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APPENDICES

ศูนย์วิทยทรัพยากร
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Appendix A

Table A.1 %Weight loss of LDPE films and LDPE/encapsulated particle films under outdoor test

	Additive	%Additive (%w/w)	Exposure Time (months)			
			1	2	3	4
LDPE	-	-	0.01	0.02	0.03	0.04
LDPE	benzophenone	0.5	0.02	0.03	0.04	0.04
		1	0.01	0.03	0.04	0.03
		3	0.02	0.02	0.04	0.09
		5	0.00	0.03	0.05	0.12
LDPE	gelatin	0.5	0.01	0.02	0.03	0.05
		1	0.01	0.02	0.06	0.04
		3	0.02	0.03	0.07	0.10
		5	0.00	0.04	0.08	0.12
LDPE	EN1	0.5	0.01	0.03	0.02	0.03
		1	0.01	0.05	0.03	0.06
		3	0.00	0.05	0.09	0.16
		5	0.00	0.02	0.08	0.16
LDPE	EN2	0.5	0.00	0.03	0.04	0.06
		1	0.01	0.02	0.06	0.08
		3	0.02	0.02	0.05	0.09
		5	0.01	0.02	0.06	0.12
LDPE	EN3	0.5	0.00	0.03	0.02	0.05
		1	0.00	0.05	0.08	0.09
		3	0.00	0.02	0.10	0.25
		5	0.02	0.02	0.08	0.20
LDPE	EN4	0.5	0.00	0.03	0.04	0.03
		1	0.03	0.02	0.04	0.08
		3	0.01	0.03	0.07	0.10
		5	0.03	0.01	0.04	0.13
LDPE	EN5	0.5	0.00	0.02	0.04	0.02
		1	0.00	0.02	0.06	0.04
		3	0.01	0.03	0.07	0.11
		5	0.03	0.01	0.08	0.13
LDPE	EN6	0.5	0.01	0.02	0.04	0.08
		1	0.01	0.02	0.06	0.04
		3	0.00	0.04	0.03	0.07
		5	0.01	0.04	0.02	0.12

Table A.2 %Weight loss of LDPE films and LDPE/encapsulated particle films under accelerated test

	Additive	%Additive (%w/w)	UVB Exposure Time (hours)			
			20.5	41.0	61.5	82.0
LDPE	-	-	0.01	0.03	0.02	0.01
LDPE	benzophenone	0.5	0.02	0.03	0.04	0.02
		1	0.01	0.03	0.02	0.03
		3	0.02	0.02	0.04	0.01
		5	0.02	0.01	0.01	0.01
LDPE	gelatin	0.5	0.01	0.02	0.03	0.00
		1	0.01	0.02	0.00	0.04
		3	0.02	0.03	0.01	0.02
		5	0.00	0.01	0.02	0.02
LDPE	EN1	0.5	0.01	0.03	0.02	0.03
		1	0.01	0.01	0.03	0.00
		3	0.00	0.01	0.02	0.00
		5	0.02	0.00	0.01	0.00
LDPE	EN2	0.5	0.00	0.00	0.04	0.02
		1	0.01	0.02	0.02	0.03
		3	0.02	0.02	0.03	0.01
		5	0.02	0.01	0.01	0.03
LDPE	EN3	0.5	0.00	0.03	0.02	0.01
		1	0.00	0.03	0.02	0.00
		3	0.00	0.02	0.10	0.01
		5	0.00	0.02	0.00	0.01
LDPE	EN4	0.5	0.00	0.03	0.04	0.03
		1	0.03	0.02	0.04	0.01
		3	0.01	0.03	0.00	0.01
		5	0.01	0.01	0.01	0.02
LDPE	EN5	0.5	0.00	0.02	0.04	0.02
		1	0.00	0.02	0.01	0.04
		3	0.01	0.03	0.02	0.03
		5	0.01	0.00	0.02	0.03
LDPE	EN6	0.5	0.01	0.02	0.04	0.01
		1	0.01	0.02	0.02	0.00
		3	0.00	0.04	0.03	0.01
		5	0.01	0.03	0.01	0.02

Table A.3 %Weight loss of LDPE films and LDPE/encapsulated particle films under accelerated test during 82 -143.5 hours

