4	-44.7	-44.8	0.5
0.6% Tween 80	1 wk	-37.1	-37.6	-37.4	-37.4	0.3	-36.8	-37.1	-37.0	-37.0	0.2
	4 wk	-41.9	-40.3	-42.1	-41.4	1.0	-46.8	-46.7	-48.9	-47.5	1.2
1.2% Lipoid E80	24 hr	-35.9	-34.3	-39.2	-36.5	2.5	-38.8	-40.0	-38.6	-39.1	0.8
1.2% Vitamin E-TPGS	1 wk	-41.2	-40.2	-39.5	-40.3	0.9	-40.5	-42.2	-40.5	-41.1	1.0
	4 wk	-52.6	-52.8	-51.8	-52.4	0.5	-59.1	-59.4	-59.3	-59.3	0.2
1.2% Lipoid E80	24 hr	-38.2	-40.0	-36.8	-38.3	1.6	-40.1	-38.8	-40.7	-39.9	1.0
0.9% Vitamin E-TPGS	1 wk	-38.9	-40.1	-40.1	-39.7	0.7	-41.1	-41.1	-41.7	-41.3	0.3
	4 wk	-55.2	-52.2	-52.0	-53.1	1.8	-61.4	-58.8	-59.3	-59.8	1.4
1.2% Lipoid E80	24 hr	-39.3	-36.7	-39.0	-38.3	1.4	-39.0	-40.7	-41.1	-40.3	1.1
0.6% Vitamin E-TPGS	1 wk	-36.2	-35.8	-39.1	-37.0	1.8	-40.0	-39.6	-39.5	-39.7	0.3
	4 wk	-54.8	-55.4	-57.4	-55.9	1.4	-59.6	-63.2	-61.9	-61.6	1.8
1.2% Lipoid E80	24 hr	-36.7	-37.8	-39.2	-37.9	1.3	-38.7	-40.4	-38.8	-39.3	1.0
0.4% Vitamin E-TPGS	1 wk	-39.0	-39.4	-38.6	-39.0	0.4	-36.6	-40.4	-44.9	-40.6	4.2

Table a23. Osmolality of lipid emulsions formulated using 20% oil with various surfactants after storage at 25°C.

Formulation	Time	Osmolality (mOsm/kg)									
		Unautoclaved					Autoclaved				
		1	2	3	mean	S.D.	1	2	3	mean	S.D.
1.2% Lipoid E80	24 hr	388	392	392	391	2	398	393	391	394	4
1.2% Tween 80	1 wk	403	402	403	403	1	399	396	398	398	2
	4 wk	425	420	420	422	3	413	417	420	417	4
1.2% Lipoid E80	24 hr	386	386	386	386	0	387	386	386	386	1
0.9% Tween 80	1 wk	396	395	397	396	1	395	393	395	394	1
	4 wk	411	409	417	412	4	414	416	412	414	2
1.2% Lipoid E80	24 hr	383	381	386	383	3	379	382	379	380	2
0.6% Tween 80	1 wk	391	391	388	390	2	389	390	392	390	2
	4 wk	398	391	396	395	4	406	406	401	404	3
1.2% Lipoid E80	24 hr	386	374	374	378	7	379	378	379	379	1
1.2% Vitamin E-TPGS	1 wk	398	399	398	398	1	396	397	392	395	3
	4 wk	396	396	393	395	2	379	380	381	380	1
1.2% Lipoid E80	24 hr	370	370	368	369	1	374	373	376	374	2
0.9% Vitamin E-TPGS	1 wk	389	393	393	392	2	389	390	387	389	2
	4 wk	387	386	371	381	9	372	372	370	371	1
1.2% Lipoid E80	24 hr	370	372	371	371	1	373	374	373	373	1
0.6% Vitamin E-TPGS	1 wk	386	385	383	385	2	384	385	381	383	2
	4 wk	367	368	367	367	1	362	365	364	364	2
1.2% Lipoid E80	24 hr	370	369	373	371	2	371	371	373	372	1
0.4% Vitamin E-TPGS	1 wk	384	381	384	383	2	379	382	382	381	2

Table a24. pH of lipid emulsions formulated using 20% oil with various surfactants after storage at 25°C.

Formulation	Time	pH value									
		Unautoclaved					Autoclaved				
		1	2	3	mean	S.D.	1	2	3	mean	S.D.
1.2% Lipoid E80	24 hr	8.05	8.02	8.03	8.03	0.02	6.92	6.74	6.85	6.84	0.09
1.2% Tween 80	1 wk	6.52	6.15	6.30	6.32	0.19	6.86	6.80	6.83	6.83	0.03
	4 wk	6.13	6.23	6.34	6.23	0.11	6.50	6.61	6.67	6.59	0.09
1.2% Lipoid E80	24 hr	8.06	8.03	8.07	8.05	0.02	6.68	6.80	6.72	6.73	0.06
0.9% Tween 80	1 wk	5.74	6.40	5.81	5.98	0.36	6.53	6.69	6.69	6.64	0.09
	4 wk	6.16	5.10	6.26	5.84	0.64	6.67	6.50	6.71	6.63	0.11
1.2% Lipoid E80	24 hr	8.05	8.03	8.06	8.05	0.02	6.51	6.73	6.65	6.63	0.11
0.6% Tween 80	1 wk	6.36	6.36	6.46	6.39	0.06	6.74	6.74	6.80	6.76	0.03
	4 wk	6.10	6.05	6.11	6.09	0.03	6.55	6.62	6.67	6.61	0.06
1.2% Lipoid E80	24 hr	8.06	8.06	8.04	8.05	0.01	6.71	6.68	6.63	6.67	0.04
1.2% Vitamin E-TPGS	1 wk	6.52	6.70	6.50	6.57	0.11	6.62	6.55	6.61	6.59	0.04
	4 wk	6.67	6.74	6.70	6.70	0.04	6.50	6.51	6.48	6.50	0.02
1.2% Lipoid E80	24 hr	8.05	8.07	8.05	8.06	0.01	6.67	6.69	6.69	6.68	0.01
0.9% Vitamin E-TPGS	1 wk	6.74	6.86	6.63	6.74	0.12	6.69	6.70	6.72	6.70	0.02
	4 wk	6.53	6.39	6.44	6.45	0.07	6.63	6.65	6.59	6.62	0.03
1.2% Lipoid E80	24 hr	8.06	8.07	8.06	8.06	0.01	7.07	6.97	6.87	6.97	0.10
0.6% Vitamin E-TPGS	1 wk	6.59	6.53	6.52	6.55	0.04	6.74	6.66	6.69	6.70	0.04
	4 wk	6.56	6.48	6.63	6.56	0.08	6.66	6.55	6.67	6.63	0.07
1.2% Lipoid E80	24 hr	8.00	8.06	8.05	8.04	0.03	6.75	6.71	6.81	6.76	0.05
0.4% Vitamin E-TPGS	1 wk	6.45	6.45	6.49	6.46	0.02	6.60	6.58	6.59	6.59	0.01

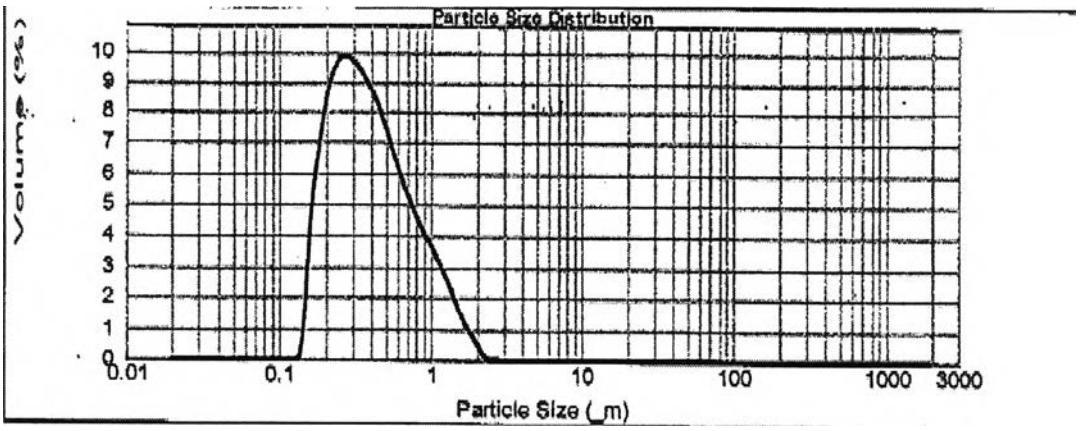


Figure a1. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C50 for 3 cycles.

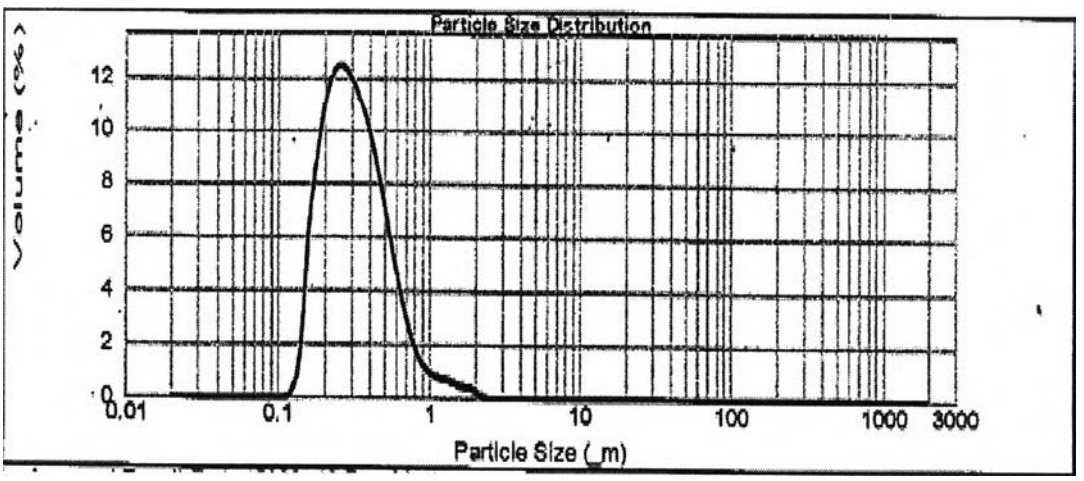


Figure a2. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C50 for 5 cycles.

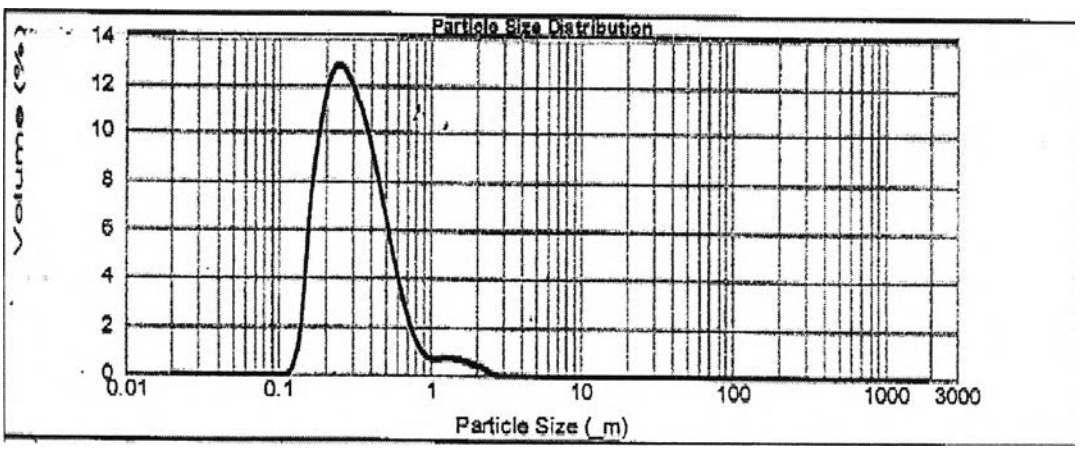


Figure a3. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C50 for 7 cycles.

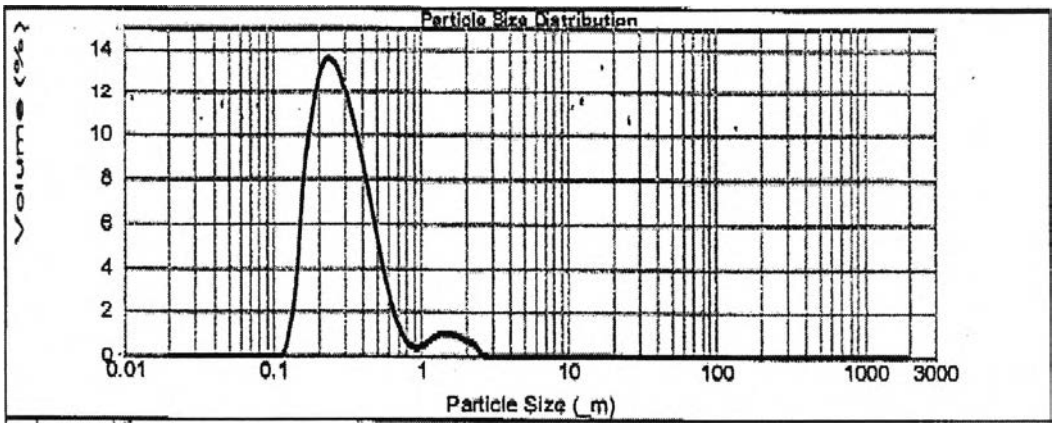


Figure a4. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C50 for 10 cycles.

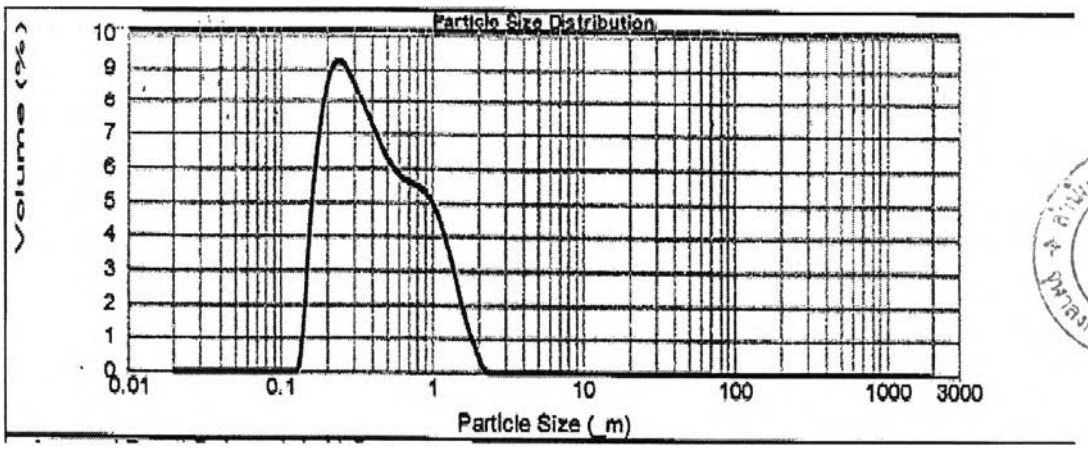


Figure a5. Particle size distribution of 10% oil+EPC + Na oleate unautoclaved emulsion passing Emulsiflex C50 for 3 cycle.

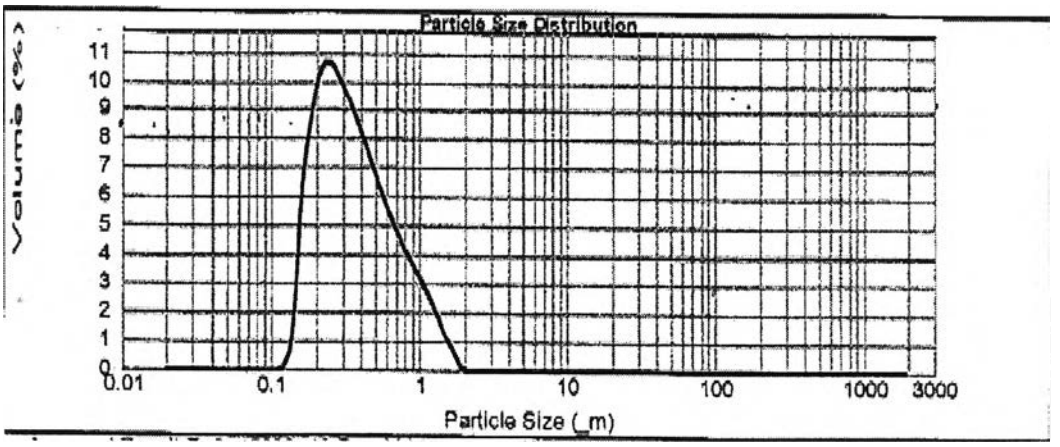


Figure a6. Particle size distribution of 10% oil+EPC + Na oleate unautoclaved emulsion passing Emulsiflex C50 for 5 cycles.

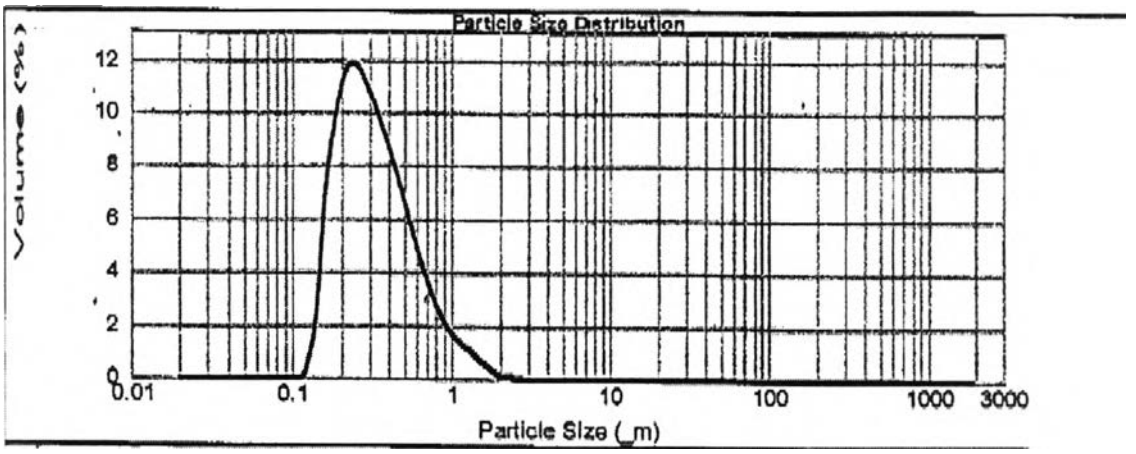


Figure a7. Particle size distribution of 10% oil+EPC + Na oleate unautoclaved emulsion passing Emulsiflex C50 for 7 cycles.

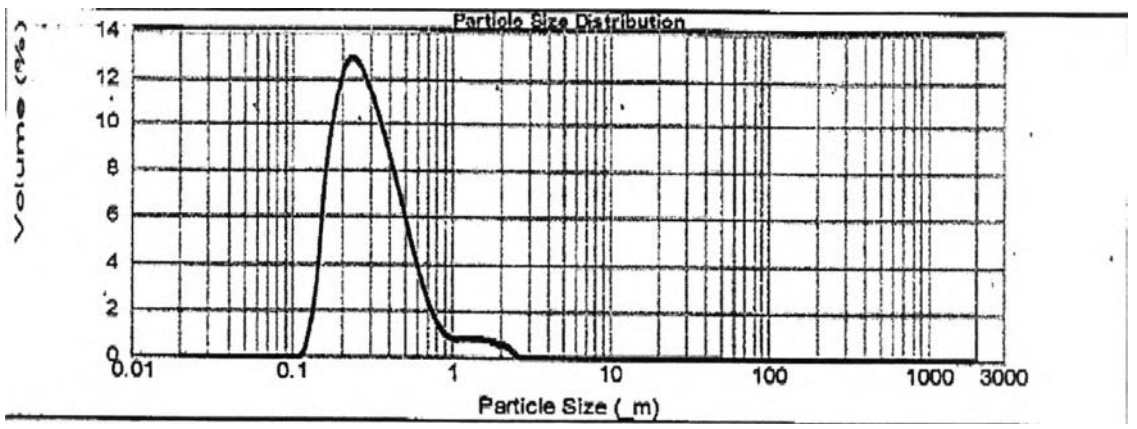


Figure a8. Particle size distribution of 10% oil+EPC + Na oleate unautoclaved emulsion passing Emulsiflex C50 for 10 cycles.

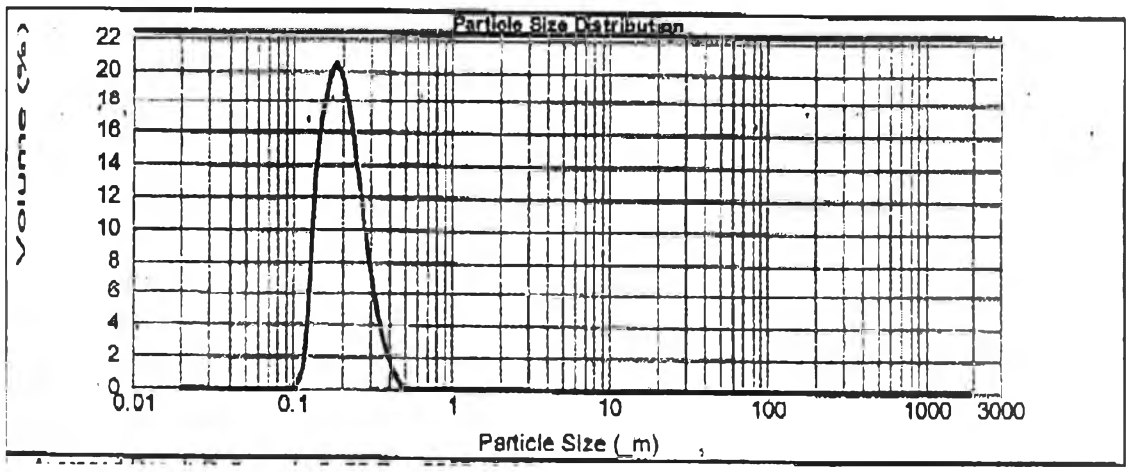


Figure a9. Particle size distribution of 10% oil+EPC + Tween 80 unautoclaved emulsion passing Emulsiflex C50 for 3 cycles.

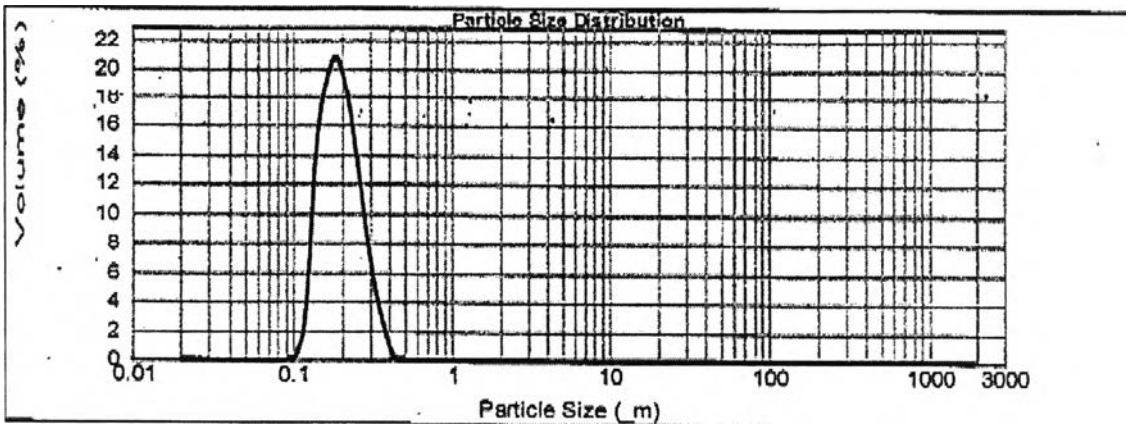


Figure a10. Particle size distribution of 10% oil+EPC + Tween 80 unautoclaved emulsion passing Emulsiflex C50 for 5 cycles.

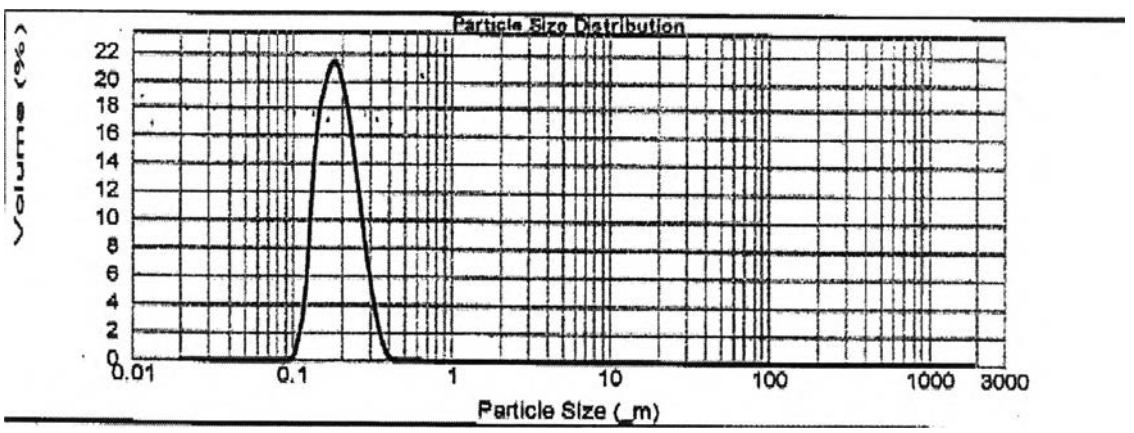


Figure a11. Particle size distribution of 10% oil+EPC + Tween 80 unautoclaved emulsion passing Emulsiflex C50 for 7 cycles.

