

REFERENCES

1. Bikiaris et al. LDPE/Starch Blends Compatibilized with PE-g-MA copolymers. Journal of Applied Polymer Science (1998) : 1503-1521.
2. Prinos et al. Preparation and Characterization of LDPE/Starch Blends Containing EVA as Compatibilizer. Polymer Engineering and Science v38 (1998) : 954-964.
3. Tikusis. Nondestructive Quantitative Determination of Starch Content in Polyethylene by Solid State NMR and FTIR. Polymer Engineering and Science v33 (1993) : 26-31.
4. ชมรมเทคโนโลยีสิ่งแวดลอมและธุรกิจ. พลาสติกที่ย่อยสลายทางเลือกและทางรอดใหม่ของสิ่งแวดลอม. เทคโนโลยีสิ่งแวดลอมเพื่อธุรกิจ 6 ฉบับที่ 2 (เม.ย - มิ.ย. 43) : 1-3.
5. Susan E.M. Understanding Packaging Technology. USA : Hanser Publisher, 1997.
6. Sailaja et al. Use of PE-g-MA as Compatibilizer for HDPE – Tapioca Starch Blends. Journal of Applied Polymer Science v80 (2001) : 863-872.
7. Renata et al. Composition and Functional Properties of Banana Flour from Different Varieties. Starch/Starke v52 (2000) : 63-68.
8. Lii et al. Investigation of the Physical and Chemical Properties of Banana Starches. Starch/Starke v47 (1982) : 1493-1497.
9. Brydson. Plastic Material. London : The Butterworth Group, 1975.
10. Fred W. Text Book of Polymer Science. USA : A Wiley-Interscience, 1984.
11. Fred W. Text Book of Polymer Science. Japan : Wiley Toppan, 1962.
12. Daniel C.A. Polymers : Structure and Properties. USA : Technomic, 1989.
13. กล้าณรงค์ และ เกื้อกุล. เทคโนโลยีของแป้ง. สำนักพิมพ์มหาวิทยาลัยเกษตรศาสตร์, 2543.
14. Willet. Rheology of Thermoplastic Starch : Effect of temperature, moisture Content, and Additives on Melt Viscosity. Polymer Engineering and Science v35 (1995) : 202-210.
15. Thakore et al. Morphology, Thermomechanical Properties, and Biodegradability of LDPE/Starch Blend. Journal of Applied Polymer Science (1999) : 2791-2802.
16. Kalenga et al. Characterization of Starch and Fiber of Banana Fruit. Journal of Food Science v46 (1981) : 1885-1890.

17. Perez et al. Some Structural, Physicochemical and Functional Studies of Banana Starches Isolated from Two Varieties Growing in Guerrero, Mexico. Starch/Starke v52 (2000) : 68-73.
18. [Http://newcrop.hortpurdue.edu](http://newcrop.hortpurdue.edu) : 2/7/2000
19. Griffin. .British Patent, 1,586,344 (1973).
20. Maddever and Chapman. Processing Symposium Biodegradable Plastic (1987).
21. George et al. Thermoplastic Starch Blends with a Poly(ethylene-co-vinyl alcohol): Processibility and Physical Properties. Polymer Engineering and Science v34 , (1994) : 17-23.
22. Bhattacharya et al. Properties of Blends of Starch and Synthetic Polymers Containing Anhydride Groups: Effect of Amylopectin to Amylose Ratio in Starch. Journal of Applied Polymer Science v57 (1995) : 539-554.
23. Simmon et al. structural Characteristics of Biodegradable Thermoplastic Starch/Poly (ethylene-vinyl alcohol) Blends. Journal of Applied Polymer Science v58 (1995) : 2259-2285.
24. Ioannis et al. Biodegradable Films Made from LDPE, Wheat Starch and Soluble Starch for Food Packaging Application. Carbohydrate Polymer v33 (1997) : 89-103.
25. Otey and Westhoff. US. Patent, 133,784 (1979).
26. Willet. Mechanical Properties of LDPE/Granular Starch Composites. Journal of Applied Polymer Science v54 (1994) : 1685-1695.
27. Goheen et al. Degradation of PE-Starch Blends in Soil. (1991) : 2691-2701.
28. Wool. Biodegradation Dynamics of Polymer-Starch Composites. . Journal of Applied Polymer Science v77 (2000) : 1643-1657.
29. Griffin. Chemistry and Technology of Biodegradable Polymers. UK : Blackie Academic and Professional, 1994.
30. Morton-Jones. Polymer Processing. USA : Chapman and Hill, 1989.
31. Kang et al. Studies on the Physical Properties of Modified Starch-Filled HDPE Film. Journal of Applied Polymer Science v60 (1996) : 1977-1984.