Additive	%Additive (%w/w)	UVB Exposure Time (hours)			
		82.0	102.5	123.0	143.5
-	-	0.01	0.02	0.03	0.05
benzophenone	5	0.01	0.01	0.02	0.06
gelatin	5	0.02	0.03	0.00	0.04
EN1	5	0.00	0.01	0.02	0.06
EN2	5	0.03	0.00	0.01	0.05
EN3	5	0.01	0.02	0.00	0.06
EN4	5	0.02	0.01	0.03	0.04
EN5	5	0.03	0.00	0.02	0.05
EN6	5	0.02	0.02	0.01	0.04

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Appendix B

Table B.1 Carbonyl Index of LDPE films and LDPE/encapsulated films under outdoor test

	Additive	%Additive (%w/w)	Exposure Time (months)				
			0	1	2	3	4
LDPE	-	-	0.072	0.161	0.402	0.606	0.612
LDPE	benzophenone	0.5	0.074	0.285	0.411	0.695	0.627
		1	0.079	0.207	0.599	0.666	0.741
		3	0.045	0.299	0.485	0.796	1.096
		5	0.080	0.312	0.669	0.911	1.399
LDPE	gelatin	0.5	0.079	0.299	0.546	0.622	0.700
		1	0.054	0.323	0.627	0.706	0.693
		3	0.129	0.242	0.467	0.785	0.750
		5	0.137	0.355	0.581	0.785	0.921
LDPE	EN1	0.5	0.028	0.206	0.459	0.706	0.623
		1	0.026	0.316	0.429	0.716	0.722
		3	0.091	0.324	0.593	0.816	0.832
		5	0.024	0.264	0.600	0.826	0.923
LDPE	EN2	0.5	0.152	0.196	0.402	0.597	0.621
		1	0.026	0.349	0.412	0.601	0.612
		3	0.053	0.388	0.501	0.624	0.731
		5	0.068	0.219	0.432	0.693	0.864
LDPE	EN3	0.5	0.023	0.201	0.392	0.622	0.610
		1	0.019	0.158	0.561	0.602	0.635
		3	0.025	0.195	0.422	0.591	0.632
		5	0.031	0.291	0.531	0.623	0.597
LDPE	EN4	0.5	0.058	0.144	0.497	0.665	0.612
		1	0.016	0.196	0.472	0.612	0.621
		3	0.098	0.186	0.632	0.691	0.671
		5	0.097	0.155	0.495	0.764	0.806
LDPE	EN5	0.5	0.172	0.204	0.604	0.590	0.601
		1	0.043	0.149	0.431	0.563	0.619
		3	0.072	0.193	0.413	0.769	0.731
		5	0.093	0.134	0.519	0.749	0.847
LDPE	EN6	0.5	0.041	0.200	0.431	0.559	0.621
		1	0.024	0.150	0.399	0.692	0.612
		3	0.033	0.170	0.597	0.682	0.731
		5	0.032	0.160	0.567	0.612	0.864

Table B.2 Carbonyl Index of LDPE films and LDPE/encapsulated particle films under accelerated test