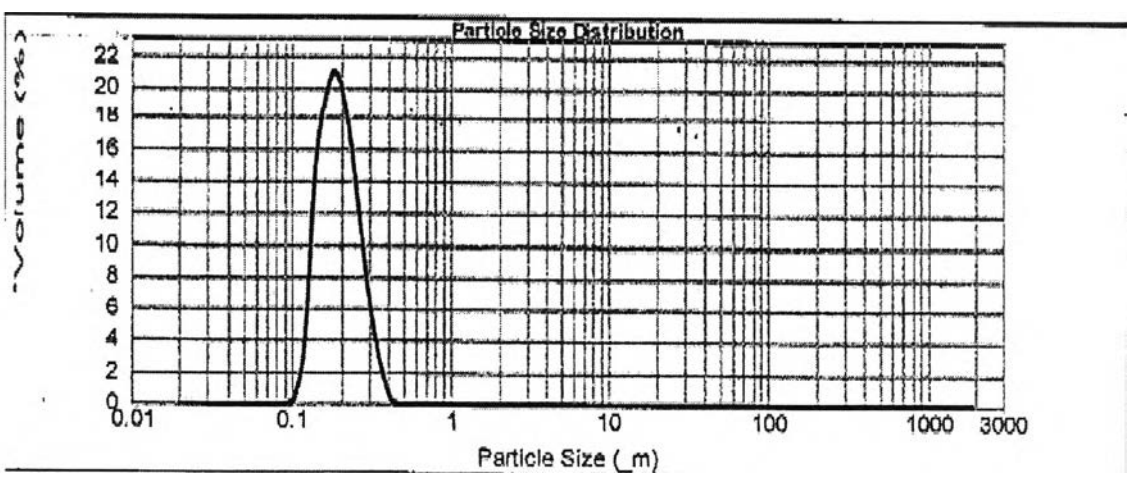


Figure a12. Particle size distribution of 10% oil+EPC + Tween 80 unautoclaved emulsion passing Emulsiflex C50 for 10 cycles.

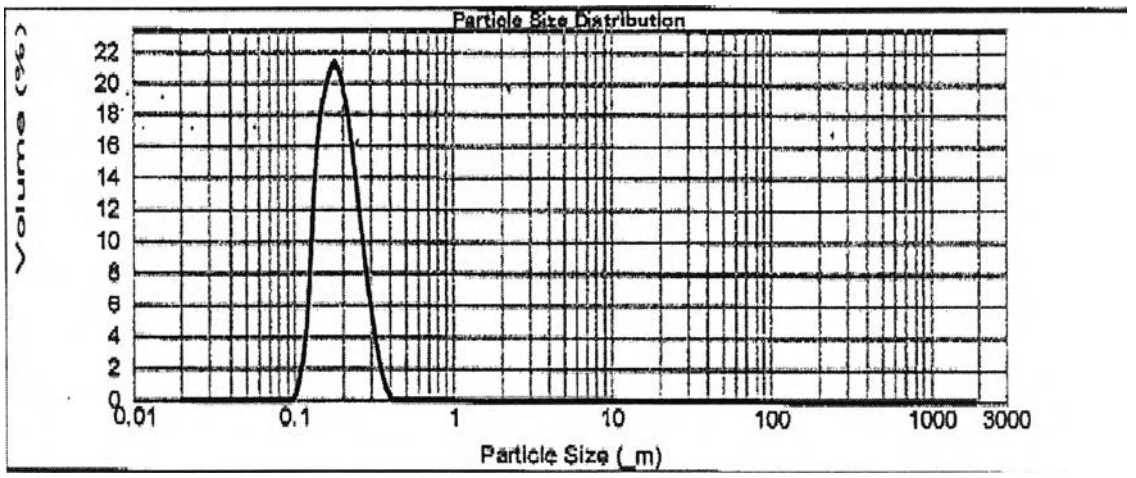


Figure a13. Particle size distribution of 10% oil+EPC + Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C50 for 3 cycles.

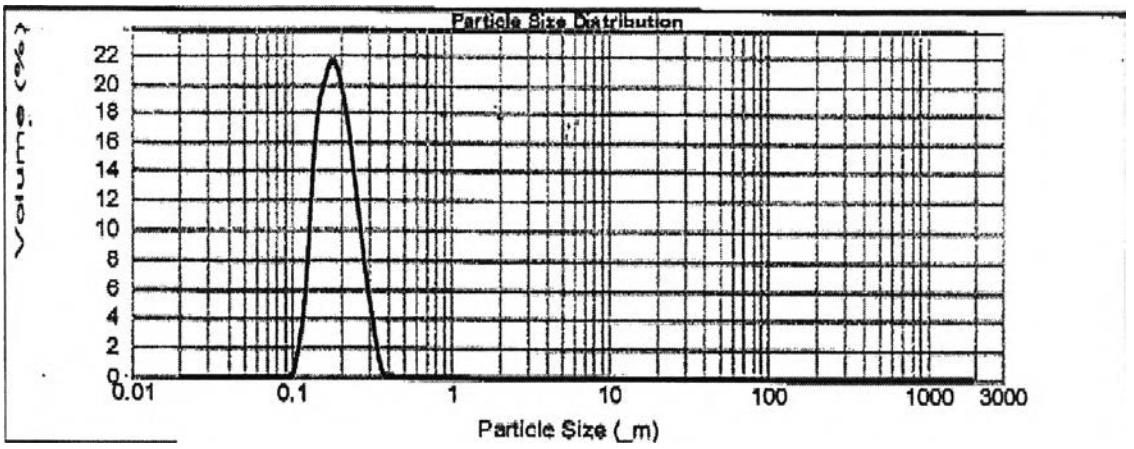


Figure a14. Particle size distribution of 10% oil+EPC + Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C50 for 5 cycles.

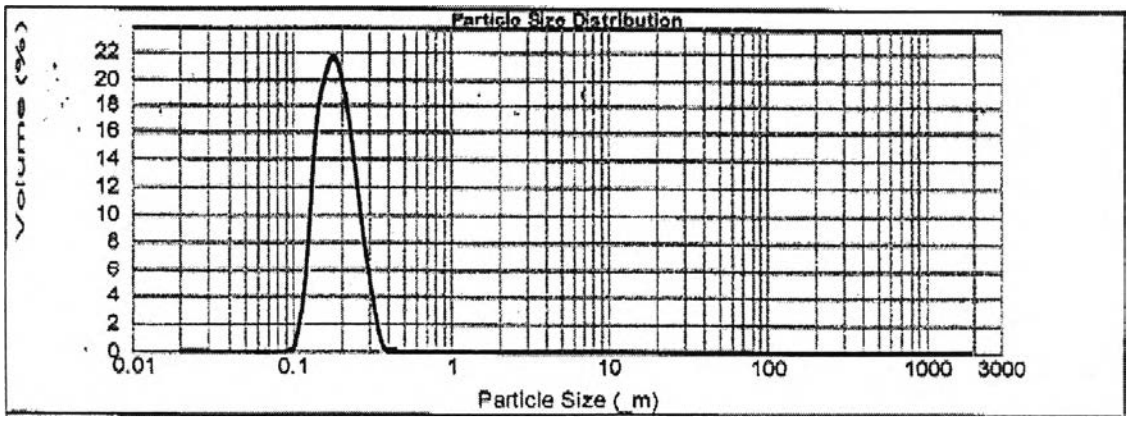


Figure a15. Particle size distribution of 10% oil+EPC + Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C50 for 7 cycles.

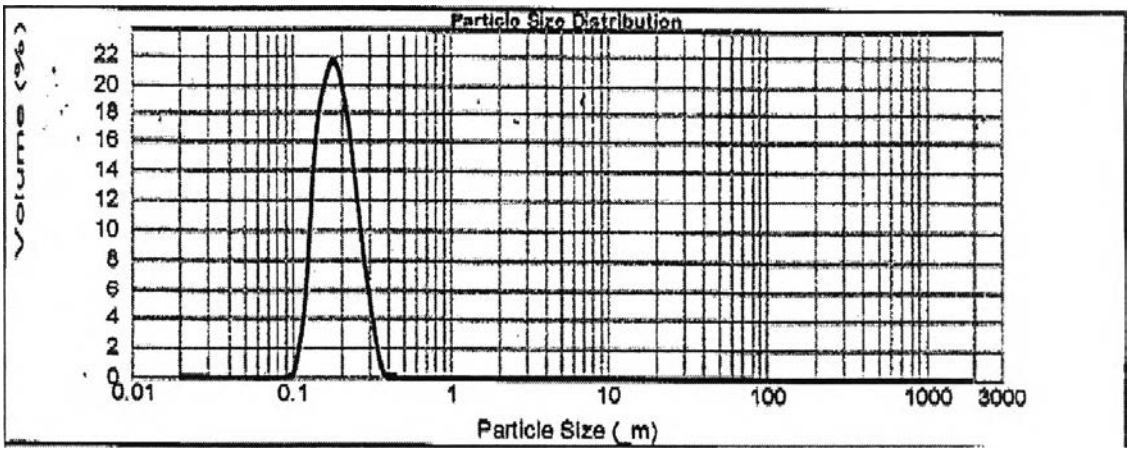


Figure a16. Particle size distribution of 10% oil+EPC + Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C50 for 10 cycles.

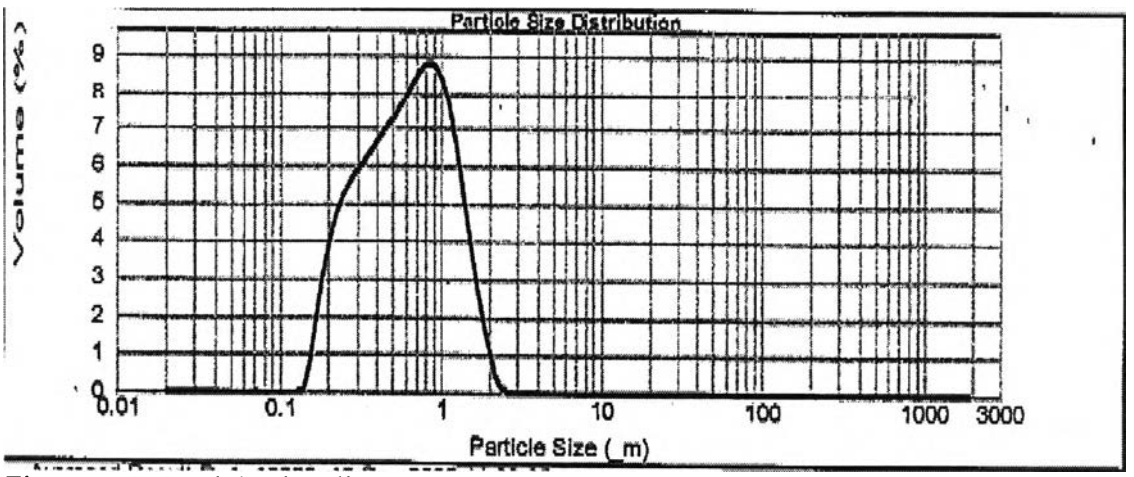


Figure a17. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C50 at 10,000 psi for 5 cycles.

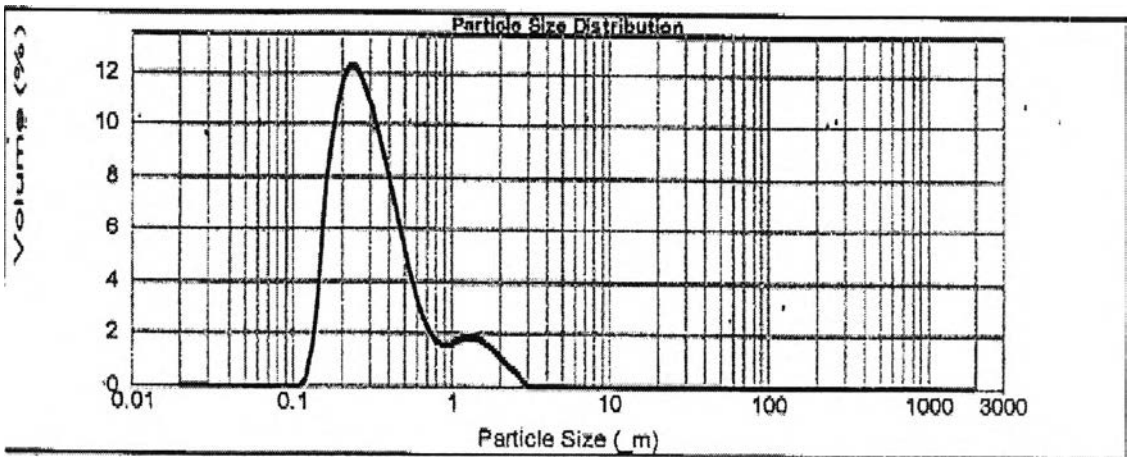


Figure a18. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C50 at 20,000 psi for 5 cycles.

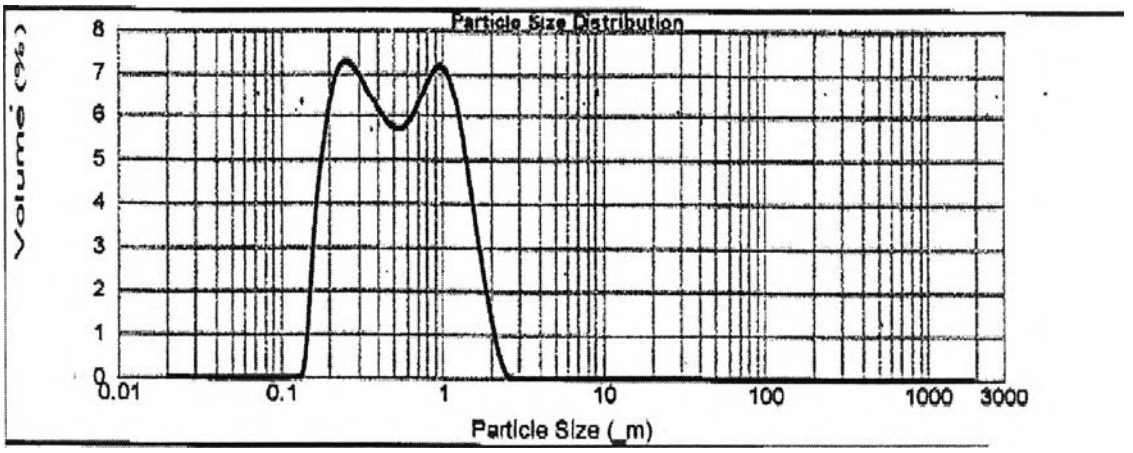


Figure a19. Particle size distribution of 10% oil+EPC + Na oleate unautoclaved emulsion passing Emulsiflex C50 at 10,000 psi for 5 cycles.

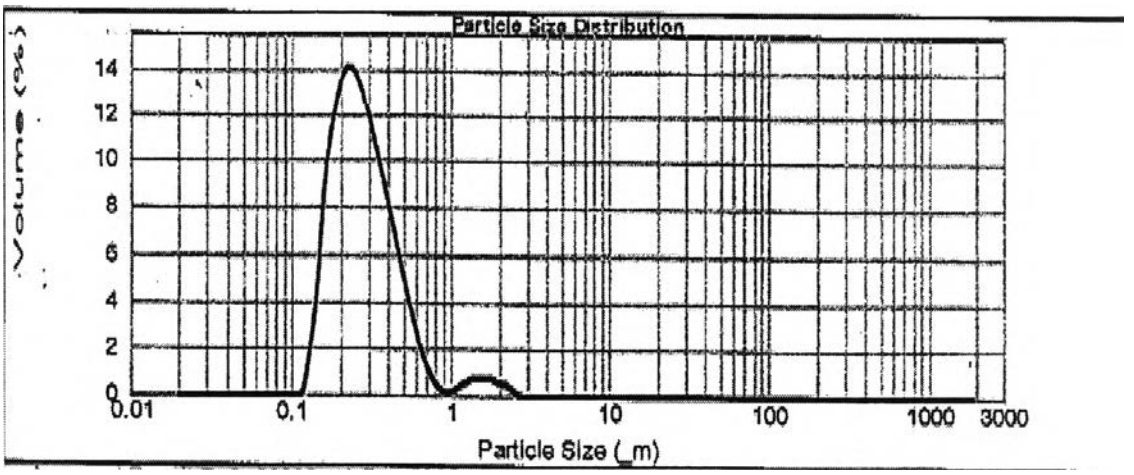


Figure a20. Particle size distribution of 10% oil+EPC+ Na oleate unautoclaved emulsion passing Emulsiflex C50 at 20,000 psi for 5 cycles.

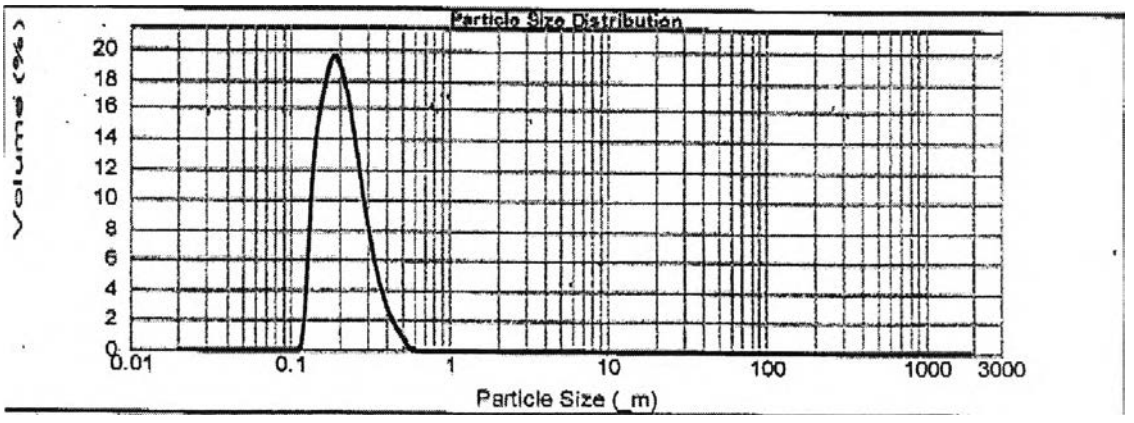


Figure a21. Particle size distribution of 10% oil+EPC+Tween 80 unautoclaved emulsion passing Emulsiflex C50 at 10,000 psi for 5 cycles.

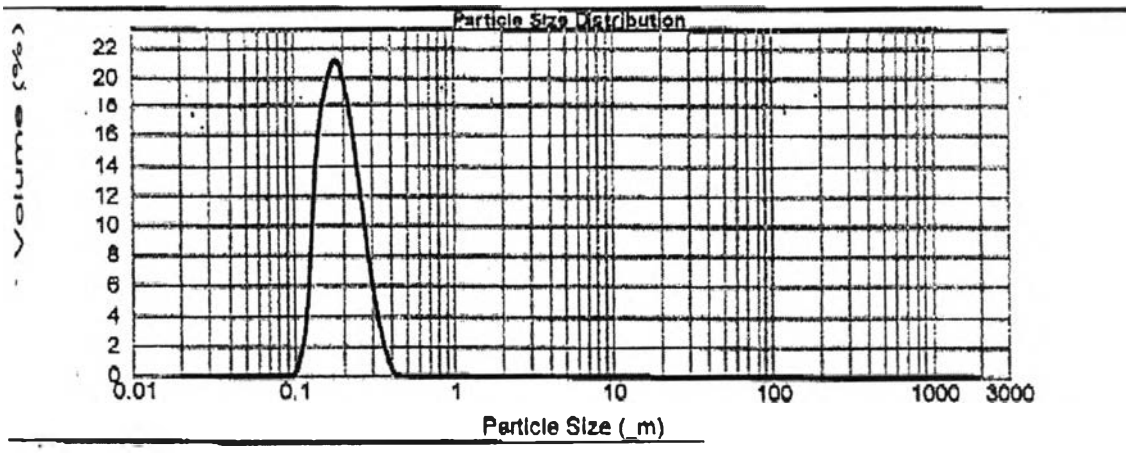


Figure a22. Particle size distribution of 10% oil+EPC+Tween 80 unautoclaved emulsion passing Emulsiflex C50 at 20,000 psi for 5 cycles.

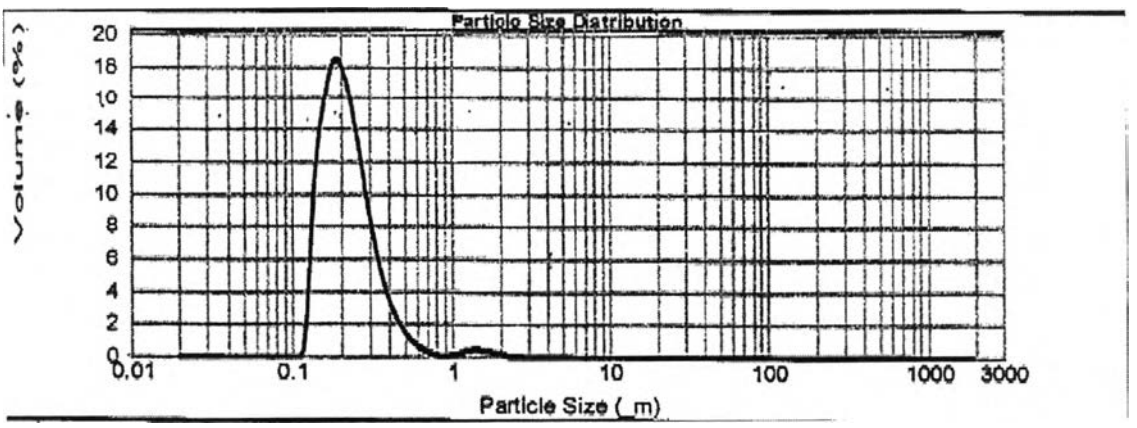


Figure a23. Particle size distribution of 10% oil+EPC+Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C50 at 10,000 psi for 5 cycles.

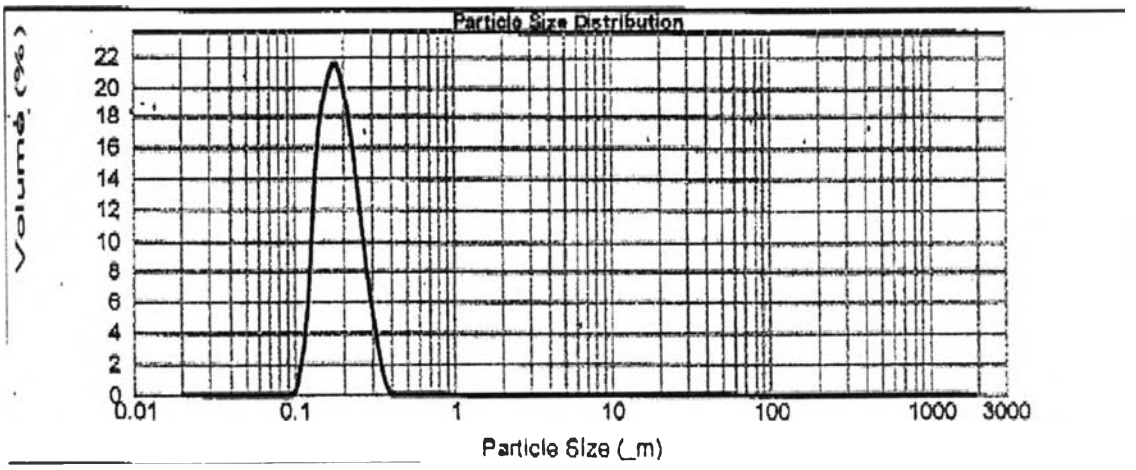


Figure a24. Particle size distribution of 10% oil+EPC+Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C50 at 20,000 psi for 5 cycles.