32. Shogren et al. Polymer Compatibility and Biodegradation of Starch – EAA – Polyethylene Blends. Journal of Applied Polymer Science v44 (1992) : 1971 – 1978.
33. Brandrup et al. Polymer Handbook. USA : John Wiley & Sons, 1999.
34. www.tpigroup.co.th



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



Appendix

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Appendix

A1. Data for Tensile Strength of LDPE/Starch/EVA Blends

Machine Direction (MD)

LDPE/Starch/EVA	Tensile Strength (MPa) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	27.74	26.51	26.70	27.76	25.60	26.86	0.91
95/5/0	22.67	20.01	18.59	21.06	21.82	20.83	1.59
95/5/5	21.76	21.06	21.74	24.08	21.23	21.97	1.22
95/5/10	21.38	23.54	22.05	23.32	20.27	22.11	1.36
95/5/20	21.77	23.16	22.41	21.50	22.51	22.27	0.65
90/10/0	16.18	19.08	18.94	16.90	17.34	17.69	1.28
90/10/5	17.34	18.75	18.51	17.64	18.04	18.06	0.59
90/10/10	18.79	20.04	16.55	17.81	18.62	18.36	1.29
90/10/20	19.73	20.56	18.91	18.63	18.44	19.25	0.88
85/15/0	16.41	15.29	16.54	14.98	14.63	15.57	0.86
85/15/5	17.37	16.35	14.49	16.13	15.85	16.04	1.04
85/15/10	15.98	16.16	15.93	17.28	16.31	16.33	0.55
85/15/20	16.49	17.04	15.23	16.39	16.61	16.41	0.67
80/20/0	16.38	15.74	12.84	16.52	15.92	15.48	1.51
80/20/5	15.61	16.03	17.19	15.80	15.82	16.09	0.63
80/20/10	18.27	16.24	15.90	16.79	17.31	16.90	0.93
80/20/20	18.63	17.53	16.07	15.80	18.16	17.24	1.26

A2. Data for Tensile Strength of LDPE/Starch/EVA Blends

Transverse Direction(TD)

LDPE/Starch/EVA	Tensile Strength (MPa) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	6.57	7.55	6.84	8.18	6.76	7.18	0.67
95/5/0	5.99	5.63	6.05	6.19	5.76	5.92	0.23
95/5/5	6.27	6.29	6.13	6.04	6.03	6.15	0.12
95/5/10	7.52	5.38	6.44	6.41	6.50	6.45	0.76
95/5/20	7.01	6.89	6.85	6.38	6.75	6.78	0.24
90/10/0	5.89	6.82	4.78	5.83	5.75	5.81	0.72
90/10/5	6.21	6.02	6.03	6.01	6.01	6.06	0.09
90/10/10	6.61	6.55	6.56	6.32	5.93	6.39	0.28
90/10/20	6.35	6.56	6.61	6.79	6.27	6.52	0.21
85/15/0	5.60	5.94	5.61	5.48	5.60	5.65	0.17
85/15/5	5.75	5.65	5.55	5.98	5.85	5.76	0.17
85/15/10	5.67	5.71	6.01	5.85	5.71	5.79	0.14
85/15/20	6.26	5.97	6.05	5.96	5.92	6.03	0.14
80/20/0	5.55	5.90	5.50	5.53	5.66	5.63	0.16
80/20/5	5.87	5.34	5.81	5.79	5.40	5.64	0.25
80/20/10	5.99	5.59	5.83	5.73	5.41	5.71	0.22
80/20/20	5.93	5.92	5.87	5.87	5.73	5.86	0.08

A3. Data for Elongation at Break of LDPE/Starch/EVA Blends

Machine Direction(MD)