	Additive	%Additive (%w/w)	UVB Exposure Time (hours)				
			0	20.5	41.0	61.5	82.0
LDPE	-	-	0.072	0.161	0.402	0.606	0.612
LDPE	benzophenone	0.5	0.074	0.285	0.411	0.695	0.627
		1	0.079	0.207	0.599	0.666	0.741
		3	0.045	0.299	0.485	0.796	1.096
		5	0.080	0.312	0.669	0.911	1.399
LDPE	gelatin	0.5	0.079	0.119	0.208	0.267	0.540
		1	0.054	0.068	0.206	0.248	0.597
		3	0.129	0.209	0.153	0.181	0.391
		5	0.137	0.180	0.242	0.322	0.540
LDPE	EN1	0.5	0.028	0.093	0.192	0.365	0.495
		1	0.026	0.086	0.253	0.513	0.586
		3	0.091	0.132	0.240	0.447	0.483
		5	0.024	0.098	0.251	0.344	0.638
LDPE	EN2	0.5	0.023	0.106	0.289	0.330	0.427
		1	0.019	0.104	0.211	0.330	0.398
		3	0.025	0.107	0.227	0.230	0.359
		5	0.031	0.085	0.255	0.290	0.346
LDPE	EN3	0.5	0.023	0.201	0.392	0.622	0.610
		1	0.019	0.158	0.561	0.602	0.635
		3	0.025	0.195	0.422	0.591	0.632
		5	0.031	0.291	0.531	0.623	0.597
LDPE	EN4	0.5	0.021	0.157	0.155	0.330	0.308
		1	0.016	0.120	0.220	0.330	0.316
		3	0.098	0.123	0.301	0.284	0.366
		5	0.097	0.108	0.247	0.335	0.299
LDPE	EN5	0.5	0.065	0.215	0.154	0.271	0.412
		1	0.059	0.146	0.204	0.269	0.401
		3	0.072	0.110	0.167	0.410	0.397
		5	0.081	0.136	0.183	0.326	0.421
LDPE	EN6	0.5	0.041	0.116	0.250	0.305	0.400
		1	0.024	0.229	0.229	0.305	0.470
		3	0.033	0.188	0.188	0.283	0.326
		5	0.032	0.154	0.154	0.185	0.502

Table B.3 Carbonyl Index of LDPE films and LDPE/encapsulated particle films under accelerated test during 82 -143.5 hours

	Additive	%Additive (%w/w)	UVB Exposure Time (hours)			
			82.0	102.5	123.0	143.5
LDPE	-	-	0.38	0.42	0.50	0.60
LDPE	benzophenone	5	0.65	0.80	0.91	1.39
LDPE	gelatin	5	0.50	0.58	0.70	0.80
LDPE	EN1	5	0.64	0.59	0.70	0.81
LDPE	EN2	5	0.36	0.46	0.51	0.60
LDPE	EN3	5	0.35	0.43	0.40	0.50
LDPE	EN4	5	0.30	0.38	0.49	0.56
LDPE	EN5	5	0.42	0.45	0.43	0.58
LDPE	EN6	5	0.50	0.40	0.49	0.58

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Appendix C

Table C.1 Tensile strength of LDPE films and LDPE/encapsulated particle films under outdoor test

	Additive	%Additive (%w/w)	Exposure Time (months)				
			0	1	2	3	4
LDPE	-	-	7.217	6.512	6.574	6.674	5.620
LDPE	benzophenone	0.5	6.473	7.275	7.054	6.960	5.928
		1	7.479	7.110	7.125	6.461	4.976
		3	6.667	6.810	6.689	5.723	3.954
		5	6.134	6.741	6.169	5.215	3.021
LDPE	gelatin	0.5	6.401	7.301	6.443	6.539	5.900
		1	6.600	6.681	7.485	5.877	4.900
		3	5.491	5.914	6.128	6.036	4.587
		5	5.464	5.794	6.051	5.046	3.954
LDPE	EN1	0.5	5.992	4.527	5.385	5.322	5.012
		1	5.817	6.049	5.712	4.279	4.592
		3	5.898	5.896	4.785	4.300	3.278
		5	4.505	5.372	4.310	3.210	2.518
LDPE	EN2	0.5	6.235	5.311	5.709	5.394	4.900
		1	5.924	5.472	5.642	4.900	4.657
		3	5.002	4.935	4.980	4.830	4.068
		5	4.047	4.672	4.520	4.629	3.210
LDPE	EN3	0.5	6.657	5.355	5.500	5.210	5.120
		1	4.916	5.271	5.174	4.597	3.957
		3	4.842	4.915	4.279	4.579	3.759
		5	4.986	3.827	5.178	4.546	3.021
LDPE	EN4	0.5	5.598	6.849	6.038	4.816	5.120
		1	5.364	6.487	5.353	5.911	5.090
		3	5.161	6.057	5.505	4.838	4.269
		5	4.804	5.342	4.235	4.560	3.876
LDPE	EN5	0.5	6.293	5.211	5.609	5.424	4.700
		1	5.916	5.452	5.562	4.800	4.567
		3	5.112	4.895	4.900	4.850	4.075
		5	4.066	4.762	4.490	4.599	3.120
LDPE	EN6	0.5	5.304	5.691	5.429	4.172	5.310
		1	4.053	4.675	4.205	4.096	3.870
		3	5.389	5.542	6.427	4.336	3.640
		5	4.147	4.213	4.556	3.945	2.900