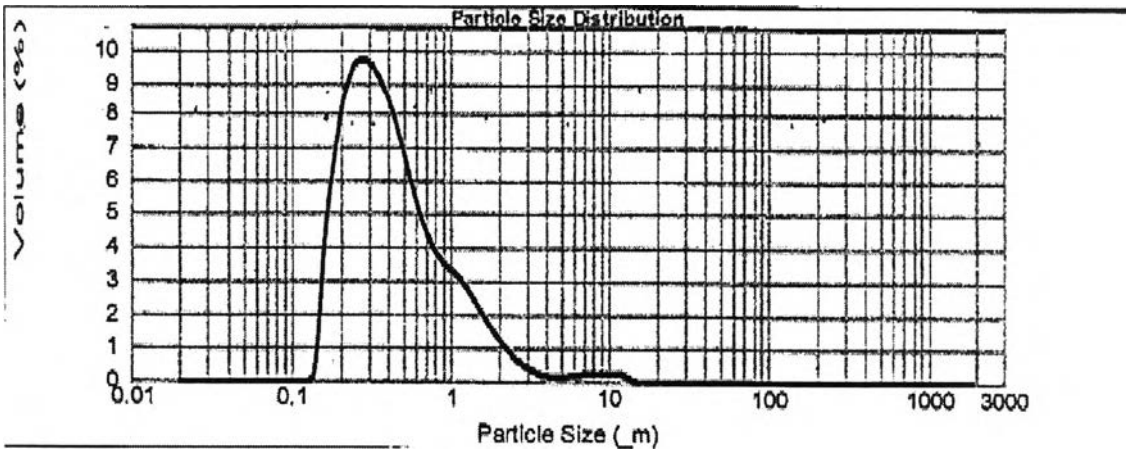


Figure a25. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C5 for 3 cycles.

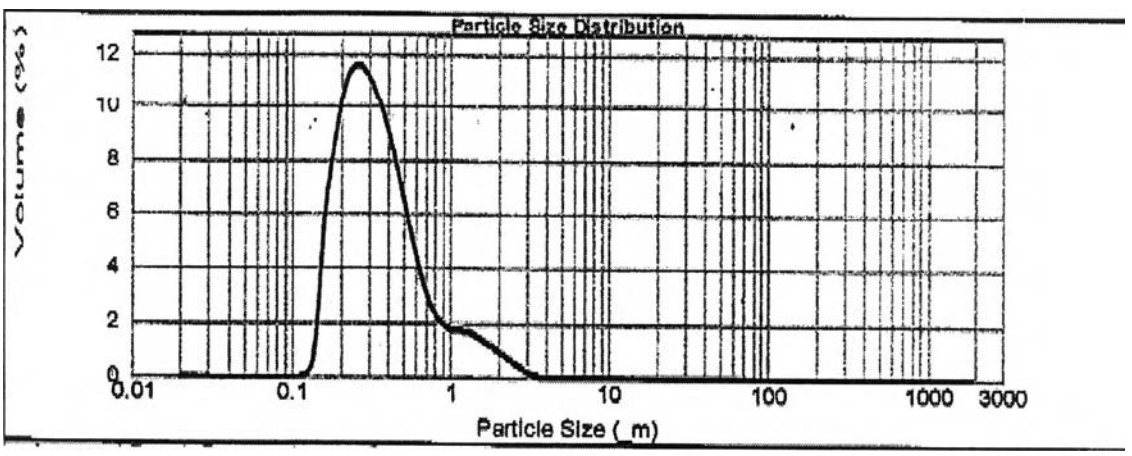


Figure a26. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C5 for 5 cycles.

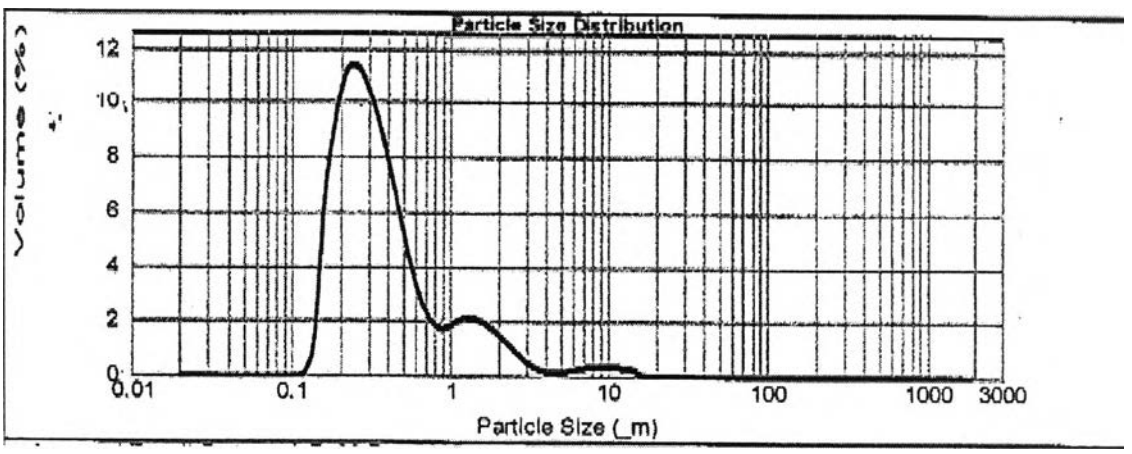


Figure a27. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C5 for 7 cycles.

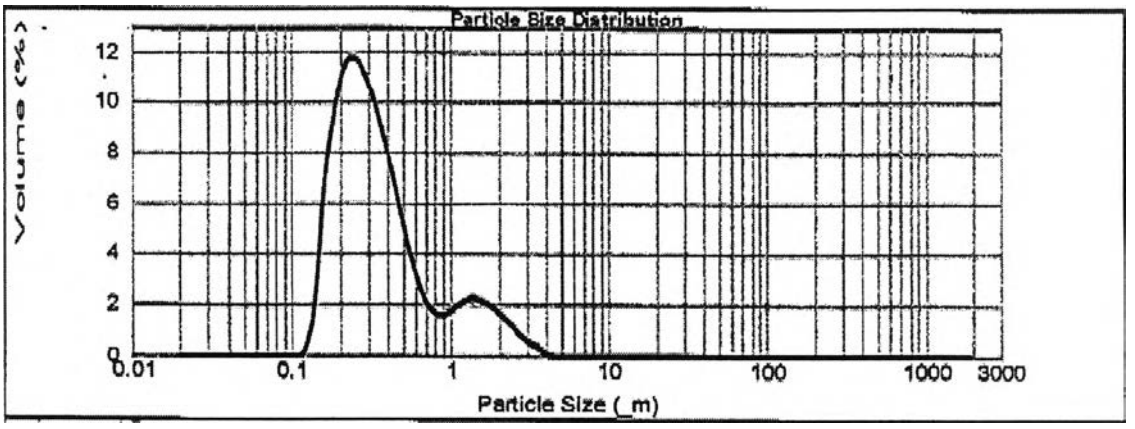


Figure a28. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C5 for 10 cycles.

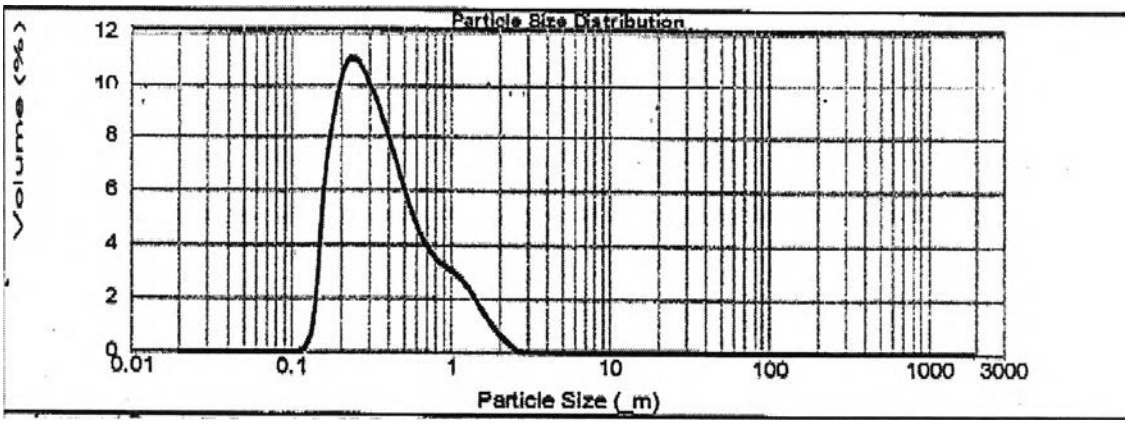


Figure a29. Particle size distribution of 10% oil+EPC+Na oleate unautoclaved emulsion passing Emulsiflex C5 for 3 cycles.

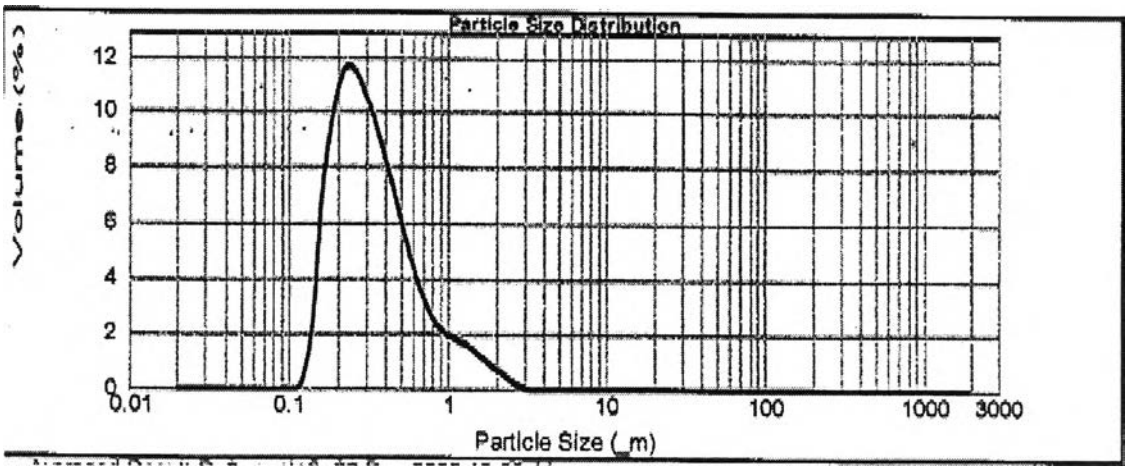


Figure a30. Particle size distribution of 10% oil+EPC+Na Oleate unautoclaved emulsion passing Emulsiflex C5 for 5 cycles.

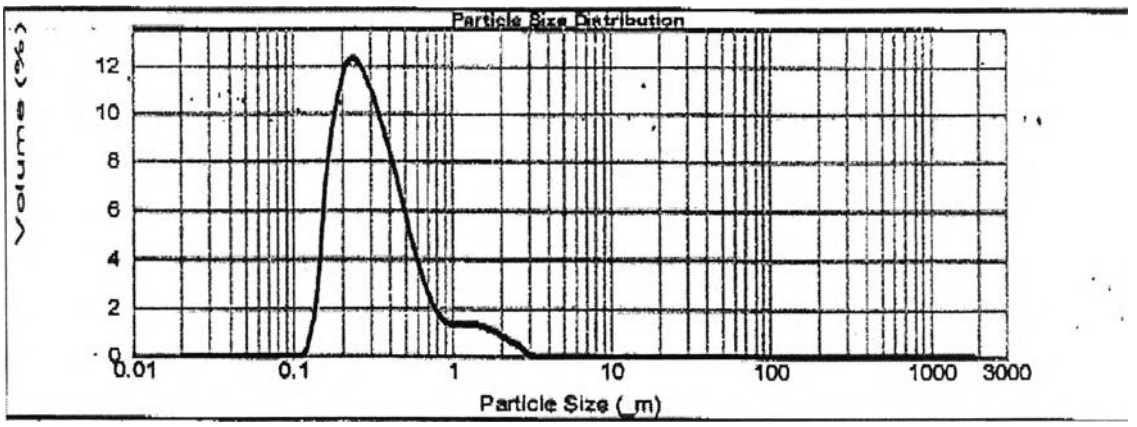


Figure a31. Particle size distribution of 10% oil+EPC+Na Oleate unautoclaved emulsion passing Emulsiflex C5 for 7 cycles.

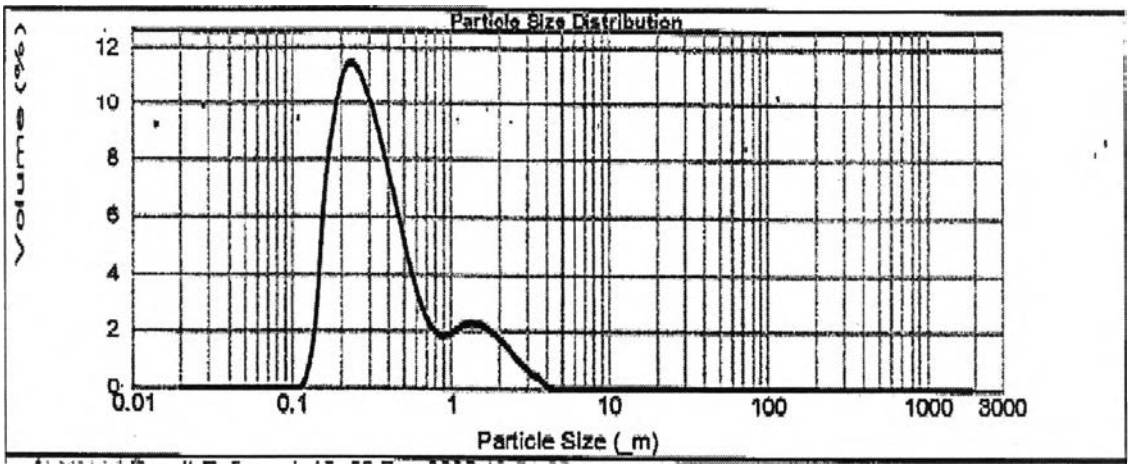


Figure a32. Particle size distribution of 10% oil+EPC+Na Oleate unautoclaved emulsion passing Emulsiflex C5 for 10 cycles.

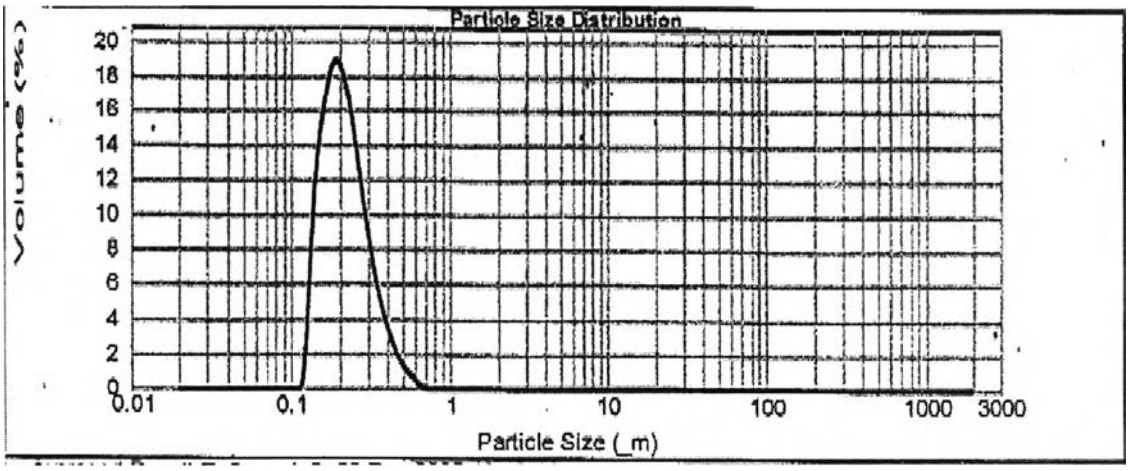


Figure a33. Particle size distribution of 10% oil+EPC+Tween 80 unautoclaved emulsion passing Emulsiflex C5 for 3 cycles.

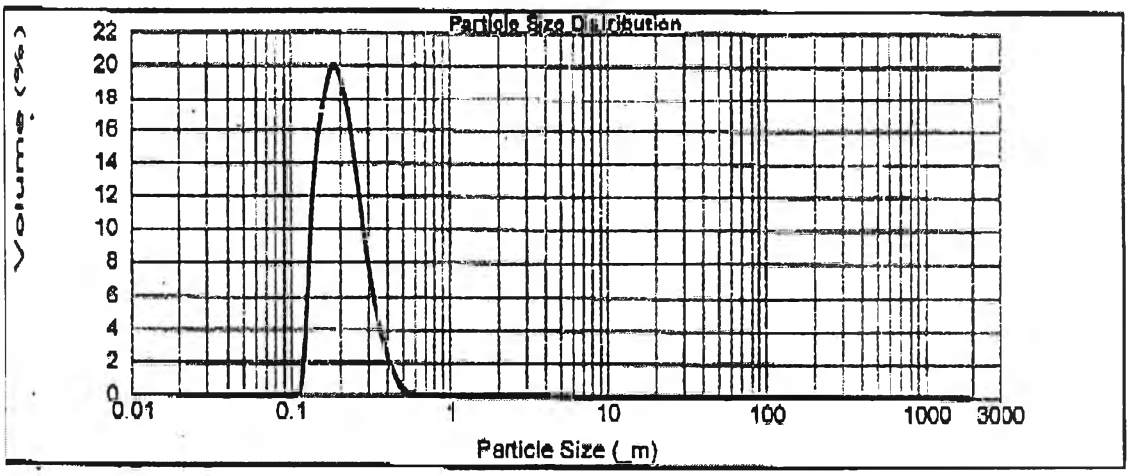


Figure a34. Particle size distribution of 10% oil+EPC+Tween 80 unautoclaved emulsion passing Emulsiflex C5 for 5 cycles.

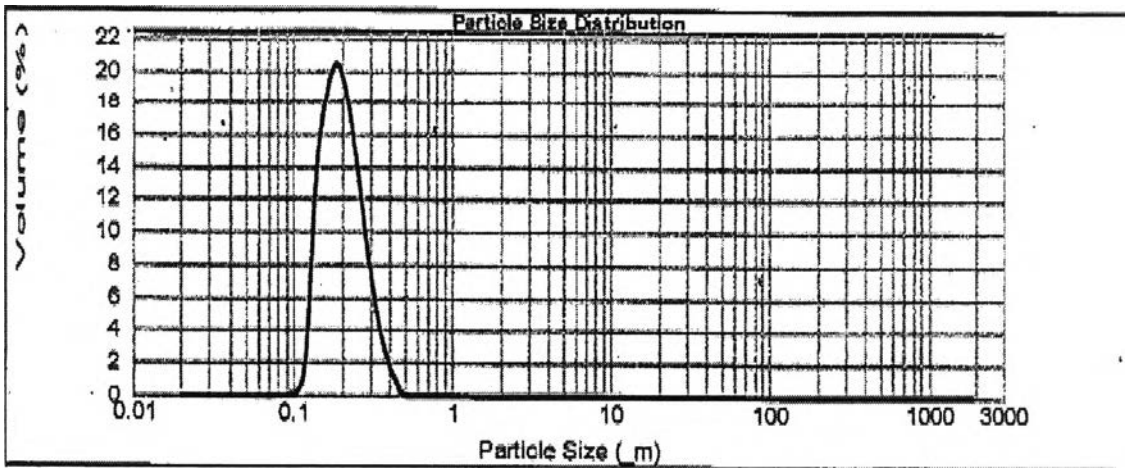


Figure a35. Particle size distribution of 10% oil+EPC+Tween 80 unautoclaved emulsion passing Emulsiflex C5 for 7 cycles.

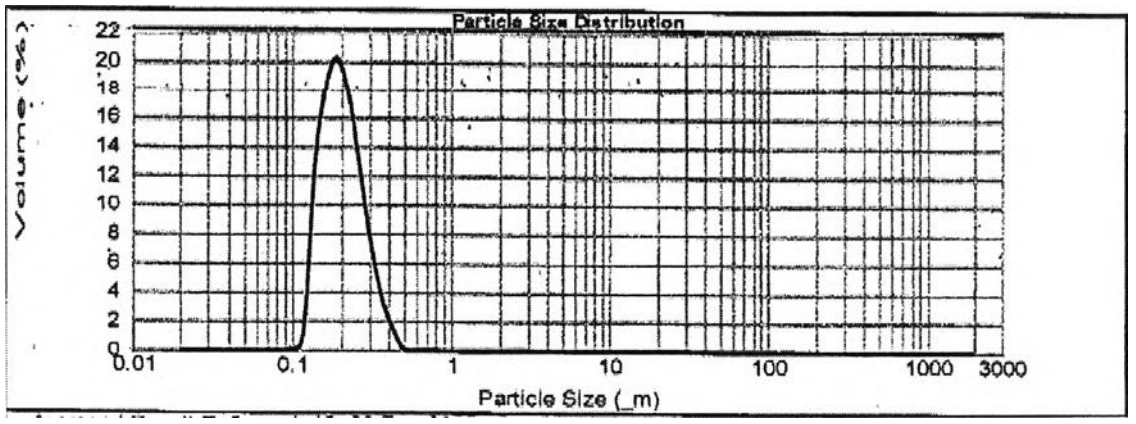


Figure a36. Particle size distribution of 10% oil+EPC+Tween 80 unautoclaved emulsion passing Emulsiflex C5 for 10 cycles.

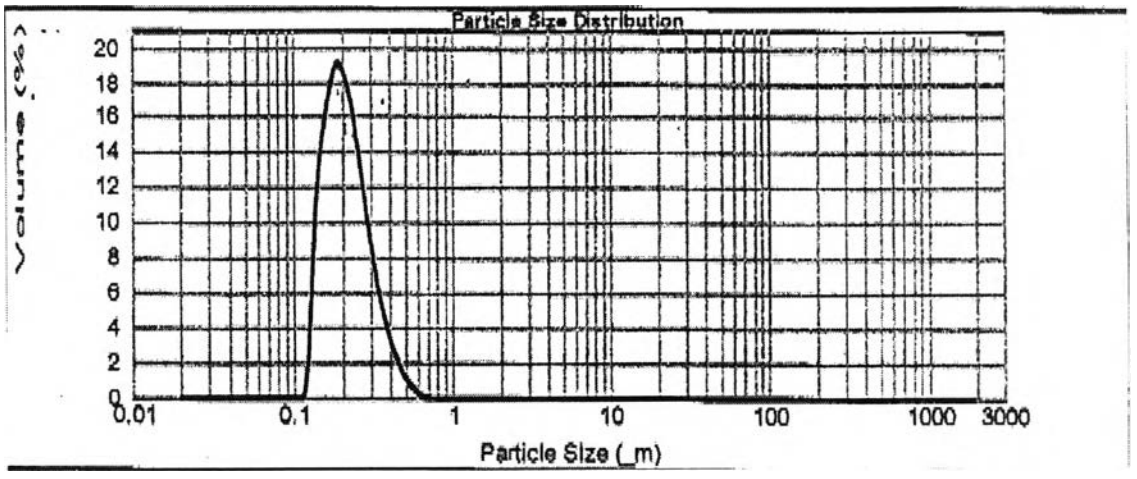


Figure a37. Particle size distribution of 10% oil+EPC+Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C5 for 3 cycles.

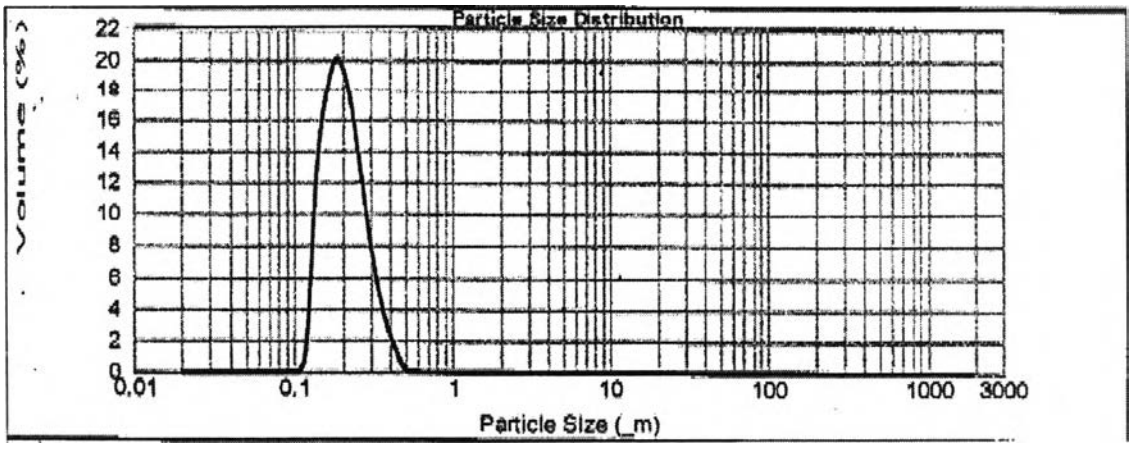


Figure a38. Particle size distribution of 10% oil+EPC+Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C5 for 5 cycles.