LDPE/Starch/EVA	Elongation at Break (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	127.5	95.5	121.9	111.6	83.9	108.1	18.2
95/5/0	75.0	76.7	80.9	91.8	69.8	78.8	8.3
95/5/5	103.4	104.5	109.9	95.4	107.1	104.1	5.5
95/5/10	119.9	111.4	107.2	108.2	101.3	109.6	6.8
95/5/20	122.5	123.3	117.4	109.5	116.7	117.9	5.5
90/10/0	83.5	78.3	71.2	63.9	76.3	74.6	7.4
90/10/5	103.8	96.5	105.5	106.1	93.4	101.1	5.7
90/10/10	100.2	102.8	108.4	95.1	108.1	102.9	5.6
90/10/20	103.2	109.2	94.7	104.6	106.8	103.7	5.5
85/15/0	75.5	78.0	61.1	77.1	70.6	72.5	7.0
85/15/5	94.4	94.1	93.0	84.4	89.4	91.0	4.2
85/15/10	96.6	100.0	96.4	92.4	86.0	94.3	5.4
85/15/20	106.7	95.0	93.3	98.1	104.6	99.5	5.9
80/20/0	76.5	75.1	67.9	70.4	69.7	71.9	3.7
80/20/5	79.9	79.1	55.7	81.9	83.2	75.9	11.5
80/20/10	88.3	82.6	72.7	74.5	76.1	78.8	6.5
80/20/20	72.4	89.8	59.0	91.6	85.3	79.6	13.7

A4. Data for Elongation at Break of LDPE/Starch/EVA Blends

Transverse Direction(TD)

LDPE/Starch/EVA	Elongation at Break (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	327.1	398.5	329.6	362.6	306.2	244.8	36.2
95/5/0	227.4	216.1	250.8	223.2	236.9	230.9	13.4
95/5/5	224.5	223.6	273.7	209.8	266.9	239.7	28.6
95/5/10	243.5	248.2	263.1	235.4	248.6	247.8	10.1
95/5/20	254.1	277.1	267.4	245.5	256.8	260.2	12.3
90/10/0	205.8	209.1	222.9	213.8	239.3	218.2	13.4
90/10/5	228.5	232.4	240.8	198.9	211.7	222.5	16.9
90/10/10	222.0	255.2	222.4	219.6	236.7	231.2	15.0
90/10/20	242.5	244.3	241.7	269.8	247.1	249.1	11.8
85/15/0	140.9	166.1	131.0	144.6	178.1	152.1	19.4
85/15/5	190.9	178.6	184.2	193.5	168.4	183.1	10.1
85/15/10	196.1	198.2	189.0	187.3	186.8	191.5	5.3
85/15/20	209.6	202.7	228.1	246.0	254.0	228.1	22.2
80/20/0	132.1	157.6	147.9	159.3	131.2	145.6	13.5
80/20/5	174.5	161.2	167.4	170.2	151.1	164.9	9.1
80/20/10	196.4	187.5	179.8	166.3	174.7	180.9	11.6
80/20/20	205.2	186.4	199.3	184.6	188.6	192.8	9.0

A5. Data for Tensile Strength of LDPE/Starch/EVA Blends After Exposed in
Activated Sludge for 2 Weeks

LDPE/Starch/EVA	Tensile Strength (MPa) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	30.08	29.02	28.22	26.14	29.07	28.51	1.48
95/5/0	23.46	22.29	20.98	18.86	22.44	21.61	1.77
95/5/5	24.02	20.99	22.46	22.25	23.64	22.67	1.20
95/5/10	22.97	24.00	24.01	22.48	24.16	23.52	0.75
95/5/20	22.54	23.74	23.68	24.66	24.79	23.88	0.91
90/10/0	18.28	17.70	19.17	19.61	19.10	18.77	0.77
90/10/5	19.36	20.40	19.89	19.55	18.90	19.62	0.56
90/10/10	20.45	22.17	19.30	19.49	20.49	20.38	1.14
90/10/20	20.75	19.23	21.01	21.34	19.84	20.43	0.87
85/15/0	16.22	16.19	15.41	17.05	16.36	16.25	0.58
85/15/5	17.59	17.45	16.94	17.64	16.80	17.28	0.39
85/15/10	17.28	16.85	17.67	17.85	17.16	17.36	0.40
85/15/20	17.43	16.64	17.95	18.08	18.01	17.62	0.61
80/20/0	14.77	15.07	15.74	15.61	14.63	15.16	0.49
80/20/5	15.60	14.63	15.26	15.08	15.60	15.23	0.41
80/20/10	15.09	15.45	16.67	15.76	15.01	15.60	0.67
80/20/20	15.93	15.29	16.35	15.23	14.88	15.54	0.59

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A6. Data for Tensile Strength of LDPE/Starch/EVA Blends After Exposed in
Activated Sludge for 4 Weeks