Table C.2 Elongation at break of LDPE films and LDPE/encapsulated particle films under outdoor test

	Additive	%Additive (%w/w)	Exposure Time (months)				
			0	1	2	3	4
LDPE	-	-	25.709	20.467	12.742	10.077	8.336
LDPE	benzophenone	0.5	21.044	27.655	15.189	7.365	7.458
		1	24.444	15.389	10.065	6.958	3.536
		3	19.763	17.082	8.544	5.796	2.196
		5	18.263	15.090	8.169	5.293	1.563
LDPE	gelatin	0.5	22.656	19.044	7.871	6.275	4.563
		1	26.357	16.025	8.849	5.036	3.981
		3	14.731	9.184	5.783	5.012	3.210
		5	19.566	10.543	6.478	3.861	2.950
LDPE	EN1	0.5	22.079	4.240	2.734	4.814	4.006
		1	15.081	7.209	3.718	4.598	3.197
		3	10.445	6.169	2.866	3.095	2.685
		5	11.741	6.144	3.298	2.119	1.998
LDPE	EN2	0.5	12.219	9.591	6.906	4.780	4.520
		1	13.966	9.046	4.551	3.590	3.410
		3	9.604	5.995	3.860	3.184	2.547
		5	7.082	6.621	3.368	3.460	2.692
LDPE	EN3	0.5	22.472	7.726	4.958	3.589	4.687
		1	9.890	7.766	4.033	2.998	3.659
		3	13.504	6.768	3.386	3.065	2.996
		5	13.180	3.962	3.460	2.963	1.998
LDPE	EN4	0.5	13.873	10.104	5.242	4.163	4.724
		1	12.800	10.550	3.991	5.816	3.559
		3	10.341	4.420	3.527	5.447	4.231
		5	10.075	4.509	2.738	4.009	2.553
LDPE	EN5	0.5	12.329	9.951	6.836	4.694	4.420
		1	13.698	9.156	4.624	3.698	3.529
		3	9.634	5.695	3.800	3.344	2.547
		5	7.192	6.581	3.468	3.590	2.782
LDPE	EN6	0.5	11.060	7.244	4.535	2.217	3.091
		1	7.231	6.357	3.066	3.960	3.659
		3	11.064	8.175	5.926	3.016	3.264
		5	7.249	4.296	3.175	3.009	2.654

Table C.3 Tensile strength of LDPE films and LDPE/encapsulated particle films under accelerated test

	Additive	%Additive (%w/w)	UVB Exposure Time (hours)				
			0	20.5	41.0	61.5	82.0
LDPE	-	-	7.217	7.032	6.992	6.832	6.768
LDPE	benzophenone	5	6.134	5.671	6.413	5.619	6.122
LDPE	gelatin	5	5.464	5.885	5.099	5.455	4.597
LDPE	EN1	5	4.505	4.224	4.271	3.606	3.450
LDPE	EN2	5	4.047	4.265	3.998	3.881	2.676
LDPE	EN3	5	4.986	4.003	3.584	3.945	3.894
LDPE	EN4	5	4.037	4.365	3.918	3.221	2.666
LDPE	EN5	5	4.930	4.225	3.538	3.601	2.616

Table C.4 Elongation at break of LDPE films and LDPE/encapsulated particle films under accelerated test

	Additive	%Additive (%w/w)	UVB Exposure Time (hours)				
			-	20.500	41.000	61.500	82.000
LDPE	-	-	25.709	23.057	21.032	20.037	19.384
LDPE	benzophenone	5	18.263	22.081	17.496	9.837	10.536
LDPE	gelatin	5	19.566	17.588	10.944	8.030	5.947
LDPE	EN1	5	11.741	9.879	6.680	3.775	2.423
LDPE	EN2	5	7.082	6.217	6.004	4.981	2.169
LDPE	EN3	5	13.180	10.317	5.959	6.656	5.889
LDPE	EN4	5	8.084	7.240	6.114	4.921	2.209
LDPE	EN5	5	7.082	6.227	5.964	4.901	2.619
LDPE	EN6	5	7.091	6.617	6.034	4.989	2.199