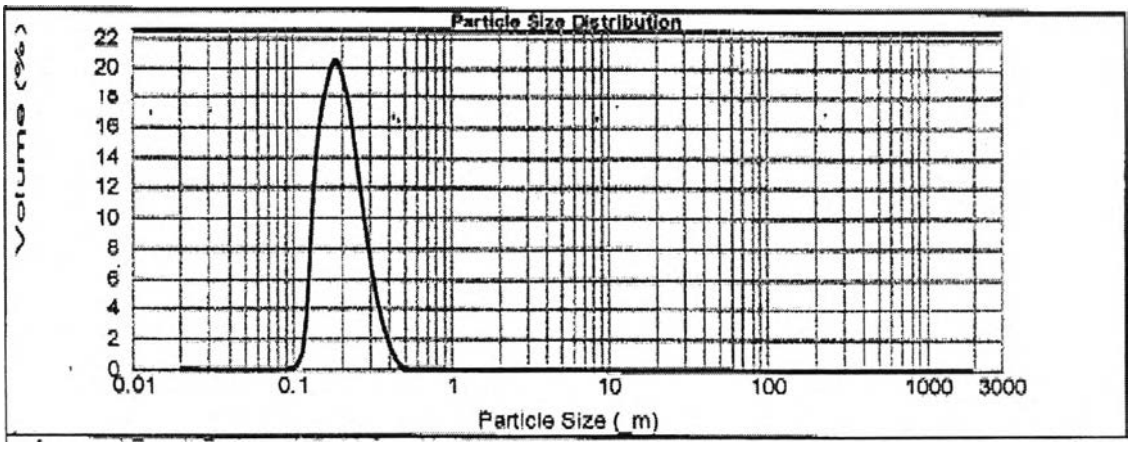


Figure a39. Particle size distribution of 10% oil+EPC+Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C5 for 7 cycles.

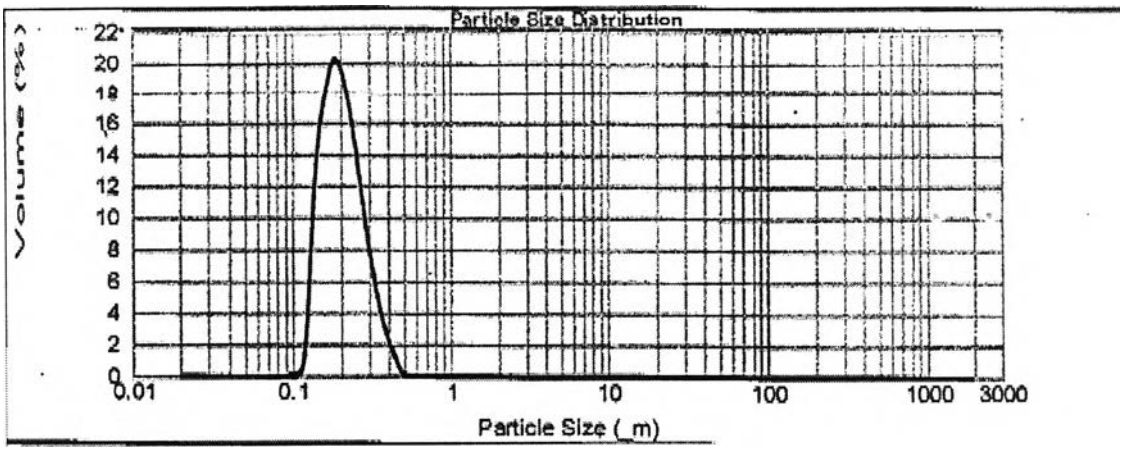


Figure a40. Particle size distribution of 10% oil+EPC+Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C5 for 10 cycles.

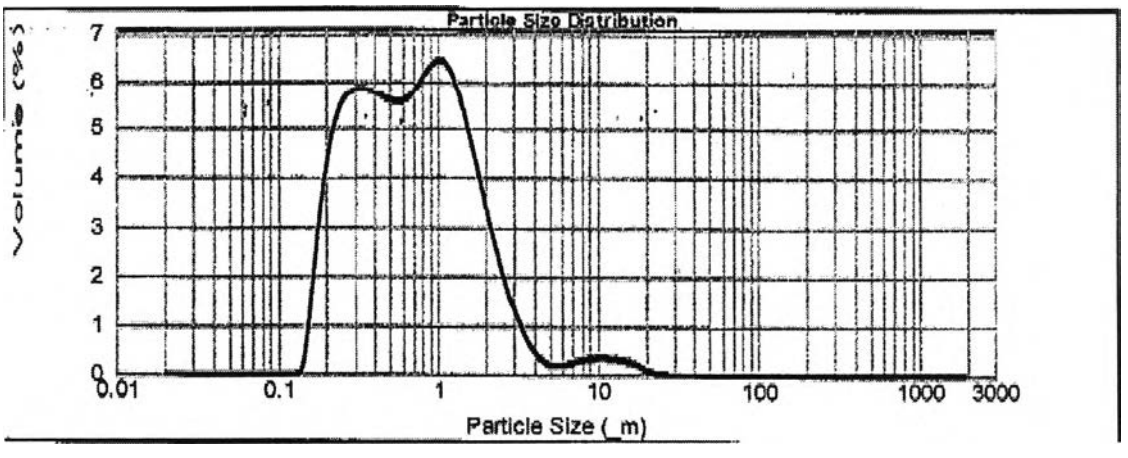


Figure a41. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C5 at 10,000 psi for 5 cycles.

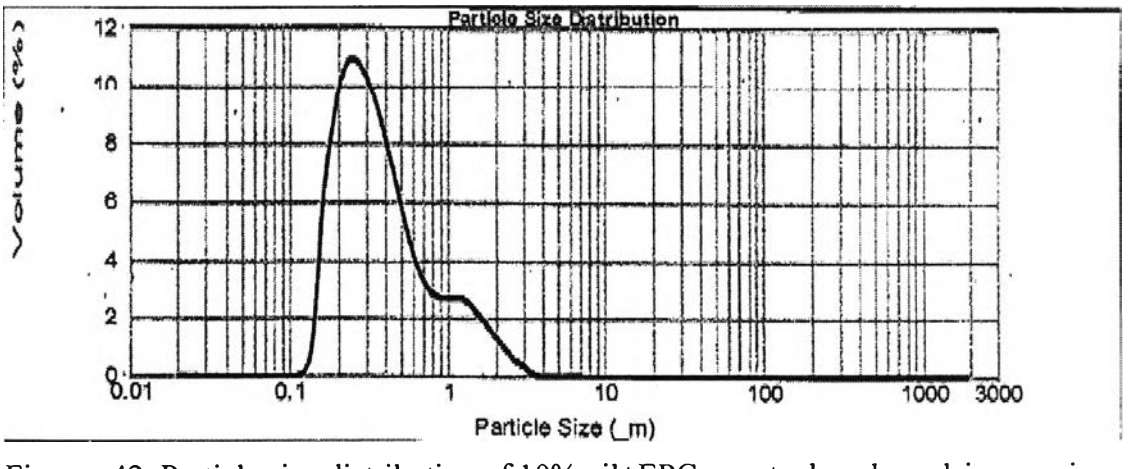


Figure a42. Particle size distribution of 10% oil+EPC unautoclaved emulsion passing Emulsiflex C5 at 20,000 psi for 5 cycles.

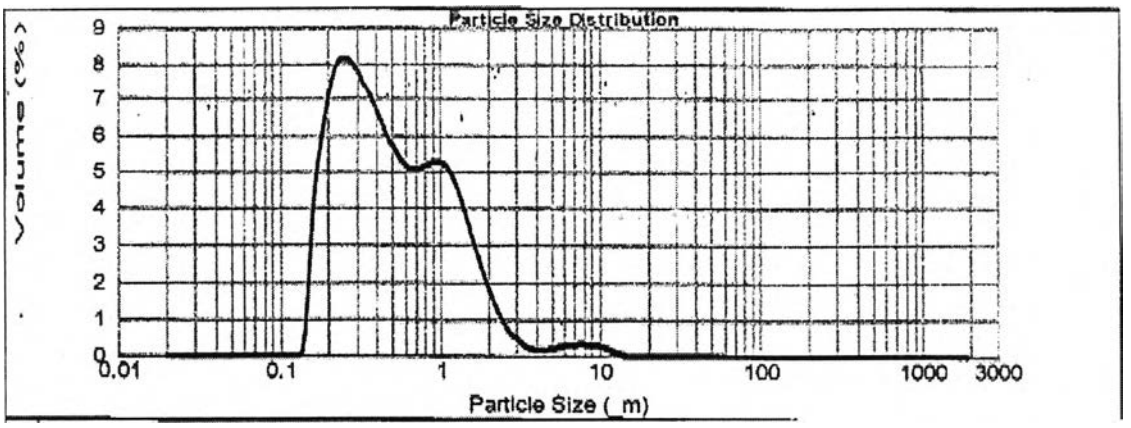


Figure a43. Particle size distribution of 10% oil+EPC+Na oleate unautoclaved emulsion passing Emulsiflex C5 at 10,000 psi for 5 cycles.

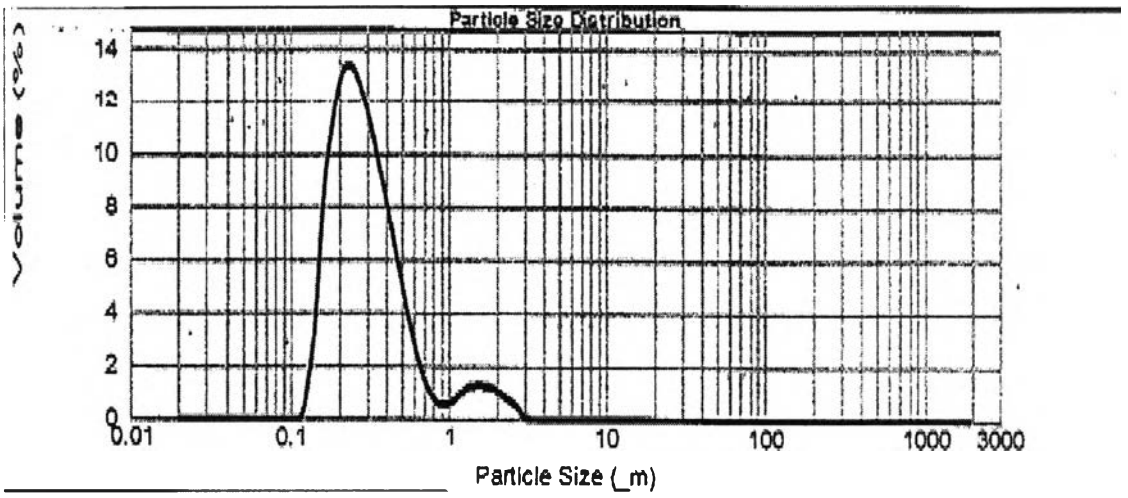


Figure a44. Particle size distribution of 10% oil+EPC+Na oleate unautoclaved emulsion passing Emulsiflex C5 at 20,000 psi for 5 cycles.

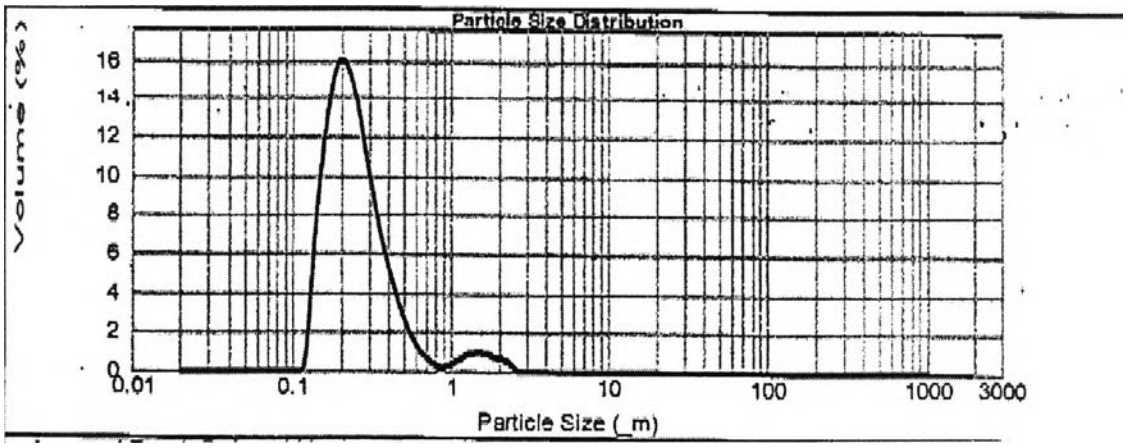


Figure a45. Particle size distribution of 10% oil+EPC+Tween 80 unautoclaved emulsion passing Emulsiflex C5 at 10,000 psi for 5 cycles.

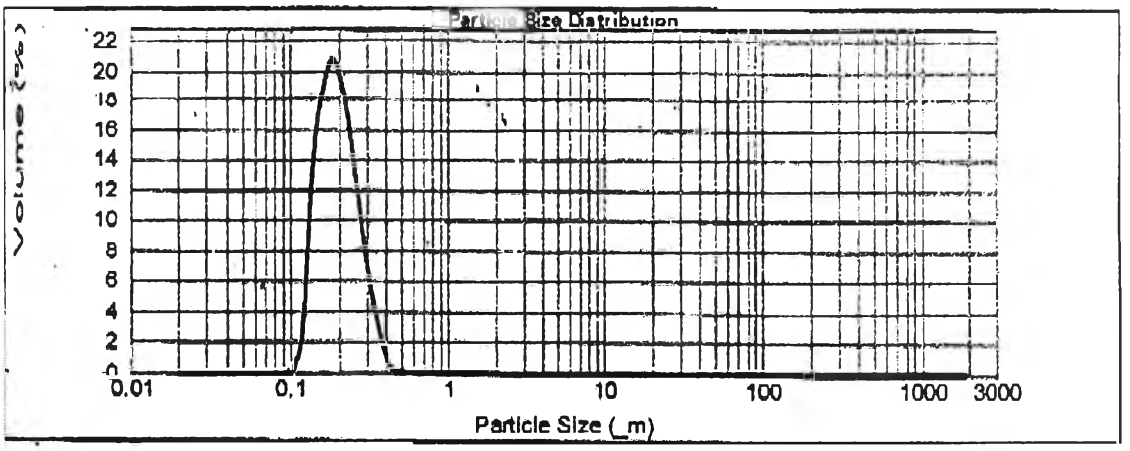


Figure a46. Particle size distribution of 10% oil+EPC+Tween 80 unautoclaved emulsion passing Emulsiflex C5 at 20,000 psi for 5 cycles.

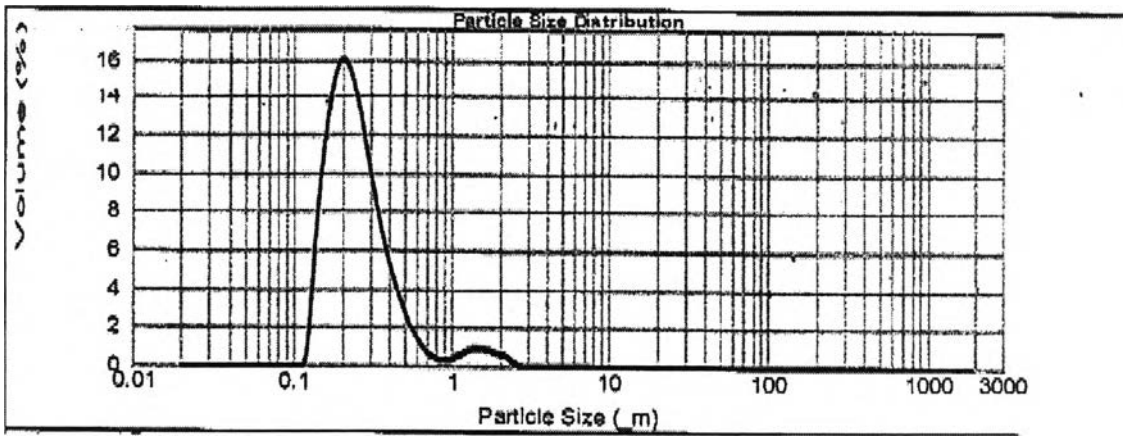


Figure a47. Particle size distribution of 10% oil+EPC+Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C5 at 10,000 psi for 5 cycles.

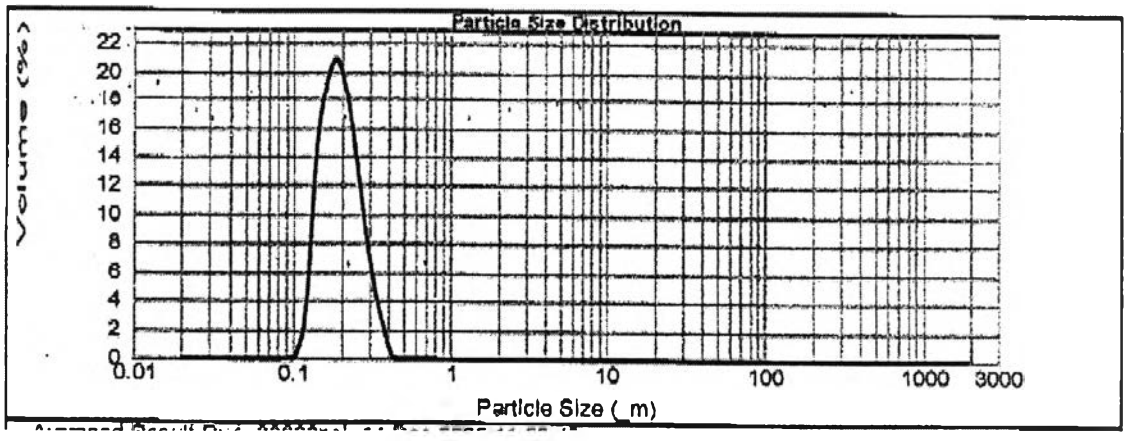


Figure a48. Particle size distribution of 10% oil+EPC+Vitamin E-TPGS unautoclaved emulsion passing Emulsiflex C5 at 20,000 psi for 5 cycles.

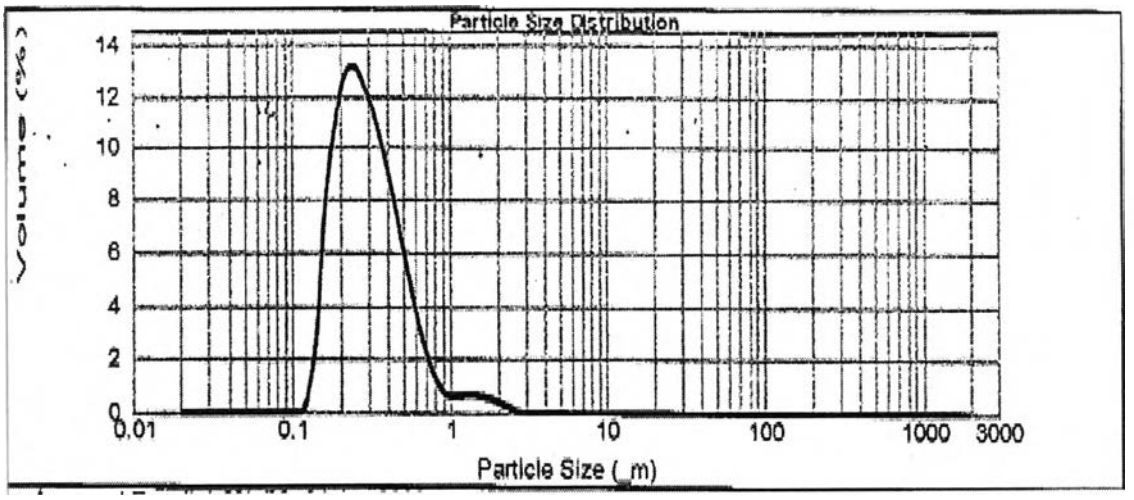


Figure a49. Particle size distribution of Rx1 unautoclaved emulsion.

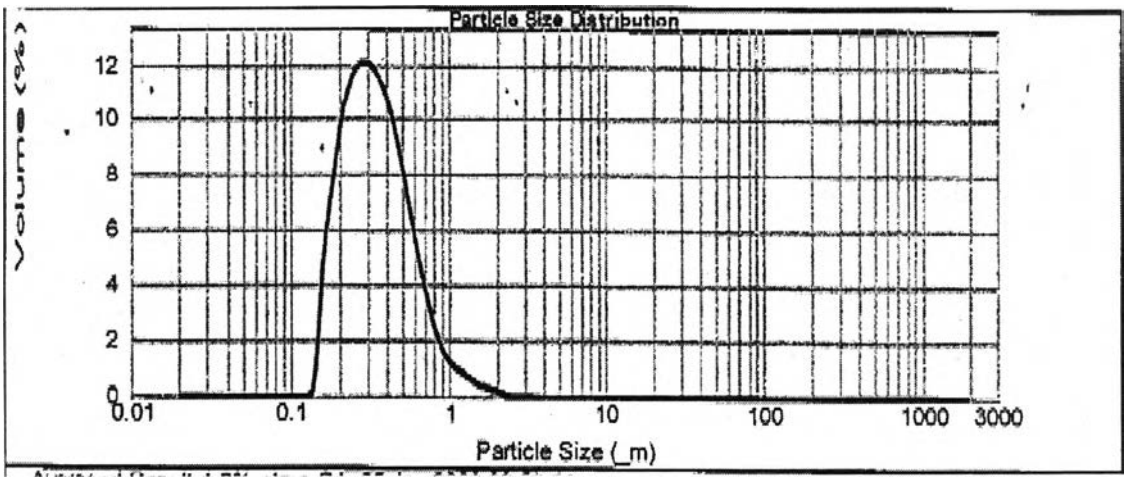


Figure a50. Particle size distribution of Rx1 autoclaved emulsion.

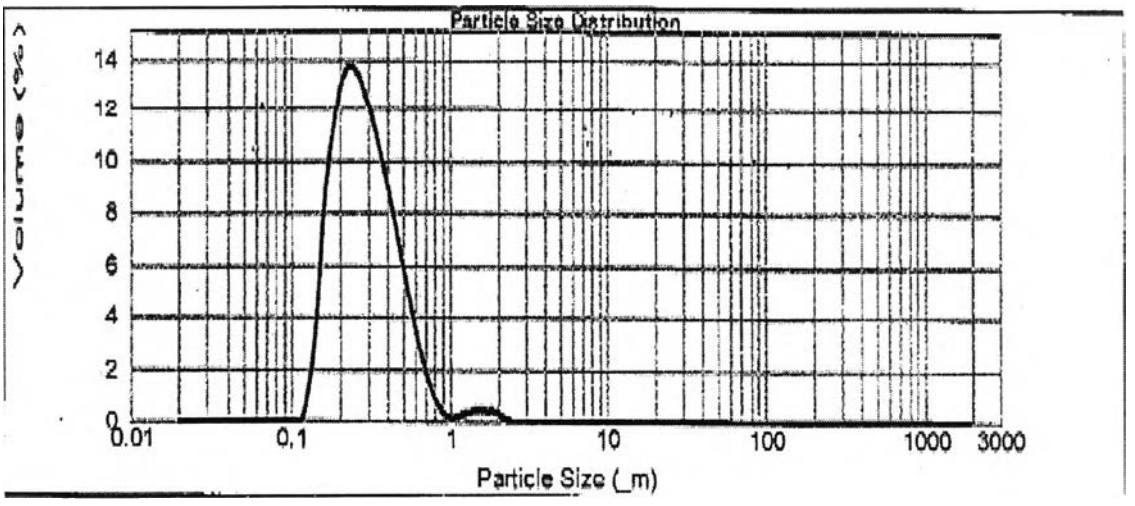


Figure a51. Particle size distribution of Rx2 unautoclaved emulsion.

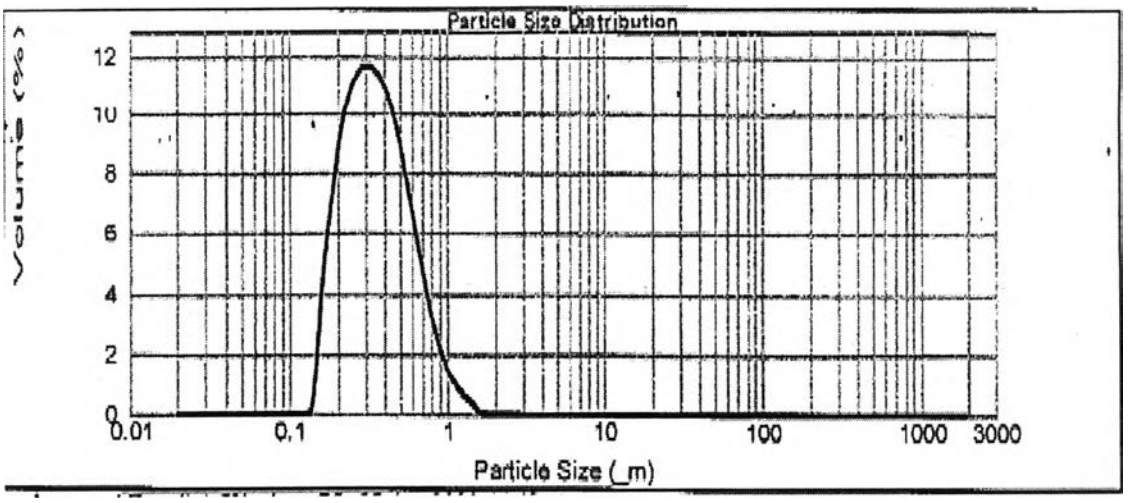


Figure a52. Particle size distribution of Rx2 autoclaved emulsion.