LDPE/Starch/EVA	Tensile Strength (MPa) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	29.44	27.86	27.97	27.33	28.25	28.17	0.78
95/5/0	20.57	19.44	20.57	19.86	20.91	20.27	0.60
95/5/5	23.36	21.29	21.76	21.46	23.07	22.19	0.96
95/5/10	23.08	23.39	22.89	22.63	20.83	22.56	1.01
95/5/20	24.04	23.29	24.46	21.66	22.77	23.24	1.10
90/10/0	18.48	18.51	17.79	17.87	17.40	18.01	0.48
90/10/5	18.45	18.28	18.20	17.96	18.55	18.29	0.23
90/10/10	18.60	19.69	19.63	18.86	18.78	19.11	0.51
90/10/20	17.77	17.66	19.36	20.88	20.07	19.15	1.41
85/15/0	17.16	18.06	13.51	15.91	15.87	16.10	1.71
85/15/5	17.02	16.98	16.82	16.95	16.62	16.88	0.16
85/15/10	17.82	17.15	16.63	16.59	16.44	16.93	0.57
85/15/20	18.04	17.46	16.55	16.60	17.41	17.21	0.63
80/20/0	15.63	14.39	14.89	14.74	14.27	14.78	0.54
80/20/5	14.32	15.94	15.04	15.16	14.50	14.99	0.64
80/20/10	15.72	14.52	14.71	15.39	15.47	15.16	0.52
80/20/20	14.67	15.68	15.72	15.04	15.25	15.27	0.44

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A7. Data for Tensile Strength of LDPE/Starch/EVA Blends After Exposed in
Activated Sludge for 6 Weeks

LDPE/Starch/EVA	Tensile Strength (MPa) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	25.17	26.91	25.09	27.54	28.49	26.64	1.49
95/5/0	19.07	19.26	20.03	19.82	20.72	19.78	0.66
95/5/5	22.18	23.04	22.26	22.16	20.26	21.98	1.03
95/5/10	22.30	22.94	22.26	21.61	21.87	22.20	0.50
95/5/20	21.36	21.77	22.95	23.36	23.57	22.60	0.98
90/10/0	16.84	17.40	18.44	16.71	17.32	17.34	0.68
90/10/5	17.09	19.38	18.22	17.41	17.39	17.90	0.93
90/10/10	17.82	21.62	18.44	17.83	18.27	18.80	1.60
90/10/20	17.47	19.93	19.58	19.58	18.75	19.06	0.99
85/15/0	14.77	15.74	16.08	15.31	15.70	15.52	0.50
85/15/5	16.82	17.85	16.68	15.84	15.55	16.55	0.91
85/15/10	16.53	15.69	16.86	17.23	17.01	16.66	0.60
85/15/20	18.27	16.05	17.96	16.81	15.54	16.93	1.18
80/20/0	12.71	14.04	14.38	14.55	13.98	13.93	0.72
80/20/5	14.78	13.17	15.45	14.24	14.15	14.36	0.84
80/20/10	15.15	14.92	14.19	14.61	14.23	14.62	0.42
80/20/20	15.41	14.48	15.36	14.24	13.90	14.68	0.68

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A8. Data for Tensile Strength of LDPE/Starch/EVA Blends After Exposed in
Activated Sludge for 8 Weeks

LDPE/Starch/EVA	Tensile Strength (MPa) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	25.43	25.55	24.78	25.98	28.19	25.99	1.30
95/5/0	18.53	19.33	18.61	20.05	18.51	19.01	0.68
95/5/5	21.92	21.59	21.52	21.64	21.95	21.72	0.20
95/5/10	22.70	22.50	19.75	22.47	21.59	21.80	1.22
95/5/20	21.00	22.49	22.39	22.67	22.96	22.30	0.76
90/10/0	18.22	16.45	16.15	15.07	16.69	16.52	1.14
90/10/5	15.40	17.54	17.60	18.49	15.58	16.92	1.36
90/10/10	18.56	17.69	18.86	17.86	19.33	18.46	0.69
90/10/20	19.50	19.07	18.01	18.54	19.76	18.98	0.71
85/15/0	14.00	14.08	13.63	14.98	15.79	14.50	0.88
85/15/5	14.94	16.10	16.37	15.57	15.65	15.73	0.55
85/15/10	15.84	16.28	16.18	16.99	15.88	16.23	0.46
85/15/20	16.99	16.90	16.63	17.50	14.82	16.57	1.03
80/20/0	14.12	12.86	12.96	12.36	12.64	12.99	0.67
80/20/5	14.10	14.13	14.30	13.69	13.90	14.02	0.23
80/20/10	14.56	14.70	14.59	13.77	13.77	14.28	0.47
80/20/20	14.12	14.23	14.64	15.00	14.25	14.45	0.37

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A9. Data for Elongation at Break of LDPE/Starch/EVA Blends After Exposed in
Activated Sludge for 2 Weeks