Appendix D

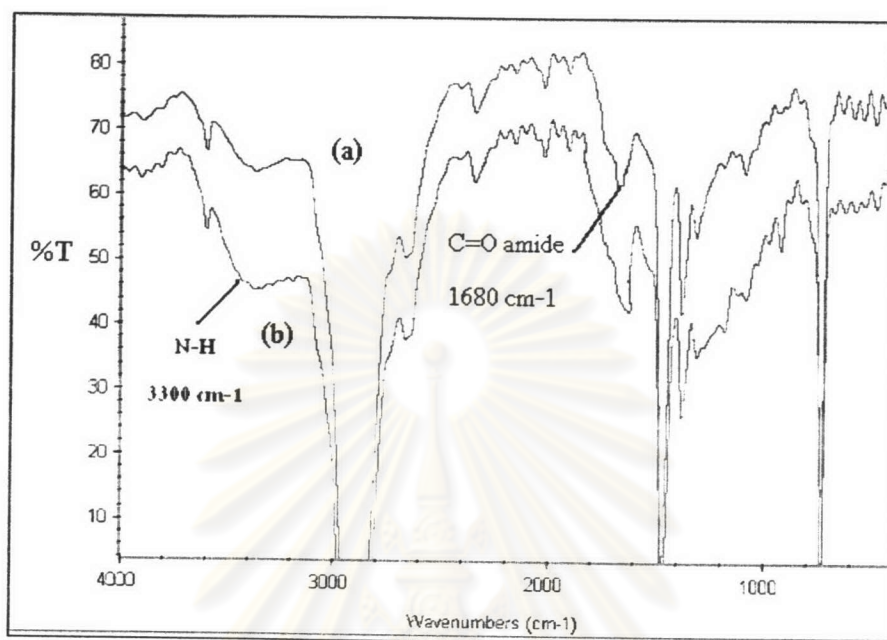


Figure D.1 FTIR spectra of LDPE containing (a) 1% gelatin and (b) 5% gelatin films

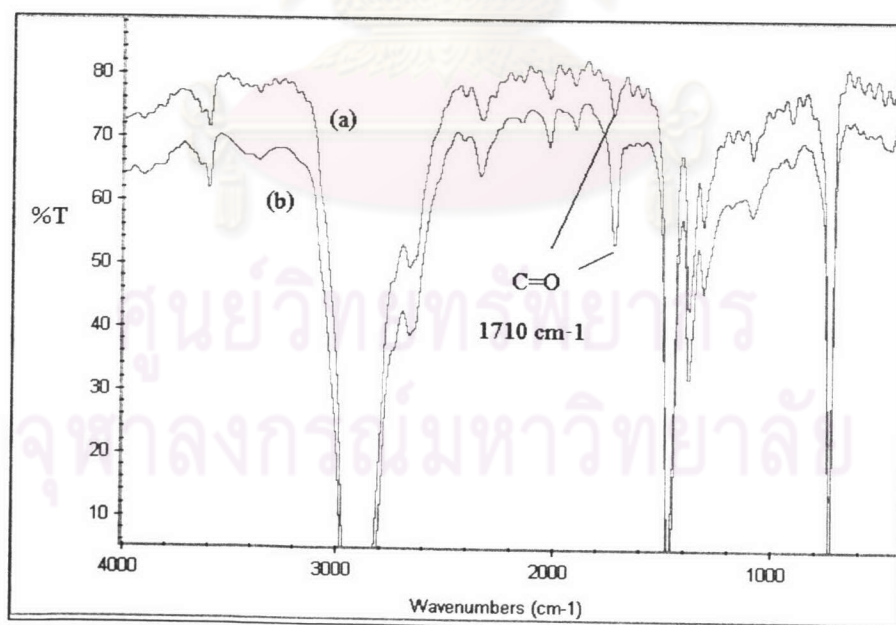


Figure D.2 FTIR spectra of LDPE containing (a) 1% benzophenone and (b) 5% benzophenone

VITA

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