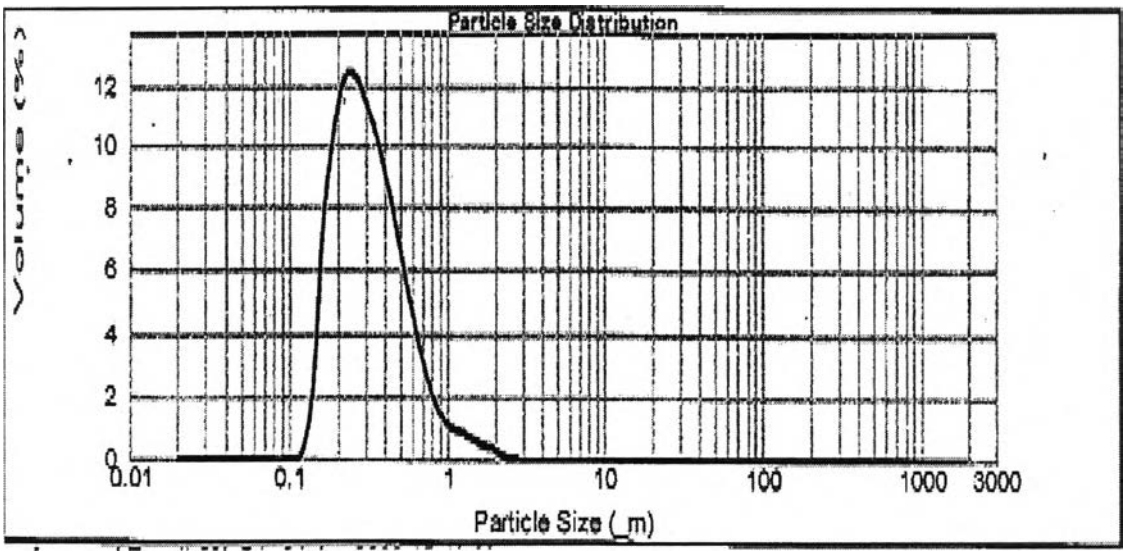


Figure a53. Particle size distribution of Rx3 unautoclaved emulsion.

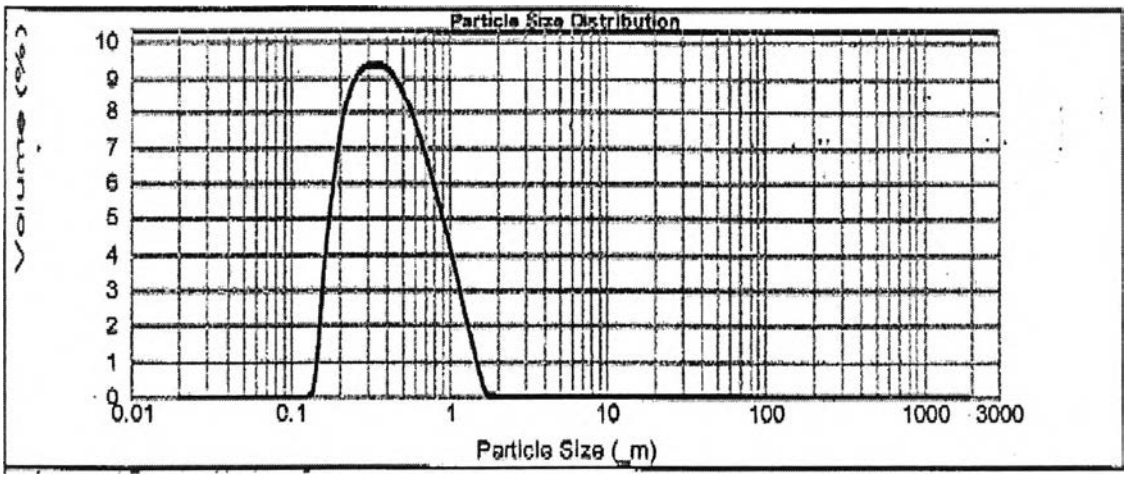


Figure a54. Particle size distribution of Rx3 autoclaved emulsion.

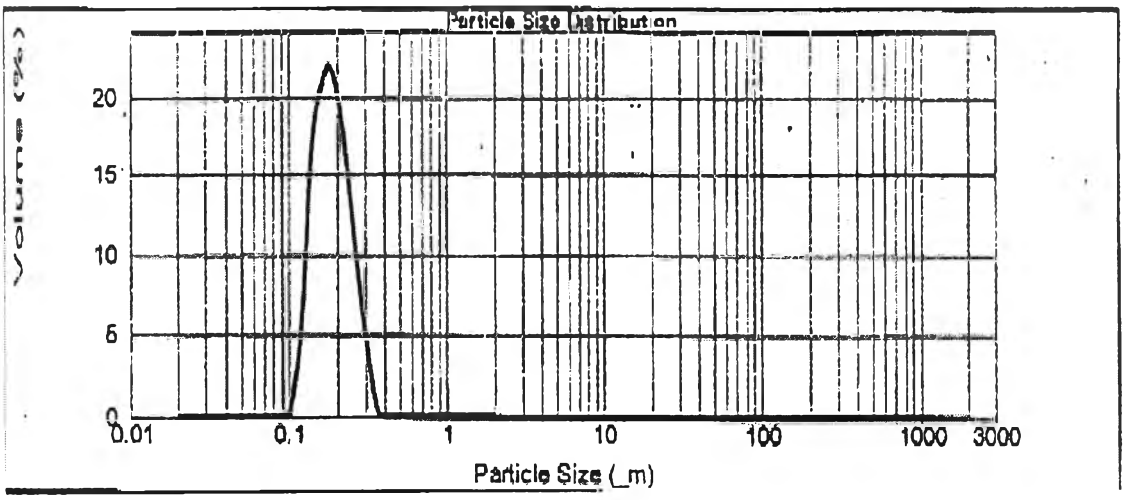


Figure a55. Particle size distribution of Rx4 unautoclaved emulsion.

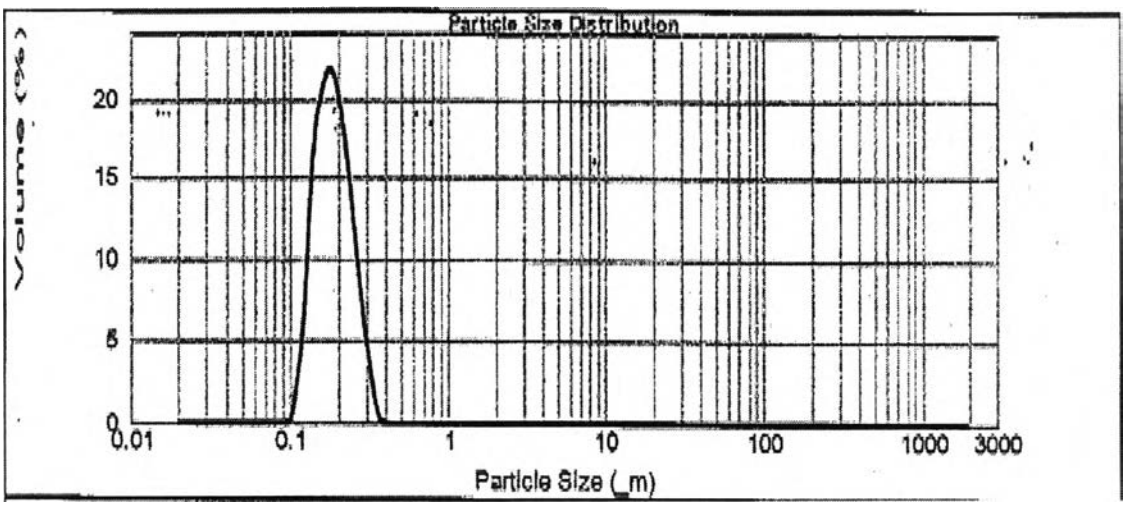


Figure a56. Particle size distribution of Rx4 autoclaved emulsion.

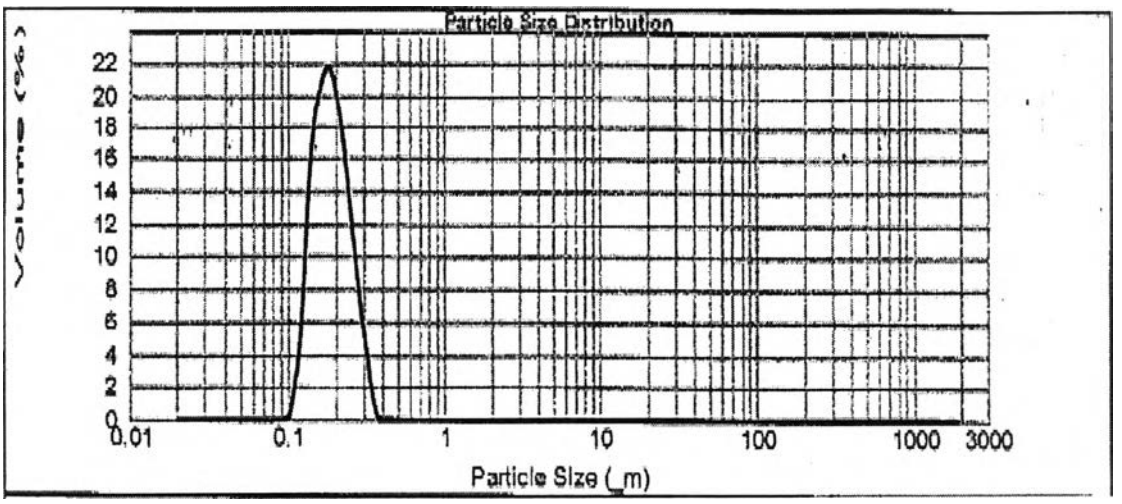


Figure a57. Particle size distribution of Rx5 unautoclaved emulsion.

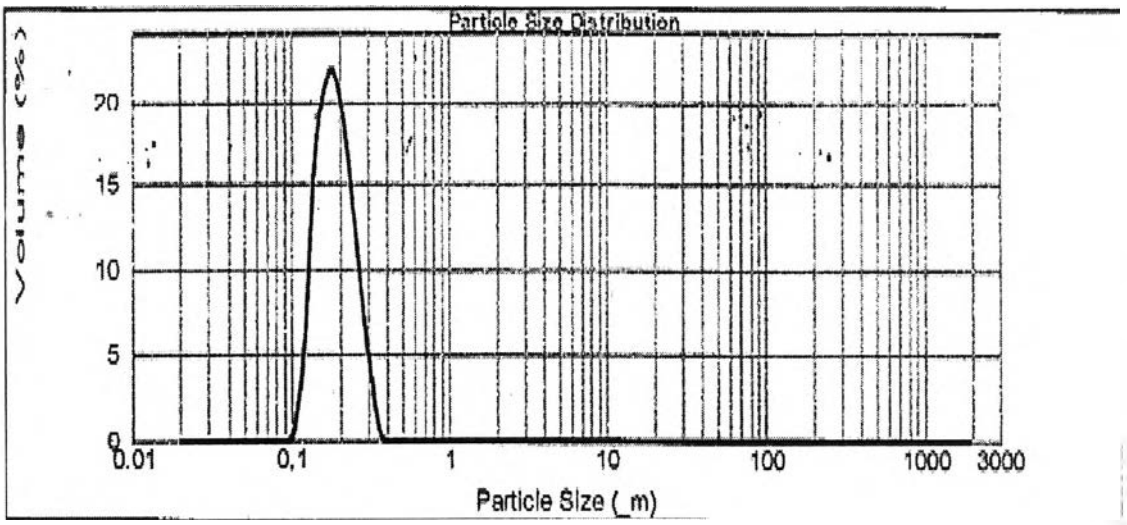


Figure a58. Particle size distribution of Rx5 autoclaved emulsion.

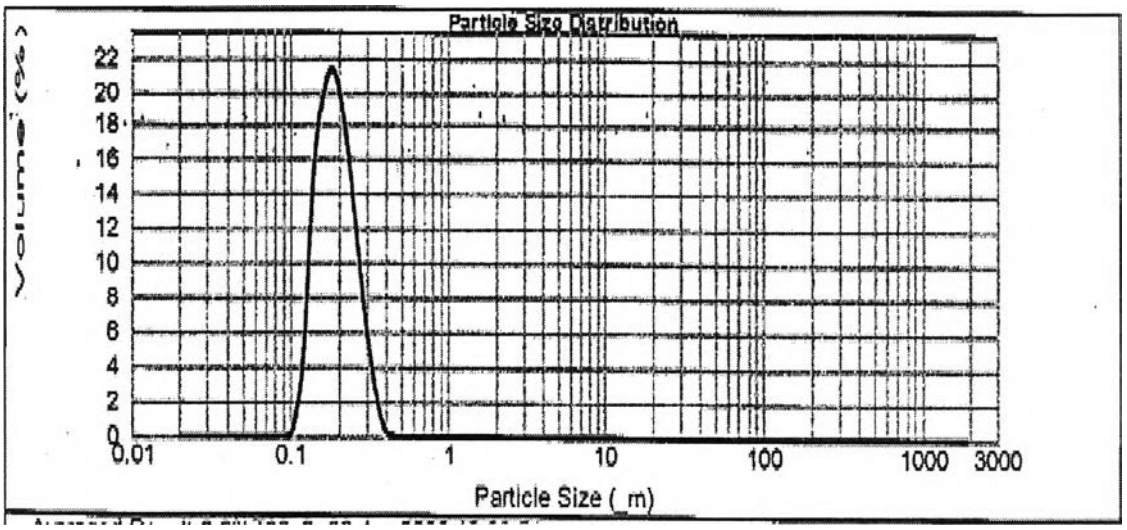


Figure a59. Particle size distribution of Rx6 unatoclaved emulsion.

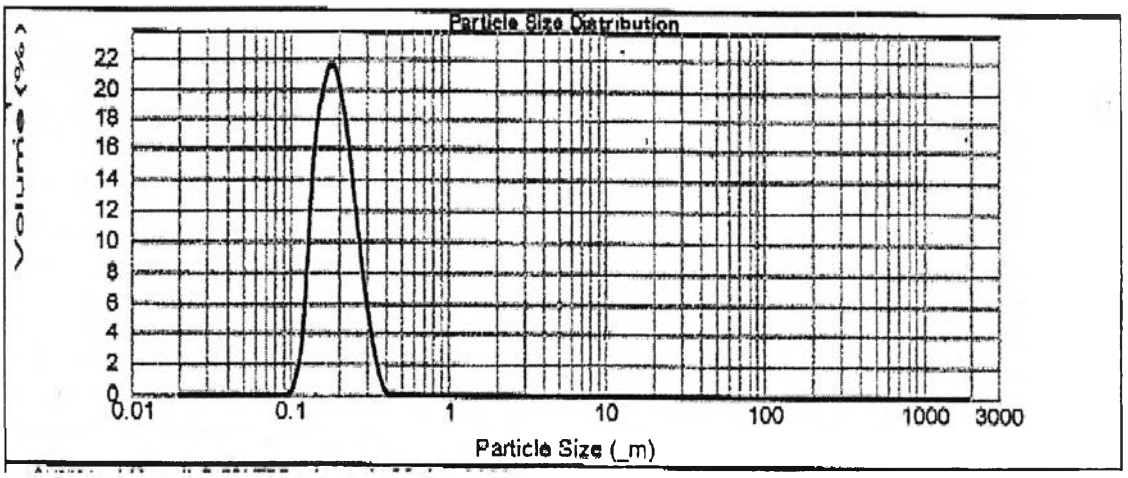


Figure a60. Particle size distribution of Rx6 autoclaved emulsion.

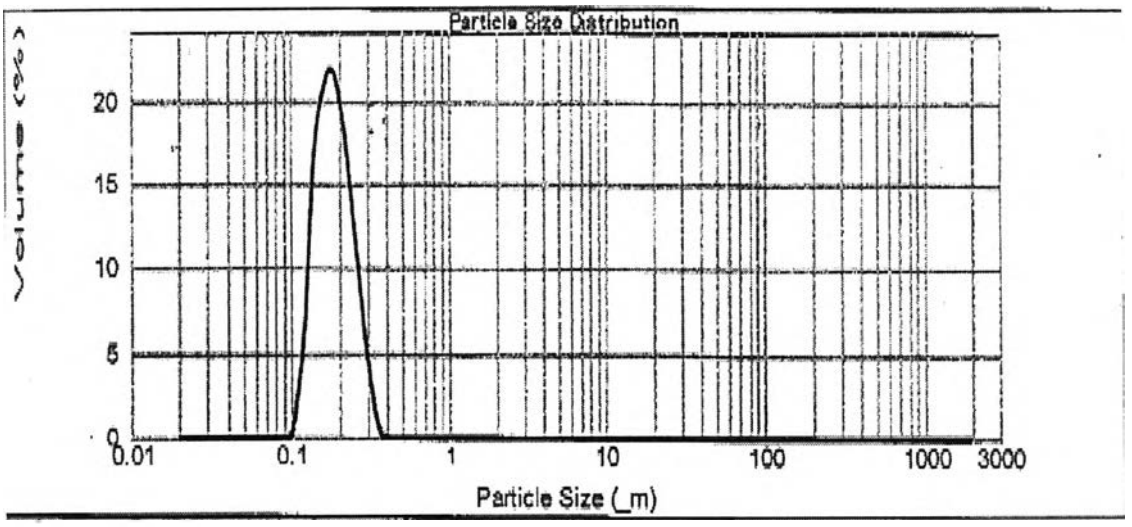


Figure a61. Particle size distribution of Rx8 unautoclaved emulsion.

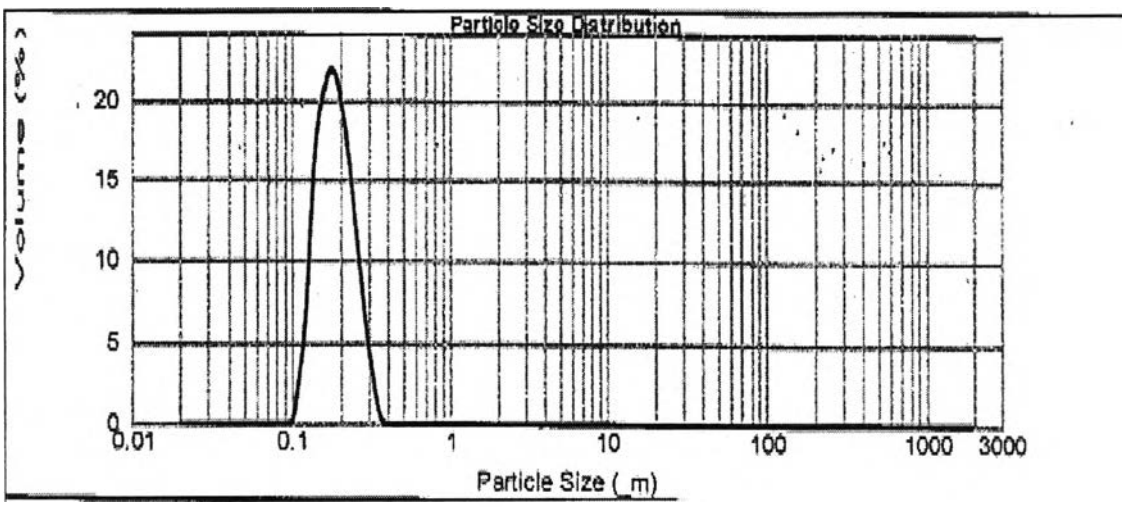


Figure a62. Particle size distribution of Rx8 autoclaved emulsion.

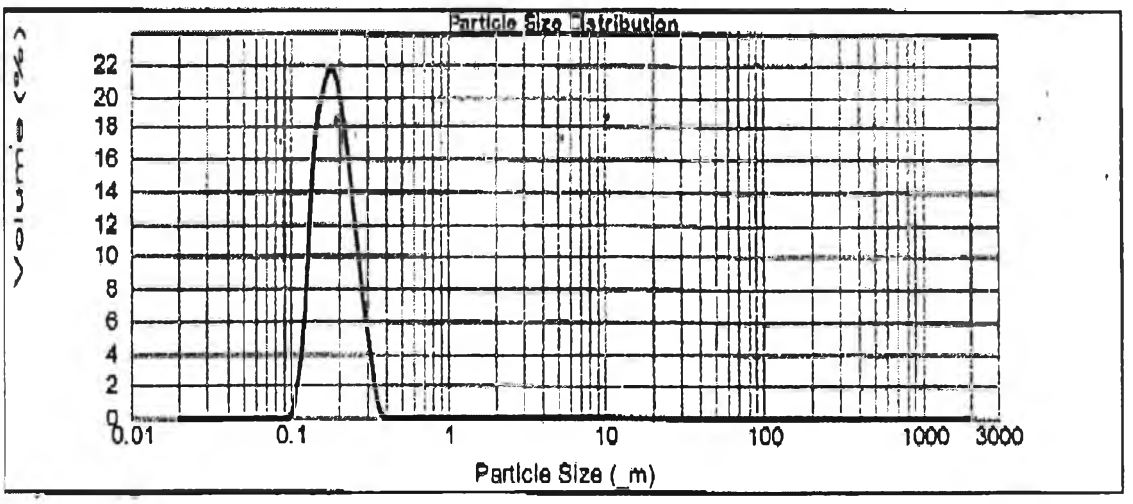


Figure a63. Particle size distribution of Rx9 unautoclaved emulsion.

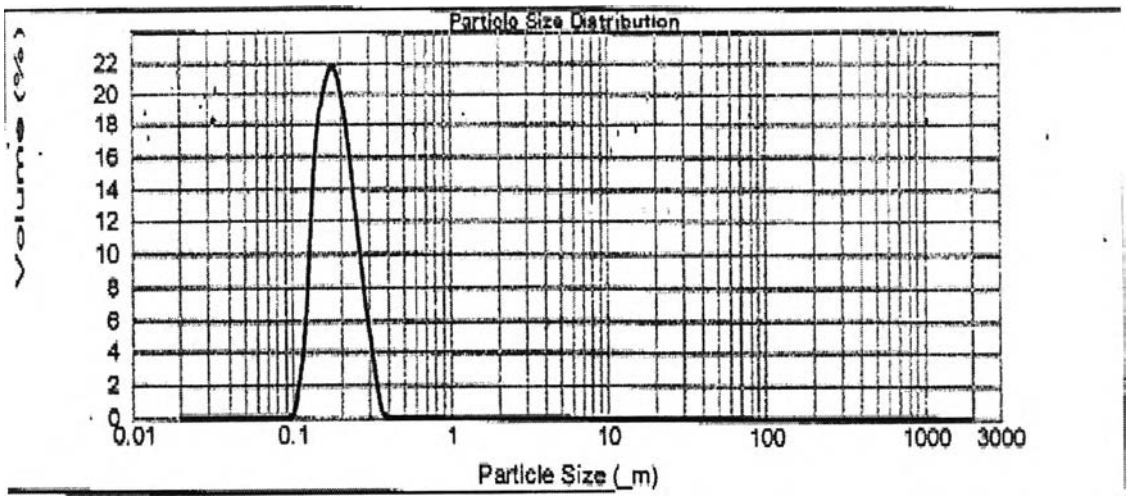


Figure a64. Particle size distribution of Rx9 autoclaved emulsion.

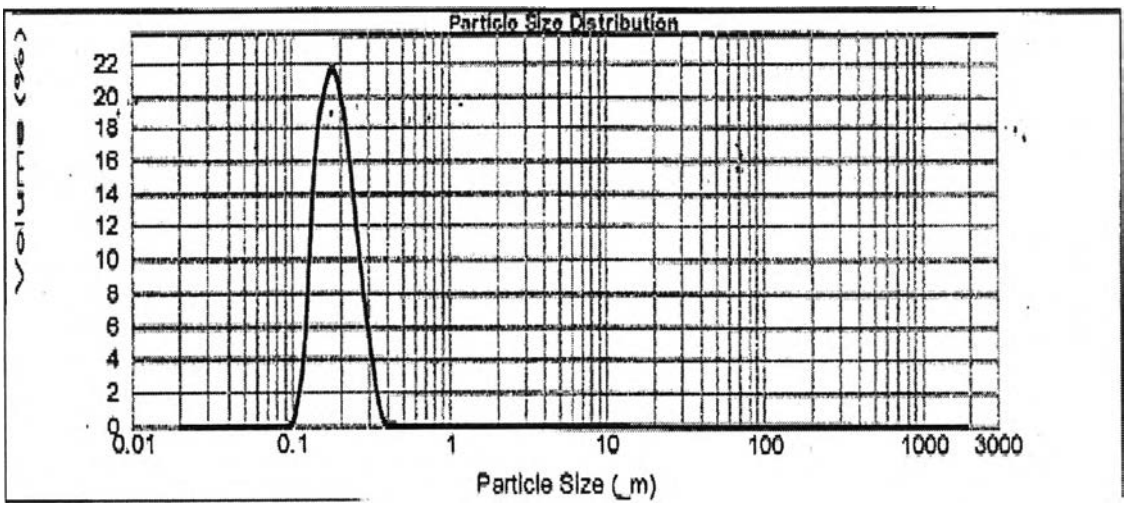


Figure a65. Particle size distribution of Rx10 unautoclaved emulsion.