LDPE/Starch/EVA	Elongation at Break (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	103.60	108.60	96.47	115.40	107.20	106.25	6.94
95/5/0	76.73	84.76	71.69	56.33	85.23	74.95	11.86
95/5/5	86.28	80.31	90.31	90.29	88.06	87.05	4.13
95/5/10	92.17	108.40	86.62	97.60	101.20	97.20	8.35
95/5/20	111.78	112.99	122.50	129.10	122.50	119.77	7.28
90/10/0	72.19	68.99	72.08	75.31	76.55	73.02	2.98
90/10/5	74.40	83.78	78.57	80.52	75.97	78.65	3.71
90/10/10	95.24	96.49	82.36	85.41	69.70	85.84	10.89
90/10/20	92.79	88.66	105.80	107.70	91.46	97.28	8.80
85/15/0	66.63	68.84	67.14	74.86	69.42	69.38	3.28
85/15/5	76.81	70.56	72.71	81.03	66.80	73.58	5.52
85/15/10	80.45	85.46	83.00	92.60	85.23	85.35	4.53
85/15/20	96.97	98.42	102.98	100.84	87.76	97.39	5.86
80/20/0	66.81	69.03	76.53	69.78	64.08	69.25	4.64
80/20/5	74.81	76.54	72.55	72.85	67.14	72.78	3.54
80/20/10	77.48	78.71	78.76	63.21	72.88	74.21	6.60
80/20/20	80.63	73.18	72.40	78.80	79.69	76.94	3.85

จุฬาลงกรณ์มหาวิทยาลัย

A10. Data for Elongation at Break of LDPE/Starch/EVA Blends After Exposed in Activated Sludge for 4 Weeks

LDPE/Starch/EVA	Elongation at Break (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	105.40	101.60	92.80	104.20	109.40	102.68	6.20
95/5/0	77.66	71.96	72.63	71.09	70.78	72.82	2.80
95/5/5	80.63	82.42	83.06	70.68	72.23	77.80	5.89
95/5/10	90.82	91.56	87.63	87.44	73.64	86.22	7.27
95/5/20	97.59	98.82	116.00	115.80	110.30	107.70	8.98
90/10/0	66.58	63.33	71.91	79.30	76.59	71.54	6.67
90/10/5	71.26	70.22	86.30	76.25	75.00	75.81	6.38
90/10/10	72.27	73.67	90.00	73.81	81.40	78.23	7.49
90/10/20	91.70	91.50	97.50	89.97	94.10	92.95	2.94
85/15/0	70.16	71.28	63.85	71.28	65.38	68.39	3.52
85/15/5	70.61	66.84	68.16	71.83	67.66	69.02	2.11
85/15/10	69.33	79.86	74.56	75.80	82.24	76.36	4.99
85/15/20	95.13	87.38	95.04	83.34	91.63	90.50	5.11
80/20/0	71.42	62.21	67.09	59.87	78.81	67.88	7.57
80/20/5	68.80	66.28	74.08	62.48	68.61	68.05	4.22
80/20/10	69.16	82.33	78.81	65.14	73.86	73.86	6.97
80/20/20	73.60	79.48	80.65	75.48	70.39	75.92	4.22

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A11. Data for Elongation at Break of LDPE/Starch/EVA Blends After Exposed in Activated Sludge for 6 Weeks

LDPE/Starch/EVA	Elongation at Break (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	82.97	113.80	84.29	102.50	116.80	100.07	15.94
95/5/0	76.89	66.00	74.08	69.69	63.61	70.05	5.50
95/5/5	70.53	70.73	83.84	80.49	69.26	74.97	6.70
95/5/10	75.46	92.54	89.17	77.89	71.18	81.25	9.17
95/5/20	100.12	106.20	114.00	88.14	94.31	100.55	10.07
90/10/0	61.81	75.26	71.81	67.71	67.21	68.76	5.08
90/10/5	69.95	61.85	82.29	71.83	82.33	73.65	8.75
90/10/10	77.20	75.40	78.20	75.60	79.10	77.10	1.61
90/10/20	89.78	87.57	95.00	99.80	91.01	92.63	4.83
85/15/0	69.61	62.31	78.70	62.50	63.49	67.32	7.03
85/15/5	62.99	61.41	74.99	67.36	73.99	68.15	6.20
85/15/10	69.90	76.01	78.32	80.29	67.03	74.31	5.64
85/15/20	79.71	91.00	95.84	94.50	79.85	88.18	7.87
80/20/0	64.12	67.66	71.36	63.01	69.76	67.18	3.57
80/20/5	72.31	72.63	66.67	63.72	62.69	67.60	4.68
80/20/10	72.93	75.48	63.70	74.33	76.52	72.59	5.15
80/20/20	77.70	67.61	79.34	73.91	74.24	74.56	4.51