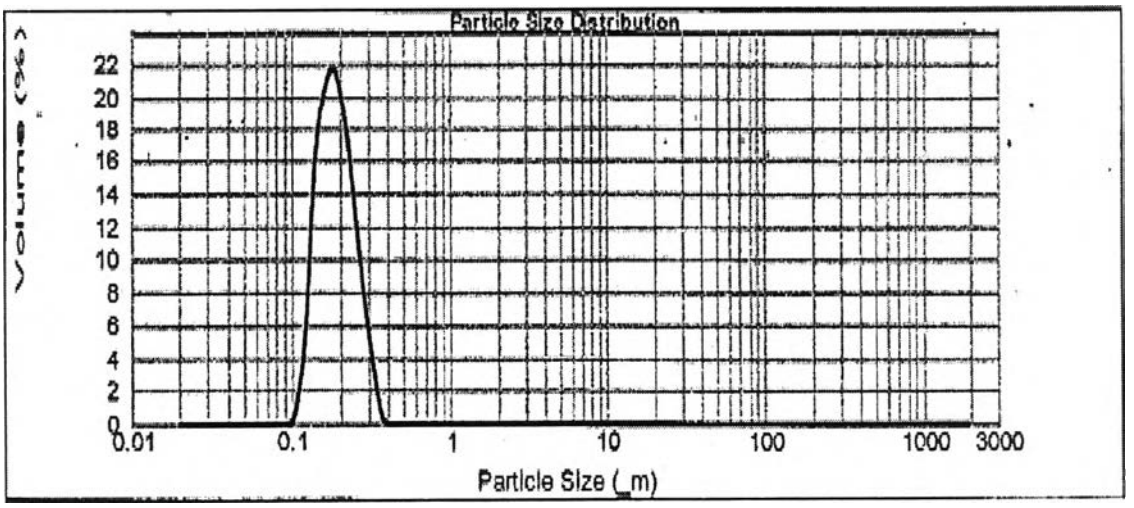


Figure a66. Particle size distribution of Rx10 autoclaved emulsion.

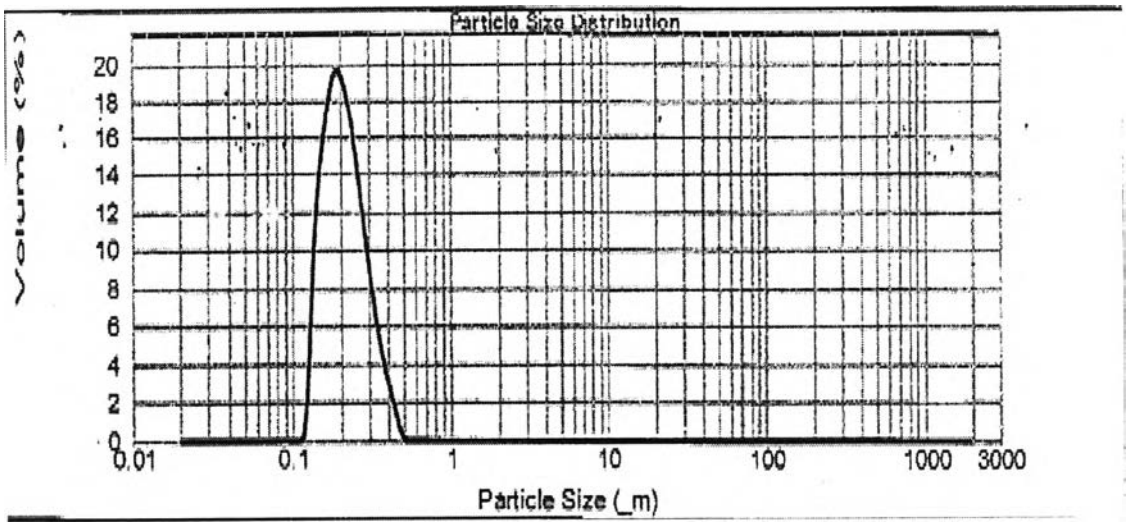


Figure a67. Particle size distribution of Rx11 unautoclaved emulsion.

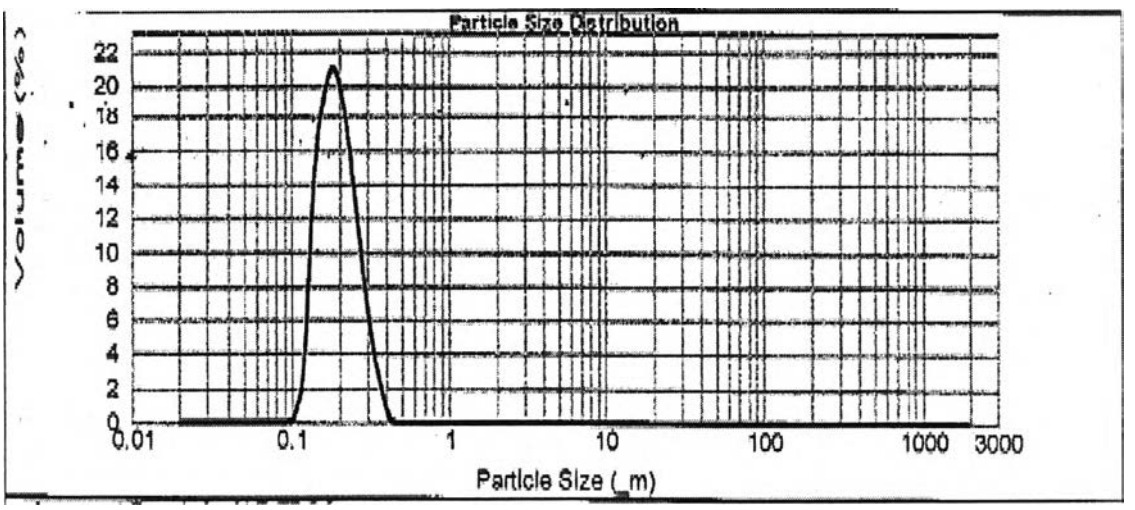


Figure a68. Particle size distribution of Rx11 autoclaved emulsion.

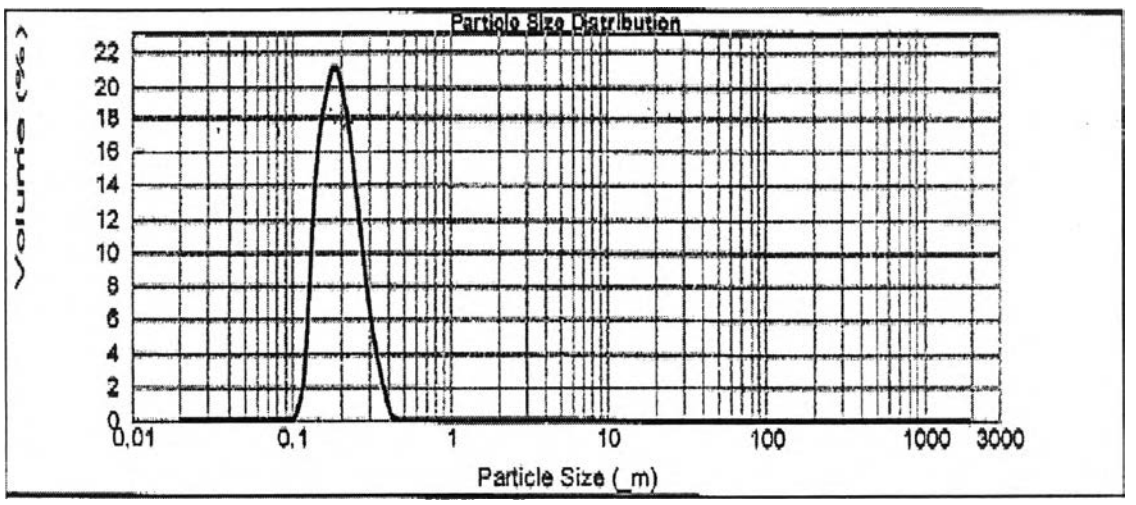


Figure a69. Particle size distribution of Rx16 unautoclaved emulsion.

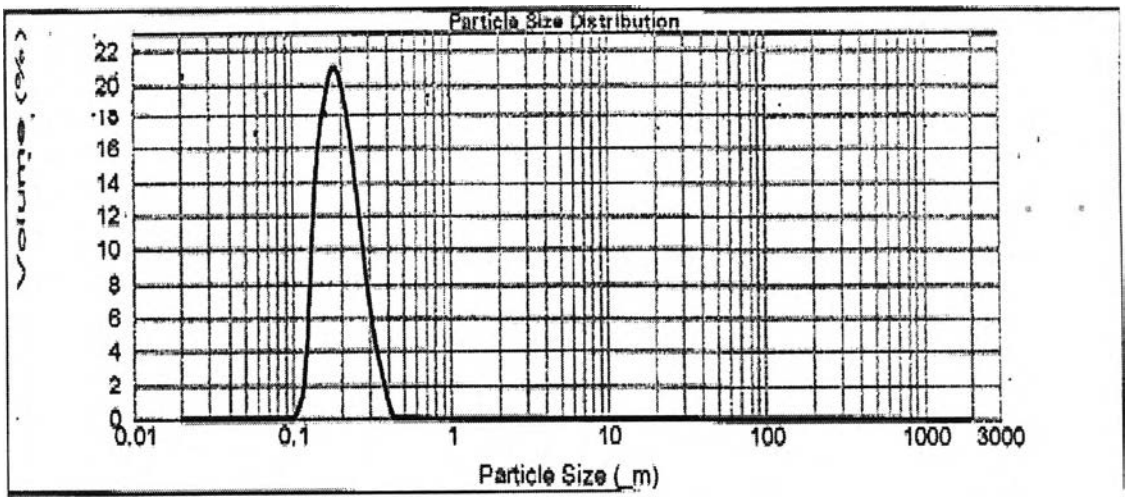


Figure a70. Particle size distribution of Rx16 autoclaved emulsion.

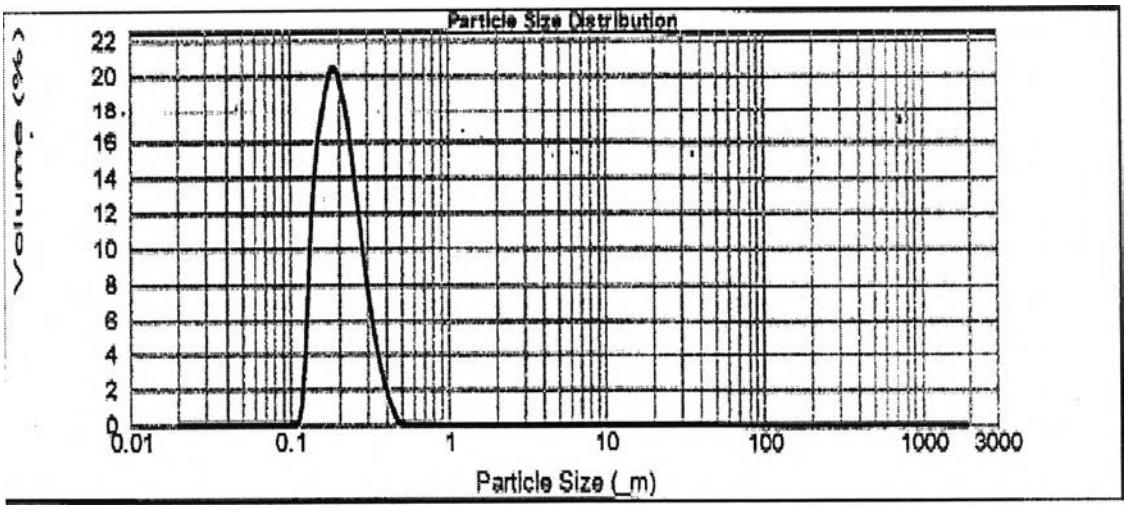


Figure a71. Particle size distribution of Rx17 unautoclaved emulsion.

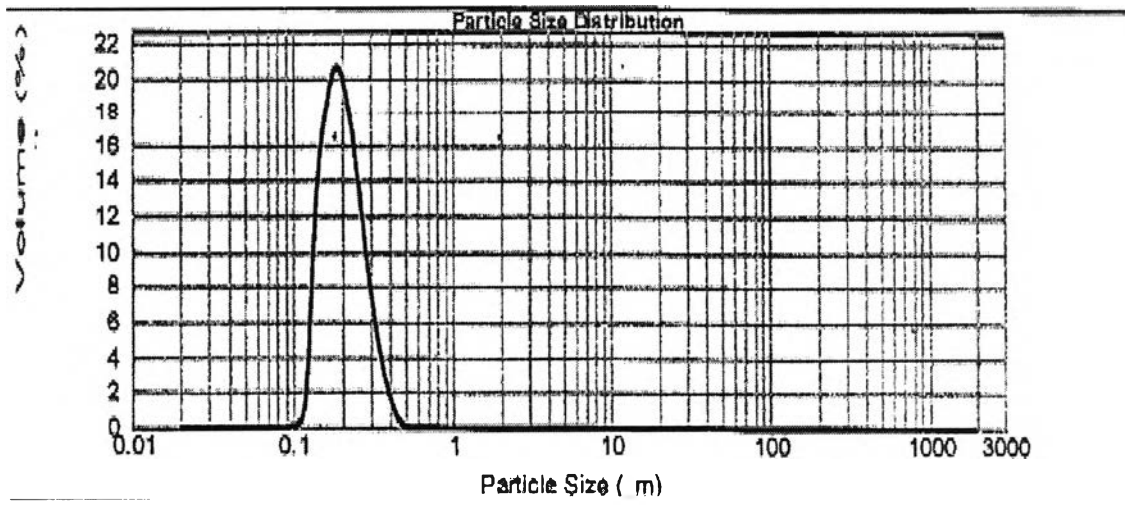


Figure a72. Particle size distribution of Rx17 autoclaved emulsion.

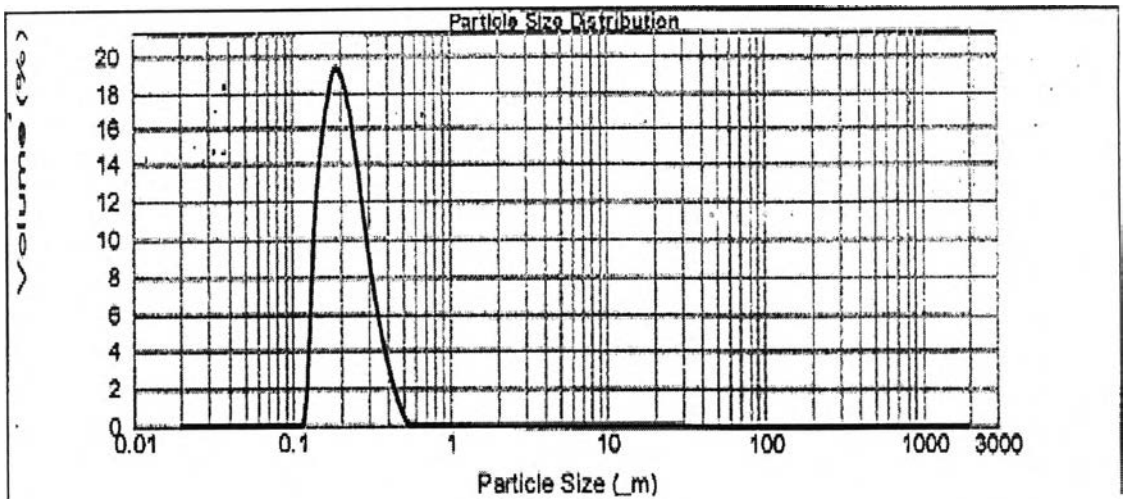


Figure a73. Particle size distribution of Rx18 unautoclaved emulsion.

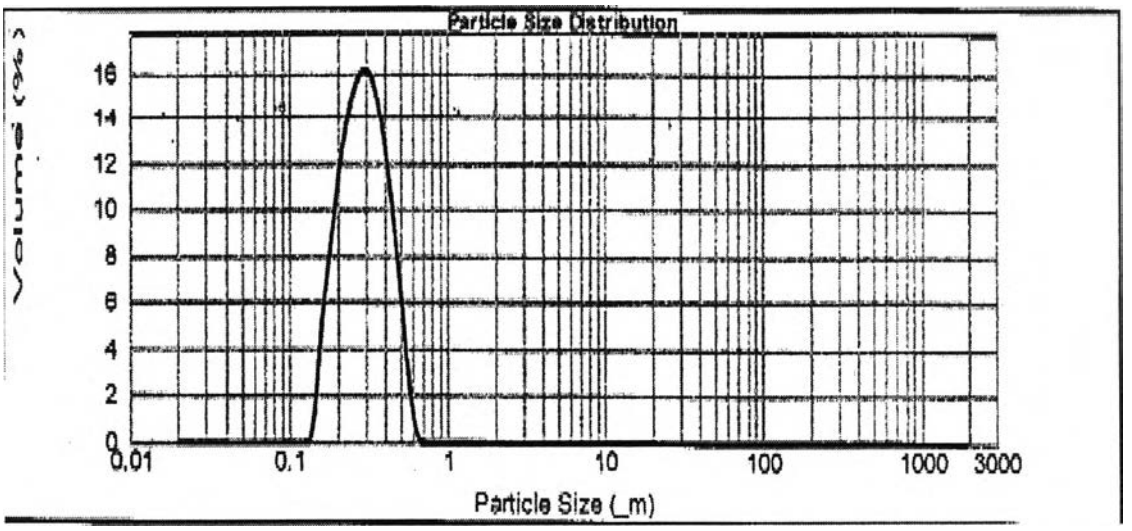


Figure a74. Particle size distribution of Rx18 autoclaved emulsion.

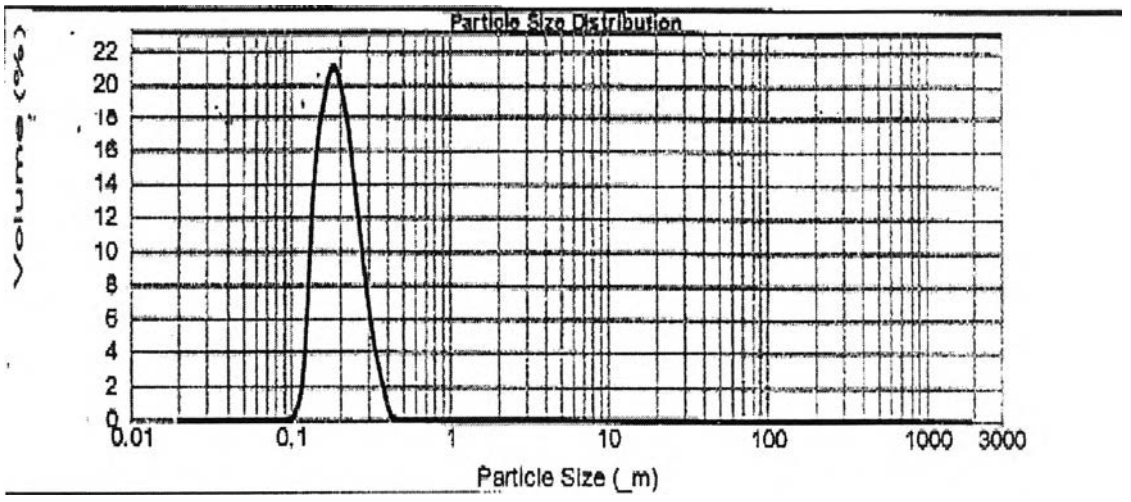


Figure a75. Particle size distribution of Rx19 unautoclaved emulsion.

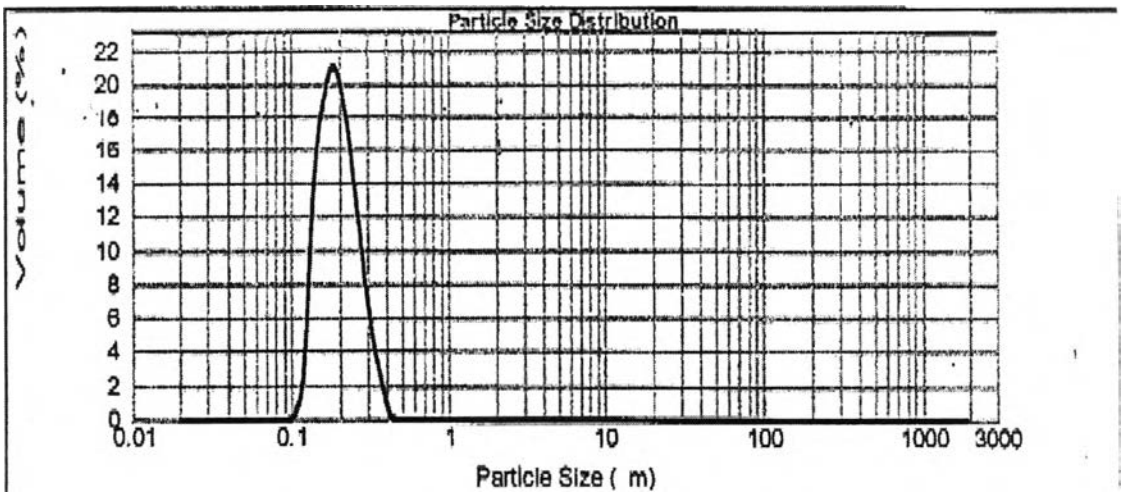


Figure a76. Particle size distribution of Rx19 autoclaved emulsion.

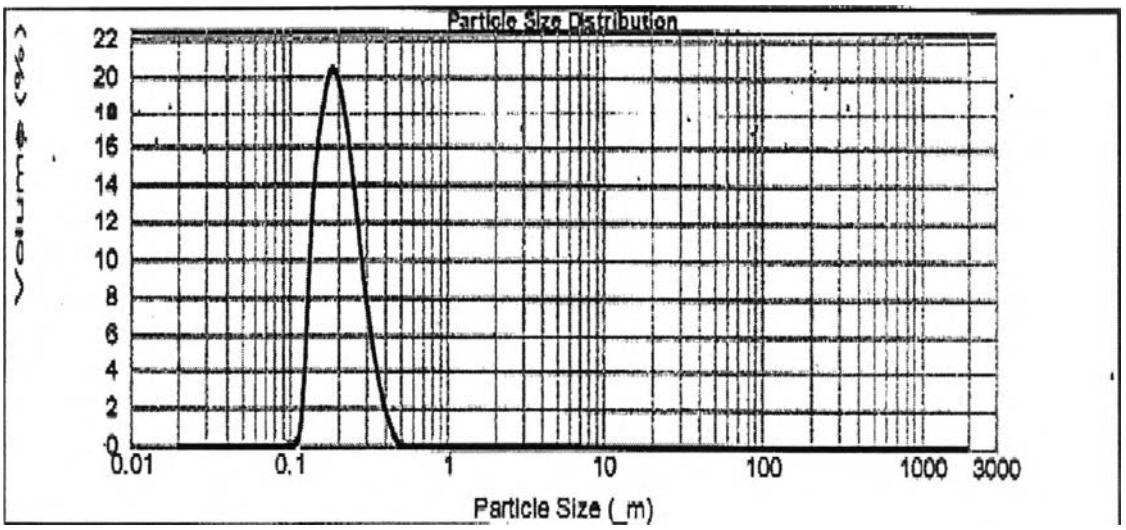


Figure a77. Particle size distribution of Rx20 unautoclaved emulsion.

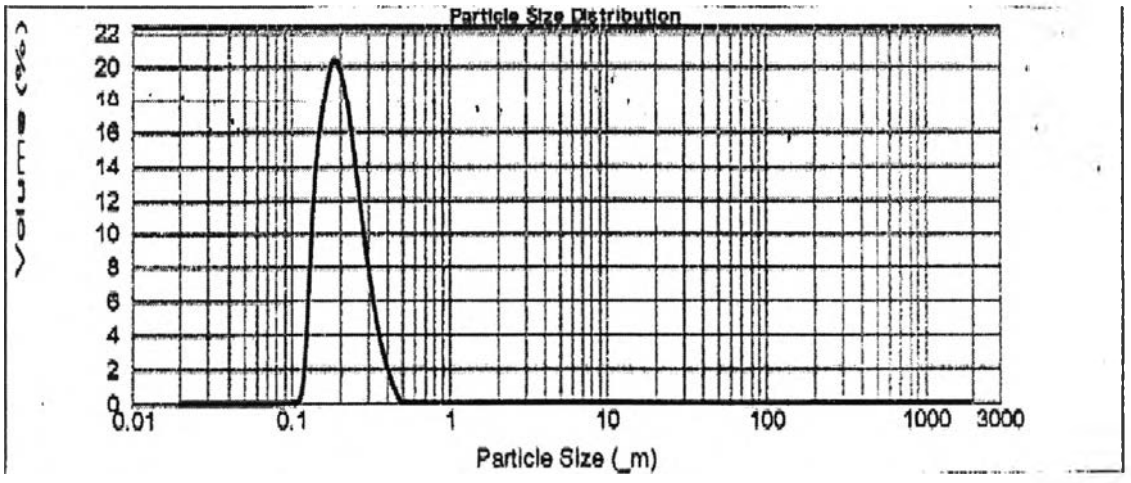


Figure a78. Particle size distribution of Rx20 autoclaved emulsion.

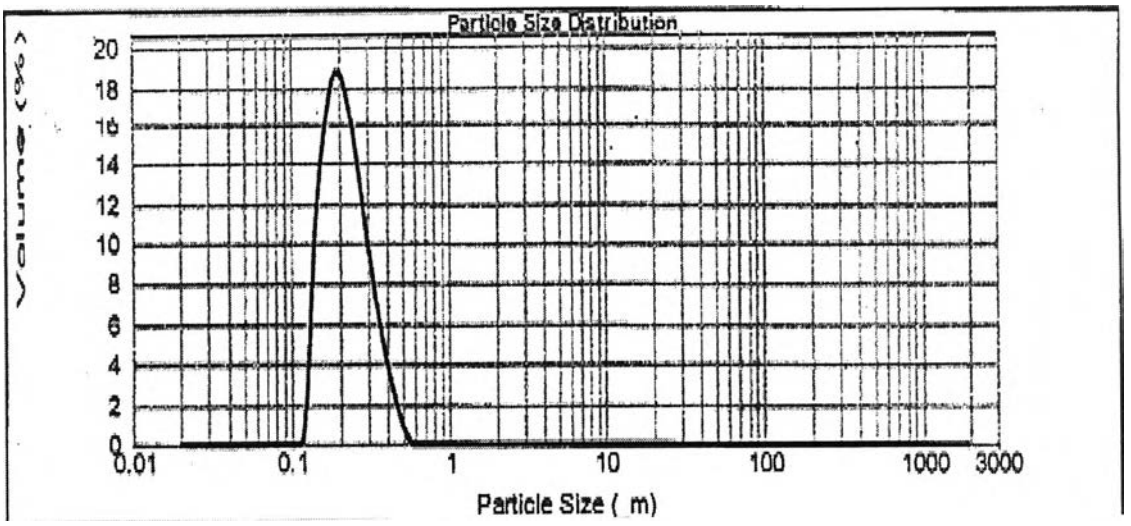


Figure a79. Particle size distribution of Rx21 unautoclaved emulsion.

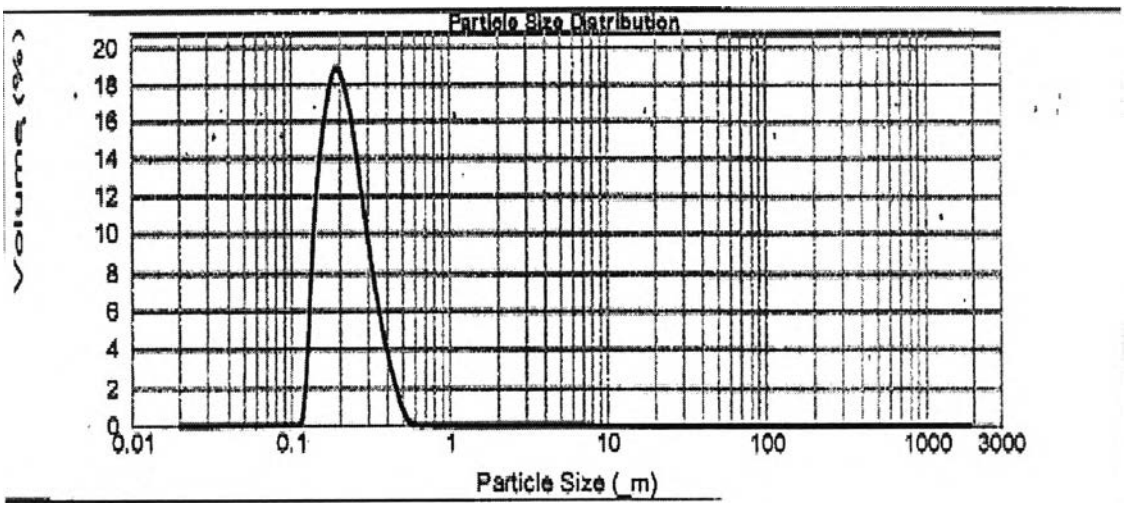


Figure a80. Particle size distribution of Rx21 autoclaved emulsion.

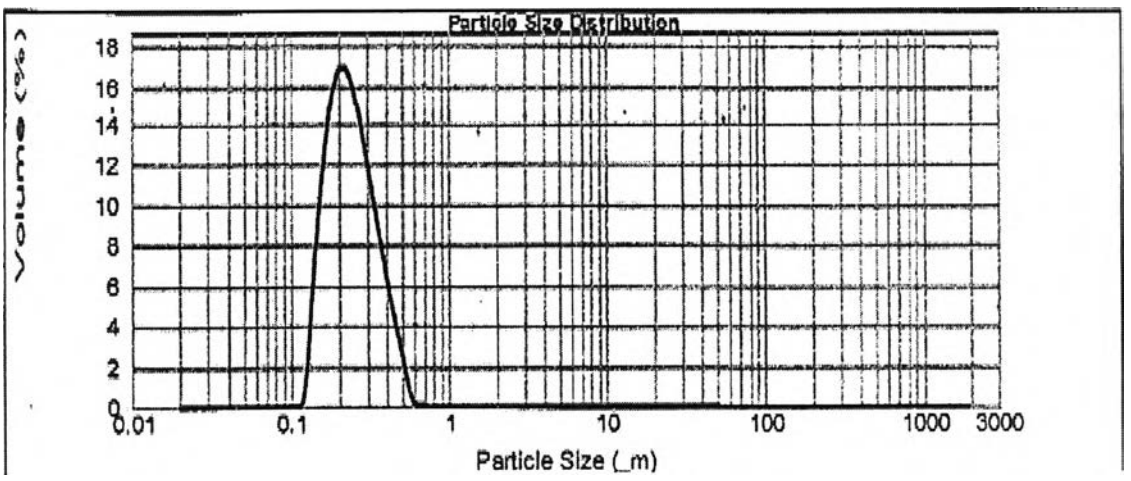


Figure a81. Particle size distribution of Rx22 unautoclaved emulsion.

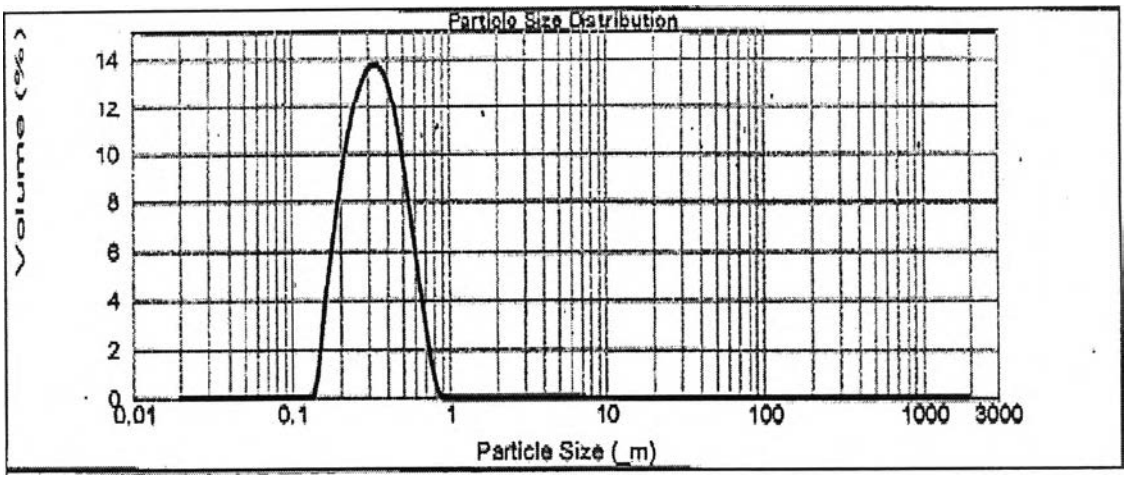


Figure a82. Particle size distribution of Rx22 autoclaved emulsion.

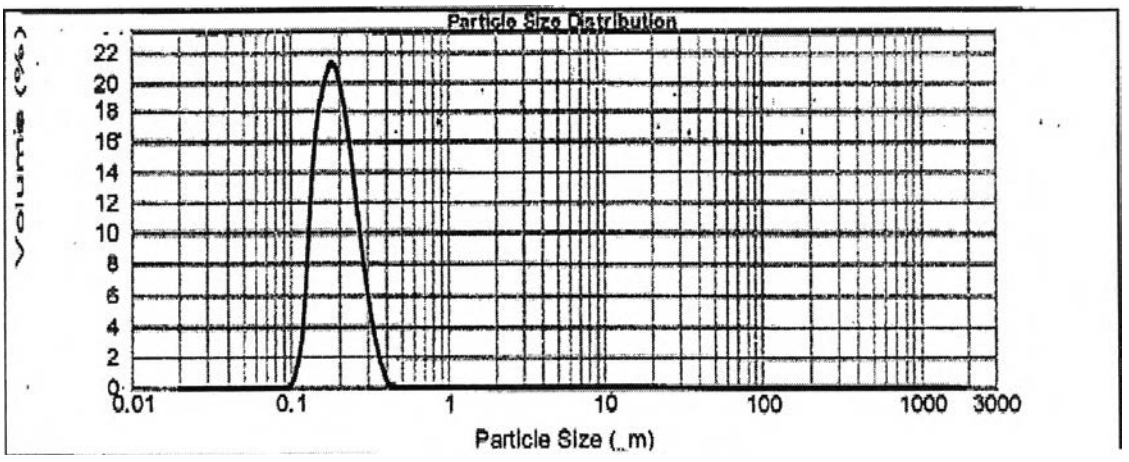


Figure a83. Particle size distribution of 1.5% w/w of 2:1 EPC:Tween® 80 unautoclaved emulsion.

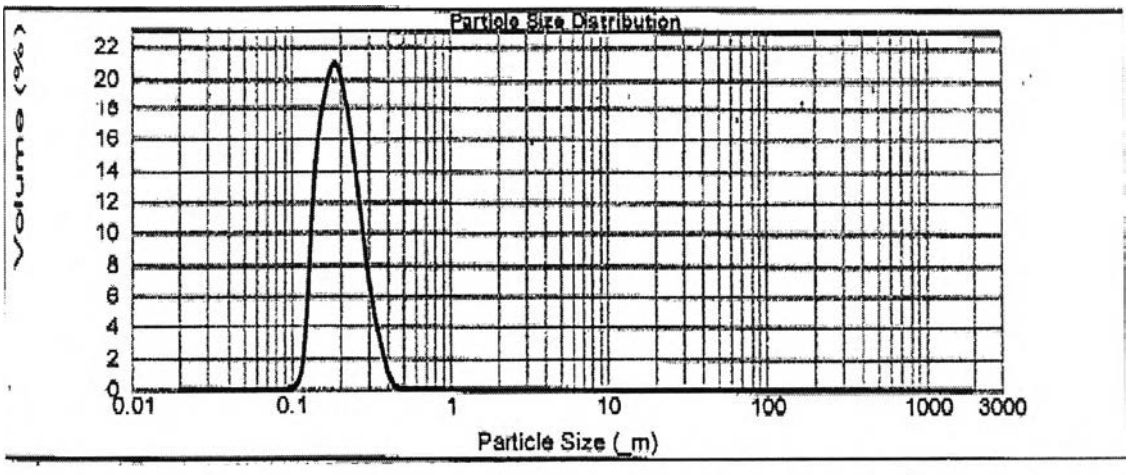


Figure a84. Particle size distribution of 1.5% w/w of 2:1 EPC:Tween® 80 autoclaved emulsion.

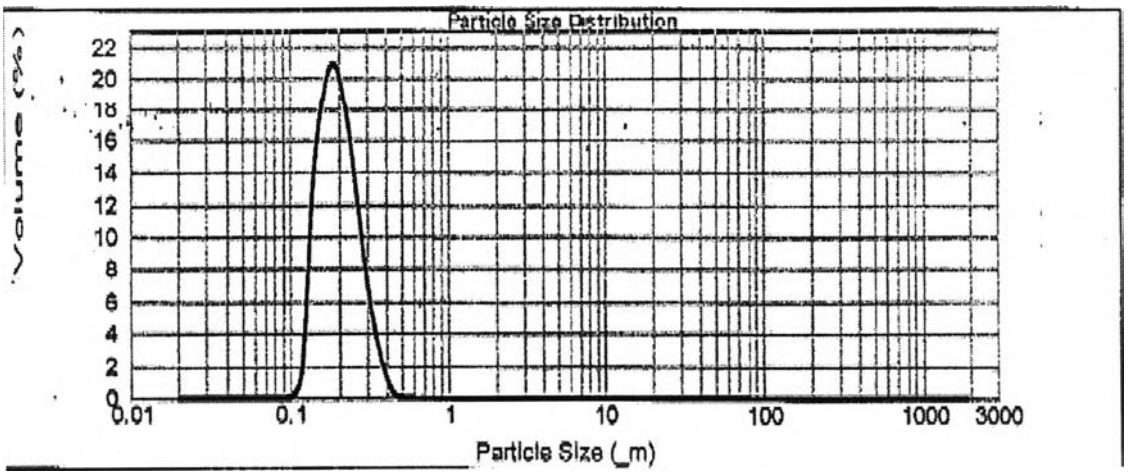


Figure a85. Particle size distribution of 1.5% w/w of 2:1 EPC:Tween® 80 autoclaved emulsion after 1-week storage at 4^0C.

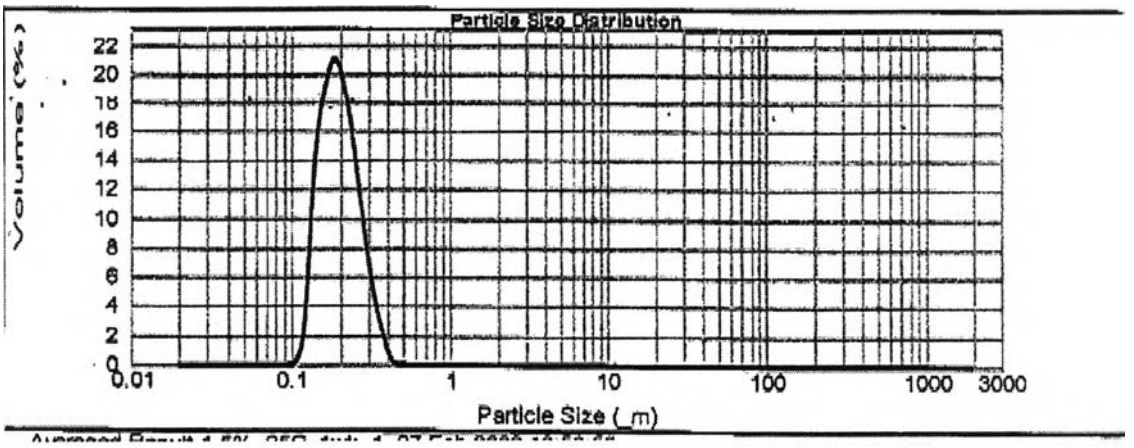


Figure a86. Particle size distribution of 1.5% w/w of 2:1 EPC:Tween® 80 autoclaved emulsion after 1-week storage at 25^0C.

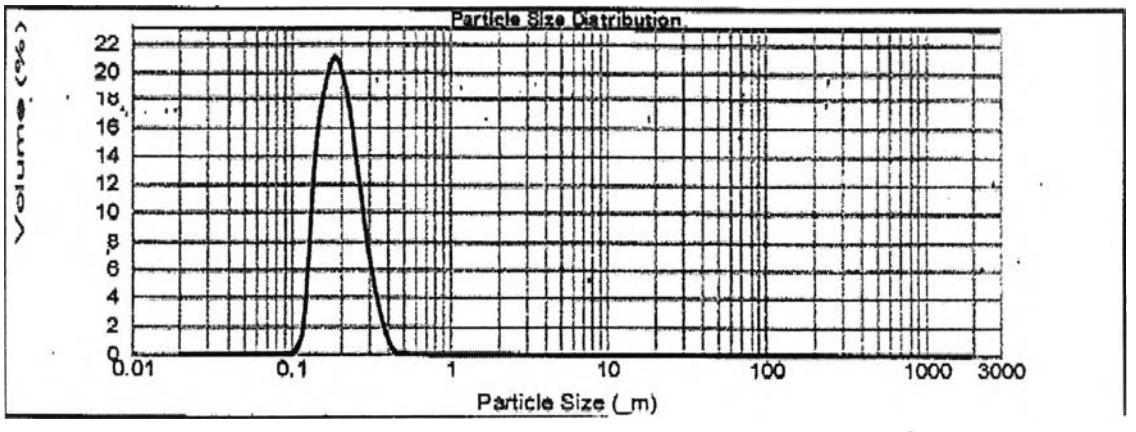


Figure a87. Particle size distribution of 1.5% w/w of 2:1 EPC:Tween® 80 autoclaved emulsion after 1-week storage at 40^0C.

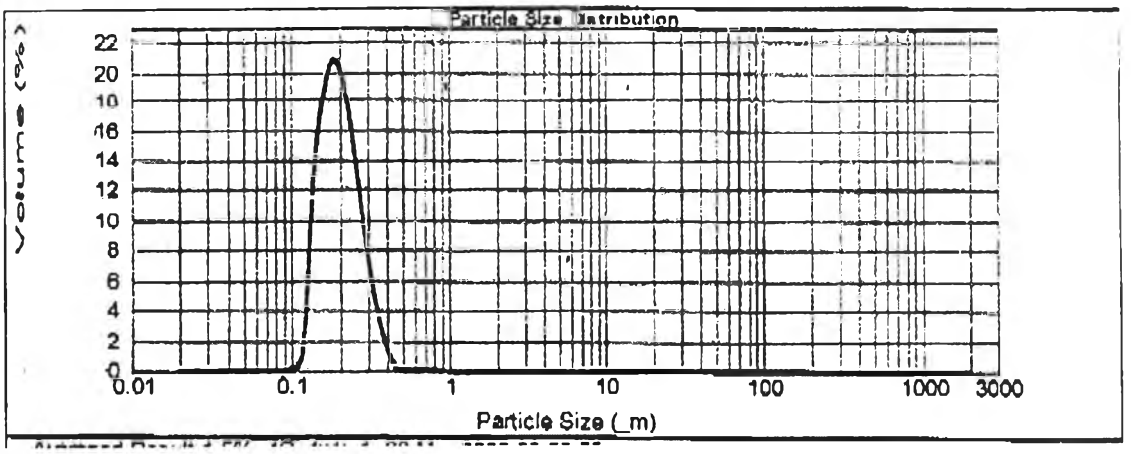


Figure a88. Particle size distribution of 1.5% w/w of 2:1 EPC:Tween® 80 autoclaved emulsion after 4-week storage at 4^0C.

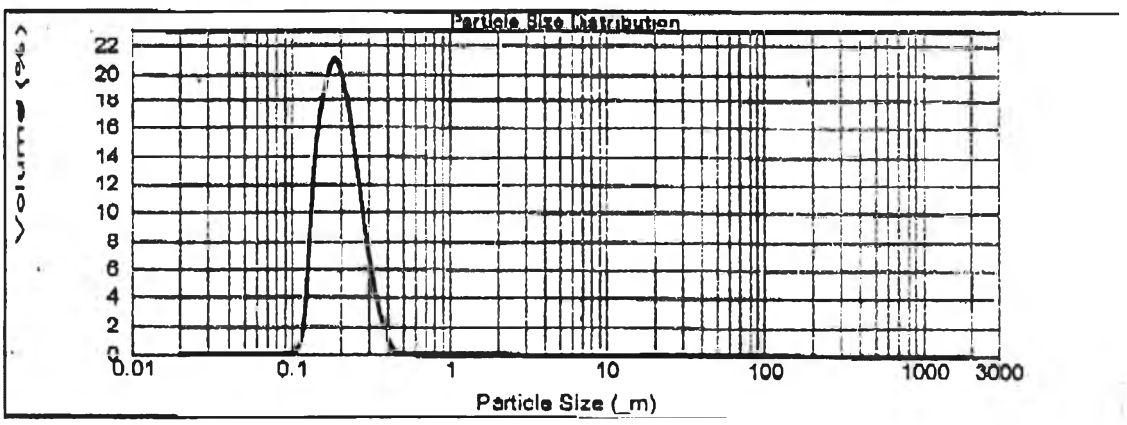


Figure a89. Particle size distribution of 1.5% w/w of 2:1 EPC:Tween® 80 autoclaved emulsion after 4-week storage at 25^0C.

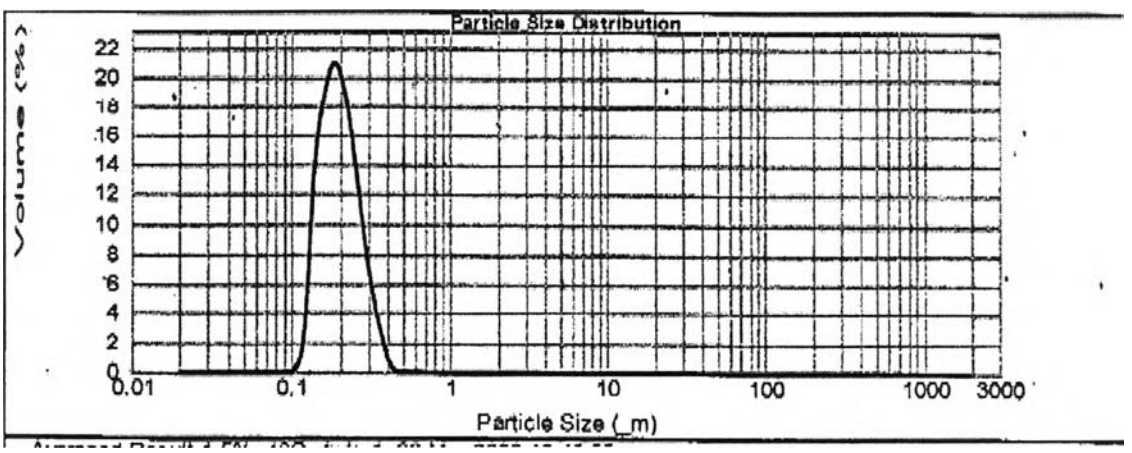


Figure a90. Particle size distribution of 1.5% w/w of 2:1 EPC:Tween® 80 autoclaved emulsion after 4-week storage at 40^0C.

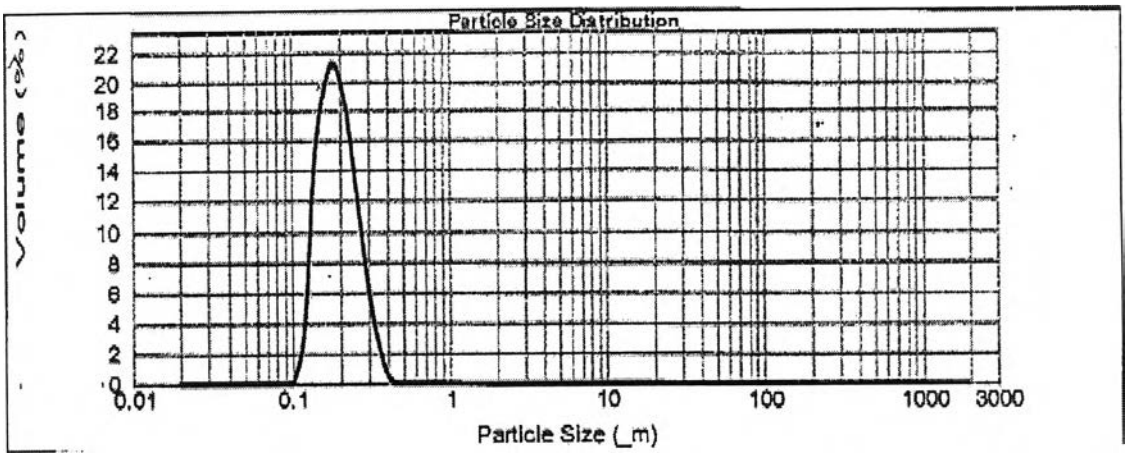


Figure a91. Particle size distribution of 1.5% w/w of 2:1 EPC:Vitamin E-TPGS unautoclaved emulsion.