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A12. Data for Elongation at Break of LDPE/Starch/EVA Blends After Exposed in Activated Sludge for 8 Weeks

LDPE/Starch/EVA	Elongation at Break (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	91.06	110.30	96.70	95.44	104.80	99.66	7.75
95/5/0	63.56	79.52	55.46	72.36	72.56	68.69	9.32
95/5/5	95.50	59.65	67.46	66.89	72.43	72.39	13.70
95/5/10	81.99	77.96	77.23	73.39	82.56	78.63	3.76
95/5/20	105.90	100.10	91.70	91.46	112.70	100.37	9.18
90/10/0	74.24	73.01	53.20	60.26	75.81	67.30	10.02
90/10/5	65.12	72.99	75.23	71.76	80.12	73.04	5.46
90/10/10	87.30	69.62	63.71	75.83	84.88	76.27	9.97
90/10/20	90.60	89.40	81.40	84.90	84.80	86.22	3.75
85/15/0	68.24	71.23	69.59	66.96	57.47	66.70	5.40
85/15/5	64.56	68.77	70.13	70.04	64.73	67.65	2.79
85/15/10	67.18	77.74	64.20	81.68	70.95	72.35	7.27
85/15/20	97.85	89.51	83.18	85.33	83.35	87.84	6.15
80/20/0	70.65	62.43	70.67	64.65	64.82	66.64	3.79
80/20/5	67.65	60.60	72.67	63.08	70.32	66.86	5.00
80/20/10	69.33	69.46	79.62	67.41	73.56	71.88	4.88
80/20/20	71.99	69.97	75.24	73.29	78.92	73.88	3.41

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A13. Data for Weight Loss of LDPE/Starch/EVA Blends After Exposed in Activated Sludge for 2 Weeks

LDPE/Starch/EVA	Weight Loss (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	0	0	0	0	0	0	0
95/5/0	0.15	0.11	0.16	0.12	0.12	0.13	0.02
95/5/5	0.09	0.10	0.09	0.10	0.09	0.09	0.01
95/5/10	0.06	0.07	0.07	0.07	0.07	0.07	0.00
95/5/20	0.03	0.04	0.04	0.04	0.03	0.03	0.01
90/10/0	0.23	0.26	0.24	0.28	0.30	0.26	0.03
90/10/5	0.22	0.21	0.28	0.25	0.24	0.24	0.03
90/10/10	0.26	0.28	0.22	0.18	0.21	0.23	0.04
90/10/20	0.21	0.23	0.18	0.20	0.14	0.19	0.03
85/15/0	0.36	0.29	0.34	0.30	0.34	0.33	0.03
85/15/5	0.27	0.29	0.29	0.31	0.26	0.28	0.02
85/15/10	0.28	0.29	0.23	0.26	0.24	0.26	0.03
85/15/20	0.22	0.28	0.23	0.25	0.23	0.24	0.02
80/20/0	0.44	0.48	0.43	0.45	0.46	0.45	0.02
80/20/5	0.39	0.41	0.46	0.38	0.49	0.43	0.05
80/20/10	0.37	0.34	0.36	0.39	0.38	0.37	0.02
80/20/20	0.35	0.29	0.36	0.34	0.31	0.33	0.03

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A14. Data for Weight Loss of LDPE/Starch/EVA Blends After Exposed in Activated Sludge for 4 Weeks

LDPE/Starch/EVA	Weight Loss (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	0	0	0	0	0	0	0
95/5/0	0.17	0.22	0.23	0.19	0.20	0.20	0.02
95/5/5	0.19	0.16	0.17	0.20	0.19	0.18	0.02
95/5/10	0.10	0.08	0.11	0.13	0.12	0.11	0.02
95/5/20	0.07	0.07	0.07	0.06	0.07	0.07	0.00
90/10/0	0.36	0.36	0.37	0.36	0.37	0.36	0.00
90/10/5	0.31	0.29	0.34	0.35	0.38	0.33	0.04
90/10/10	0.26	0.27	0.32	0.30	0.24	0.28	0.03
90/10/20	0.25	0.22	0.17	0.24	0.24	0.22	0.03
85/15/0	0.50	0.49	0.54	0.54	0.53	0.52	0.02
85/15/5	0.47	0.49	0.47	0.51	0.48	0.48	0.02
85/15/10	0.44	0.47	0.45	0.47	0.46	0.46	0.01
85/15/20	0.44	0.39	0.42	0.45	0.43	0.43	0.02
80/20/0	1.01	0.88	0.89	1.03	0.84	0.93	0.08
80/20/5	0.69	0.68	0.72	0.75	0.70	0.71	0.03
80/20/10	0.60	0.58	0.63	0.62	0.63	0.61	0.02
80/20/20	0.51	0.55	0.52	0.54	0.56	0.54	0.02