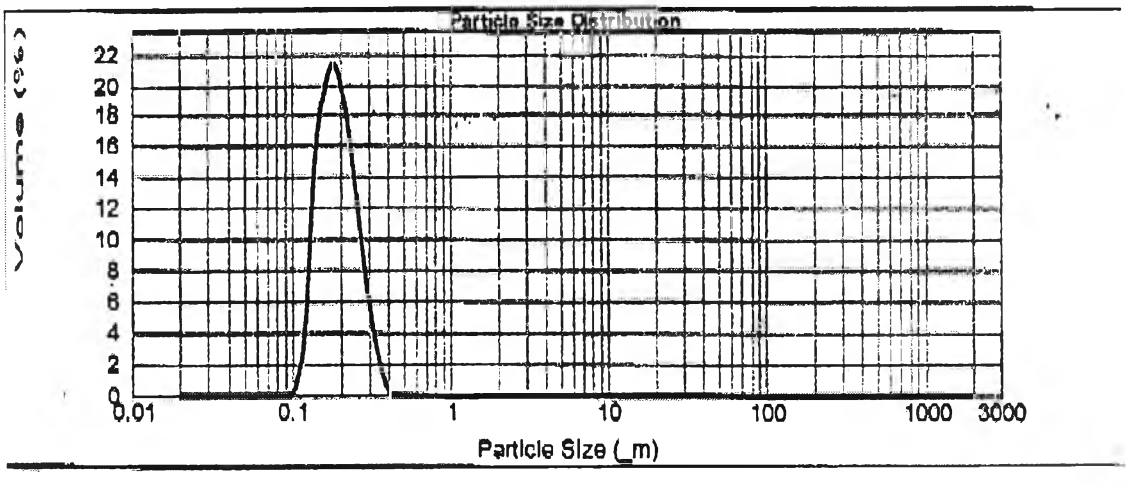


Figure a92. Particle size distribution of 1.5% w/w of 2:1 EPC:Vitamin E-TPGS autoclaved emulsion.

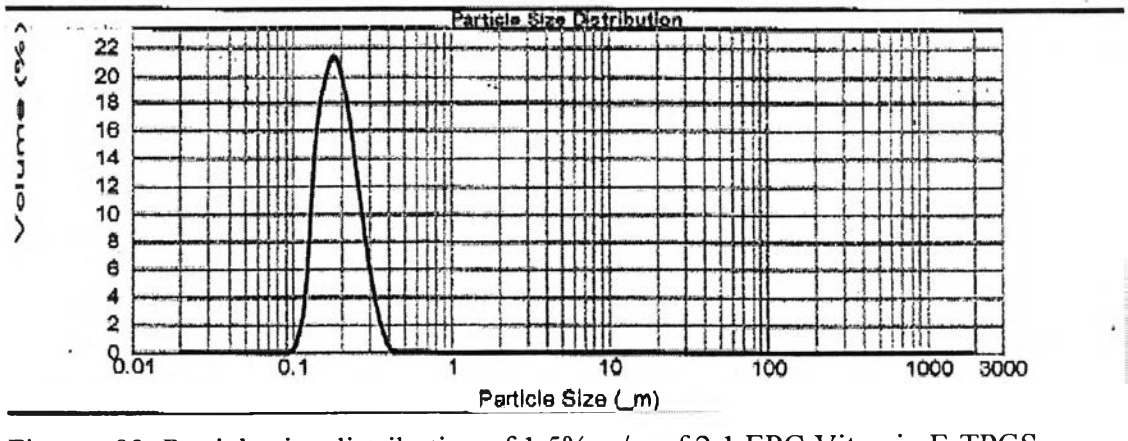


Figure a93. Particle size distribution of 1.5% w/w of 2:1 EPC:Vitamin E-TPGS autoclaved emulsion after 1-week storage at 4^0C.

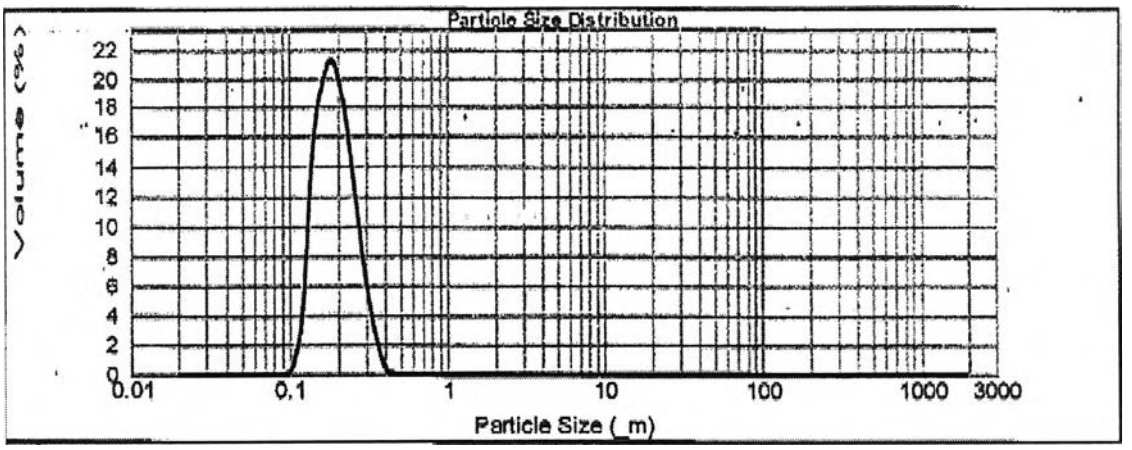


Figure a94. Particle size distribution of 1.5% w/w of 2:1 EPC:Vitamin E-TPGS autoclaved emulsion after 1-week storage at 25^0C.

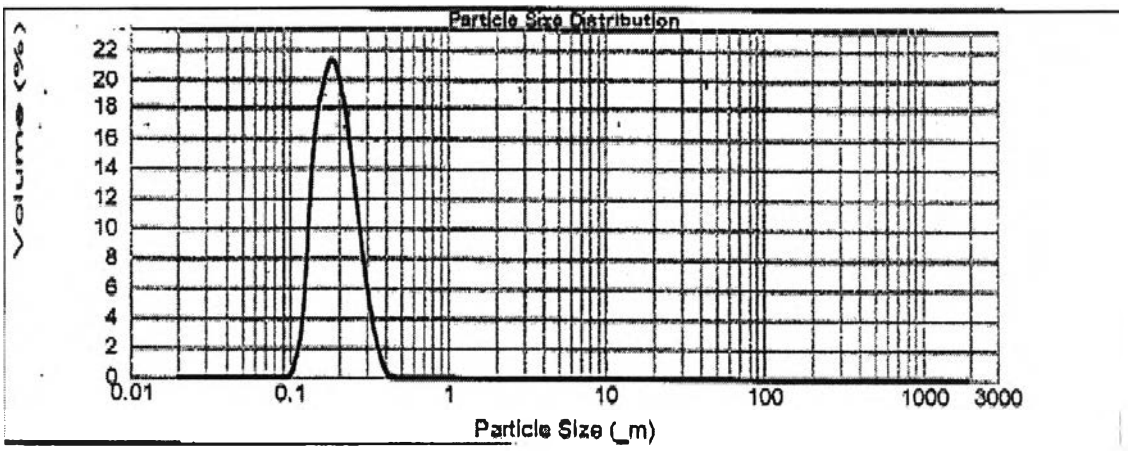


Figure a95. Particle size distribution of 1.5% w/w of 2:1 EPC:Vitamin E-TPGS autoclaved emulsion after 1-week storage at 40^0C.

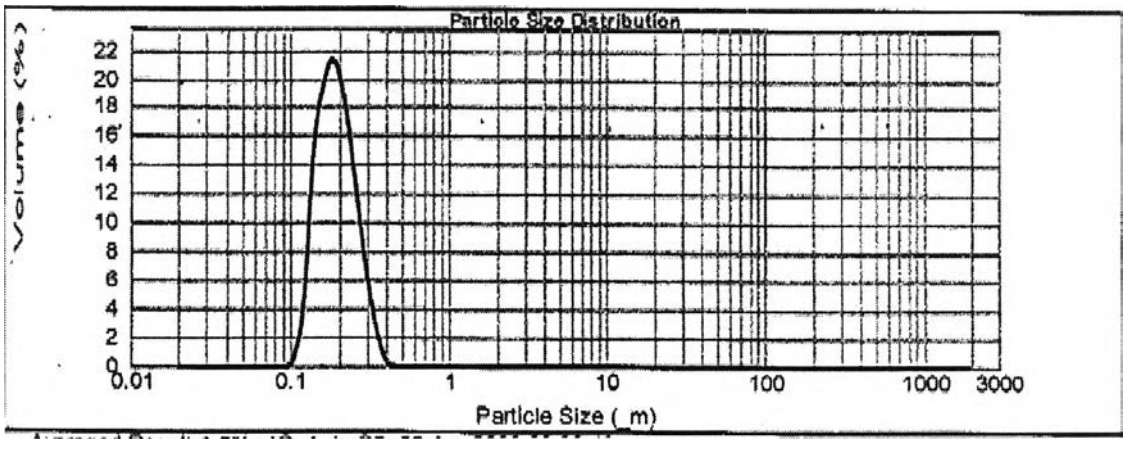


Figure a96. Particle size distribution of 1.5% w/w of 2:1 EPC:Vitamin E-TPGS autoclaved emulsion after 4-week storage at 4^0C.

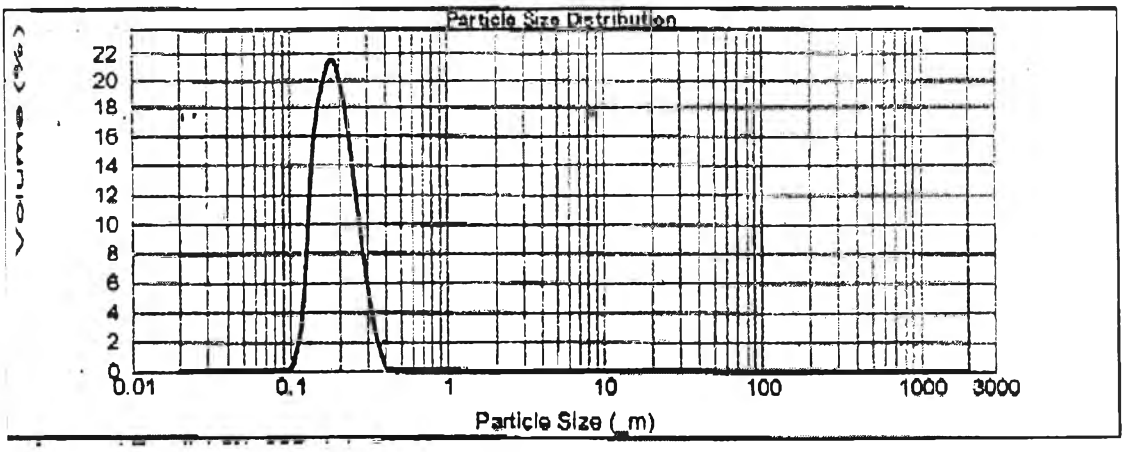


Figure a97. Particle size distribution of 1.5% w/w of 2:1 EPC:Vitamin E-TPGS autoclaved emulsion after 4-week storage at 25^0C.

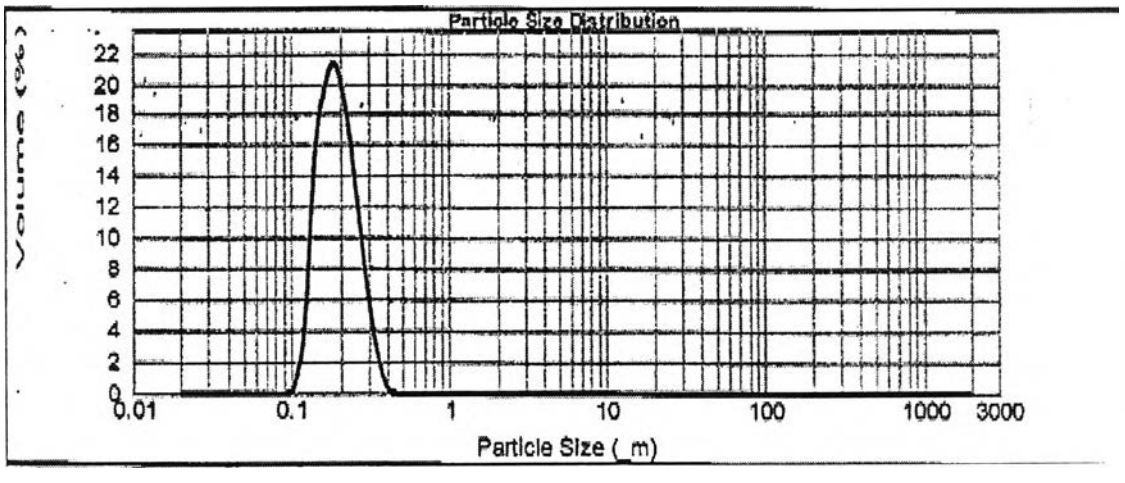


Figure a98. Particle size distribution of 1.5% w/w of 2:1 EPC:Vitamin E-TPGS autoclaved emulsion after 4-week storage at 40^0C.

APPENDIX B

Detail of raw materials

1. Egg phospholipid (Lipoid® E80)

Table b1. Composition (% w/w) of egg phospholipids (Lipoid® E80) used in the formulations.

Compositions	Specification
Phosphatidylcholine (+ LPC)	max 80 %
Phosphatidylethanolamine	max 9.5%
Lysophosphatidylcholine	n.m.t. 3.0%
Lysophosphatidylethanolamine	n.m.t. 0.5%
Sphingomyelin	max 3.0%
Phosphorus	max 4.0%
Triglycerides	n.m.t. 3.0%
Cholesterol	n.m.t. 1.5%
Free fatty acids	n.m.t. 0.05%
dl-α-Tocopherol	0.05 – 0.1%

2. Polysorbate 80 (Tween® 80)

Chemical name: Polyoxyethylene (20) sorbitan monooleate

Molecular weight: 1,310

HLB: 15.0

Relative density: 1.1

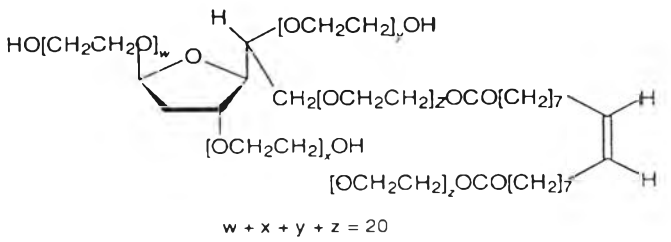
Solubility: Miscible with water, alcohol, dehydrate alcohol, ethylacetate, and methyl alcohol

Practically insoluble in liquid paraffin and fixed oils

Appearance: Yellowish or brownish-yellow oily liquid with a faint characteristic odor,

Functional category: Non-ionic surfactant, emulsifying agent, solubilizing agent, wetting agent and dispersing/suspending agent

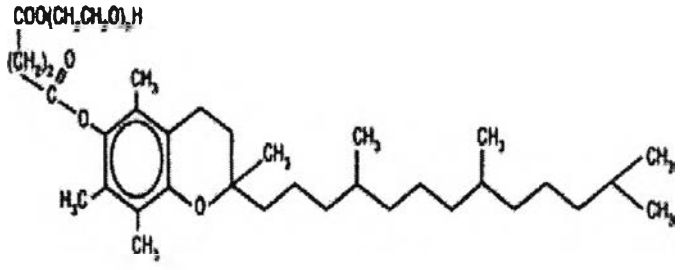
Structural formula:



3. Vitamin E-TPGS

Chemical name:	d-α-tocopheryl polyethylene glycol 1000 succinate
Molecular weight:	1,513
HLB:	13.0
Specific gravity:	1.06 at $45^{O}C$
Solubility:	Miscible with water
Appearance:	Pale yellow waxy solid
Functional category:	Non-ionic surfactant, emulsifying agent, solubilizing agent, absorption enhancer, water-soluble source of vitamin E

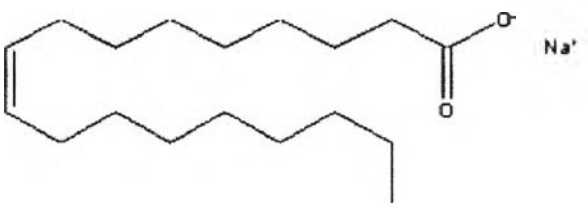
Structural formula:



4. Sodium oleate

Chemical name:	Sodium oleate
Molecular weight:	304
HLB:	18.0
Solubility:	Soluble in water
Appearance:	Pale white powder
Functional category:	Anionic surfactant, emulsifying agent

Structural formula:



5. Soybean oil

Table b2. Composition (% w/w) of soybean oil (Lipoid® Purified Soybean Oil 700) used in the formulations.

Fatty acid composition	%W/W
Linoleic acid	52.7
Linolenic acid	6.3
Oleic acid	24.9
Palmitic acid	11.5
Stearic acid	4.7

APPENDIX C

Commercial intravenous lipid emulsions

Table c1. Composition of 10% Intralipid® and 20% Intralipid®.

Composition	Intralipid® 10%	Intralipid® 20%
Fractionated soybean oil	100 g	200 g
Egg-yolk phospholipid	12.0 g	12.0 g
Glycerol	22.0 g	22.0 g
Water for injection to	1 liter	1 liter
Total energy/L	1100 kcal	2000 kcal
Osmolality (mOsm/kg water)	300	350
Package quantities	100, 500 ml	100, 250, 500 ml

Table c2. Composition of Vitalipid® N Infant.

Components	Amount
Fractionated soybean oil	100 mg
Fractionated egg phospholipids	12 mg
Retinol palmitate (corresponding to retinol)	69 mg
Ergocalciferol	1.0 mg
Dl-α-tocopherol	0.64 mg
Phytomenadione (Vitamin K)	20 mg
Glycerol	2.5 mg
Sodium hydroxide to pH	8
Water for injection	10 ml

Table c3. Particle size of 10% and 20% commercial lipid emulsions.

Commercial product	D [4,3] (μm)					d (0.5) (μm)					Figure
	1	2	3	mean	S.D.	1	2	3	mean	S.D.	
10% Intralipid®	0.295	0.282	0.291	0.289	0.007	0.272	0.258	0.268	0.266	0.007	c1
20% Intralipid®	0.318	0.319	0.316	0.318	0.002	0.298	0.299	0.295	0.297	0.002	c2
Vitalipid® N Infant	0.343	0.339	0.327	0.336	0.008	0.315	0.309	0.298	0.307	0.009	c3

Table c4. Zeta potential of 10% and 20% commercial lipid emulsions.

Commercial products	Zeta potential (mV)				
	1	2	3	mean	S.D.
10% Intralipid®	-45.9	-56.2	-51.2	-51.1	5.2
20% Intralipid®	-58.3	-61	-55.9	-58.4	2.6
Vitalipid® N Infant	-57.4	-57.1	-59.3	-57.9	1.2

Table c5. Osmolality of 10% and 20% commercial lipid emulsions.

Commercial products	Osmolality (mOsm/kg)				
	1	2	3	mean	S.D.
10% Intralipid®	286	289	287	287	2
20% Intralipid®	329	331	330	330	1
Vitalipid® N Infant	289	286	284	286	3

Table c6. pH of 10% and 20% commercial lipid emulsions.

Commercial products	pH				
	1	2	3	mean	S.D.
10% Intralipid®	7.85	7.88	7.84	7.86	0.02
20% Intralipid®	7.82	7.8	7.84	7.82	0.02
Vitalipid® N Infant	8.02	8	8.03	8.02	0.02

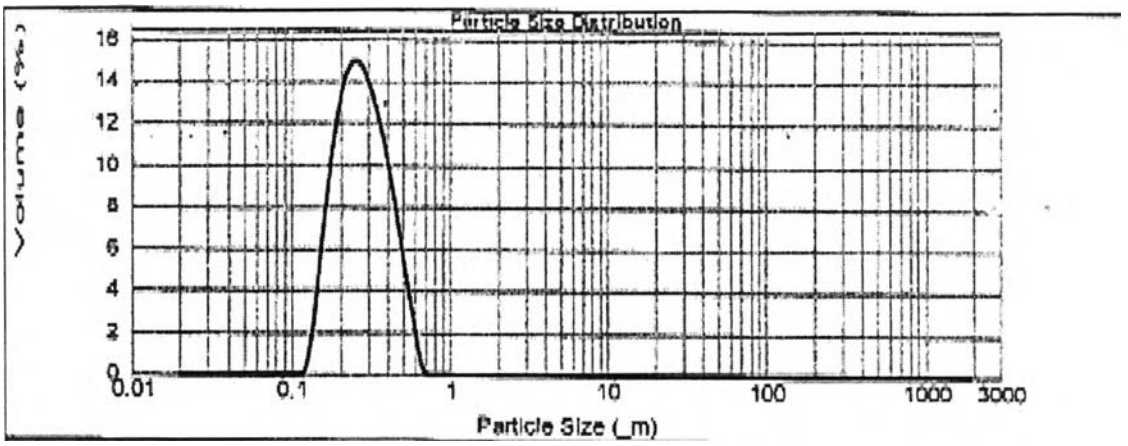


Figure c1. Particle size distribution of 10% Intralipid®.

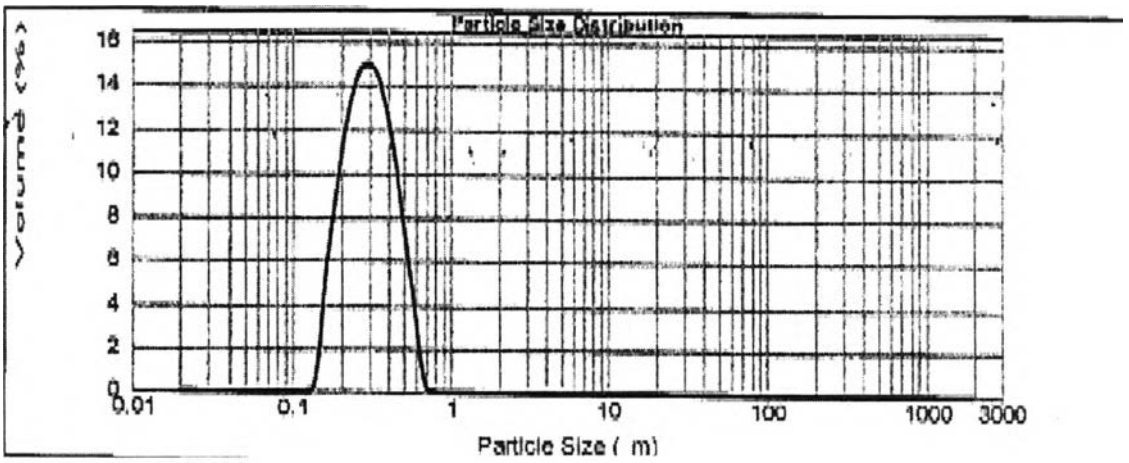


Figure c2. Particle size distribution of 20% Intralipid®.

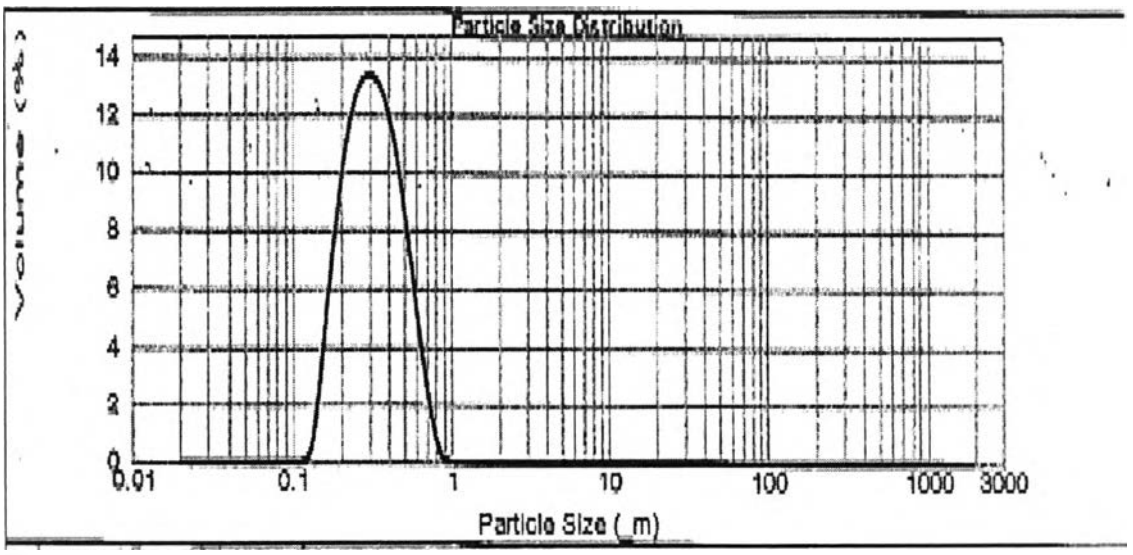


Figure c3. Particle size distribution of Vitalipid® N Infant.

VITA

Miss Thanaphan Sakulchaijaroen was born in October 7, 1974 in Bangkok, Thailand. She has received her Bachelor of Science in Chemistry from the Faculty of Sciences, King Mongkut's Institute of Technology Thonburi since 1996. After graduate, she had been worked as a chemist in research and development of cosmetic products at International Laboratories Corporation Limited from 1996-1998 and at The East Asiatic (Thailand) PCL.from 1998-2004.