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A15. Data for Weight Loss of LDPE/Starch/EVA Blends After Exposed in Activated Sludge for 6 Weeks

LDPE/Starch/EVA	Weight Loss (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	0	0	0	0	0	0	0
95/5/0	0.46	0.44	0.45	0.38	0.43	0.43	0.03
95/5/5	0.37	0.41	0.43	0.36	0.30	0.37	0.05
95/5/10	0.32	0.30	0.29	0.34	0.30	0.31	0.02
95/5/20	0.17	0.19	0.16	0.21	0.21	0.19	0.02
90/10/0	0.65	0.68	0.66	0.63	0.67	0.66	0.02
90/10/5	0.63	0.62	0.58	0.60	0.58	0.60	0.02
90/10/10	0.56	0.51	0.53	0.58	0.63	0.56	0.05
90/10/20	0.51	0.51	0.57	0.54	0.54	0.53	0.03
85/15/0	1.69	1.73	1.71	1.73	1.68	1.71	0.02
85/15/5	1.55	1.54	1.56	1.58	1.57	1.56	0.02
85/15/10	1.31	1.35	1.32	1.38	1.30	1.33	0.03
85/15/20	1.05	1.02	1.07	1.05	1.02	1.04	0.02
80/20/0	2.51	2.54	2.53	2.55	2.51	2.53	0.02
80/20/5	2.17	2.14	2.13	2.16	2.16	2.15	0.02
80/20/10	1.91	1.95	1.97	2.01	1.97	1.96	0.04
80/20/20	1.83	1.79	1.82	1.79	1.79	1.80	0.02

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A16. Data for Weight Loss of LDPE/Starch/EVA Blends After Exposed in Activated Sludge for 8 Weeks

LDPE/Starch/EVA	Weight Loss (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	0	0	0	0	0	0	0
95/5/0	0.65	0.68	0.63	0.71	0.62	0.66	0.04
95/5/5	0.53	0.51	0.49	0.50	0.48	0.50	0.02
95/5/10	0.43	0.45	0.39	0.41	0.43	0.42	0.02
95/5/20	0.27	0.31	0.30	0.28	0.26	0.28	0.02
90/10/0	1.03	1.01	0.97	0.98	0.96	0.99	0.03
90/10/5	0.97	0.97	0.95	1.00	0.93	0.96	0.03
90/10/10	0.92	0.91	0.87	0.90	0.86	0.89	0.03
90/10/20	0.83	0.83	0.79	0.82	0.85	0.82	0.02
85/15/0	1.93	1.94	1.88	1.89	1.86	1.90	0.03
85/15/5	1.76	1.74	1.76	1.78	1.77	1.76	0.01
85/15/10	1.56	1.58	1.55	1.56	1.52	1.55	0.02
85/15/20	1.30	1.35	1.33	1.31	1.29	1.32	0.02
80/20/0	2.94	3.03	2.96	2.99	2.97	2.98	0.03
80/20/5	2.46	2.51	2.50	2.46	2.43	2.47	0.03
80/20/10	2.18	2.21	2.23	2.19	2.20	2.20	0.02
80/20/20	1.94	1.98	2.02	2.03	2.02	2.00	0.04

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A17. Data for Weight Loss of LDPE/Starch/EVA Blends After Exposed in Enzyme
Solution for 2 Hours

LDPE/Starch/EVA	Weight Loss (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	0	0	0	0	0	0	0
95/5/0	0.22	0.18	0.17	0.16	0.14	0.17	0.03
90/10/0	0.34	0.36	0.40	0.32	0.36	0.36	0.03
85/15/0	0.55	0.57	0.53	0.56	0.57	0.56	0.02
80/20/0	0.83	0.80	0.79	0.80	0.82	0.81	0.02
80/20/5	0.81	0.75	0.79	0.79	0.77	0.78	0.02
80/20/10	0.72	0.76	0.74	0.74	0.77	0.75	0.02
80/20/20	0.69	0.70	0.69	0.73	0.73	0.71	0.02

A18. Data for Weight Loss of LDPE/Starch/EVA Blends After Exposed in Enzyme
Solution for 4 Hours

LDPE/Starch/EVA	Weight Loss (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	0	0	0	0	0	0	0
95/5/0	0.22	0.19	0.26	0.24	0.22	0.23	0.03
90/10/0	0.48	0.53	0.53	0.54	0.52	0.52	0.02
85/15/0	0.75	0.77	0.75	0.78	0.76	0.76	0.01
80/20/0	1.02	0.98	1.01	0.99	0.97	0.99	0.02
80/20/5	0.95	0.96	0.96	0.99	0.94	0.96	0.02
80/20/10	0.91	0.89	0.94	0.93	0.96	0.93	0.03
80/20/20	0.91	0.88	0.89	0.87	0.90	0.89	0.02

A19. Data for Weight Loss of LDPE/Starch/EVA Blends After Exposed in Enzyme

Solution for 6 Hours

LDPE/Starch/EVA	Weight Loss (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	0	0	0	0	0	0	0
95/5/0	0.56	0.48	0.50	0.52	0.53	0.52	0.03
90/10/0	0.69	0.73	0.73	0.71	0.74	0.72	0.02
85/15/0	0.89	0.88	0.85	0.90	0.87	0.88	0.02
80/20/0	1.15	1.12	1.13	1.14	1.10	1.13	0.02
80/20/5	1.05	1.08	1.06	1.09	1.12	1.08	0.03
80/20/10	1.03	1.06	1.07	1.06	1.07	1.06	0.02
80/20/20	0.98	1.02	1.03	0.98	1.03	1.01	0.03

A20. Data for Weight Loss of LDPE/Starch/EVA Blends After Exposed in Enzyme

Solution for 8 Hours

LDPE/Starch/EVA	Weight Loss (%) of LDPE/Starch/EVA Blends						
	X1	X2	X3	X4	X5	mean	SD
100/0/0	0	0	0	0	0	0	0
95/5/0	0.69	0.70	0.75	0.74	0.75	0.73	0.03
90/10/0	0.95	0.87	0.92	0.89	0.90	0.91	0.03
85/15/0	1.20	1.17	1.22	1.19	1.10	1.18	0.05
80/20/0	1.47	1.42	1.43	1.46	1.45	1.45	0.02
80/20/5	1.38	1.38	1.44	1.41	1.43	1.41	0.03
80/20/10	1.38	1.35	1.33	1.36	1.37	1.36	0.02
80/20/20	1.28	1.29	1.32	1.30	1.31	1.30	0.02

A21. Data for Moisture Absorption of Starch

Time (hrs)	Moisture Absorption (%) of Starch						
	X1	X2	X3	X4	X5	mean	SD
0	0	0	0	0	0	0	0
1	5.98	6.18	6.21	6.27	6.38	6.20	0.15
2	7.69	7.78	7.92	7.95	8.02	7.87	0.13
4	9.43	9.89	10.02	10.87	11.05	10.25	0.69
5.5	11.22	11.26	11.32	11.33	11.39	11.30	0.07
7	11.96	11.97	12.06	12.09	12.12	12.04	0.07
10	13.09	13.17	13.32	13.44	13.67	13.34	0.23
13	14.97	15.01	15.09	15.16	15.28	15.10	0.12
16	15.65	15.71	15.82	15.94	16.06	15.84	0.17
20	16.85	17.04	17.18	17.49	17.73	17.26	0.35
23	18.02	18.33	18.47	18.70	18.99	18.50	0.37
25	18.38	18.64	18.78	19.06	19.38	18.85	0.39
26	18.49	18.84	18.97	19.26	19.61	19.03	0.42
27.5	18.49	18.84	18.97	19.26	19.61	19.03	0.42
28.5	18.53	18.91	19.05	19.32	19.66	19.09	0.43
29.5	18.53	18.91	19.05	19.32	19.66	19.09	0.43
30.5	18.53	18.91	19.05	19.32	19.66	19.09	0.43

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A22. Data for Moisture Absorption of 5% Starch Blend Films at Various Amount of EVA

Time (hrs)	Moisture Absorption (%)			
	0% EVA	5% EVA	10% EVA	20% EVA
0	0	0	0	0
1	0.18	0.17	0.15	0.09
2	0.20	0.17	0.15	0.11
3	0.25	0.21	0.18	0.13
4	0.32	0.23	0.20	0.19
5	0.34	0.25	0.25	0.25
6	0.36	0.27	0.25	0.25
23	0.56	0.42	0.40	0.35
26	0.59	0.45	0.40	0.35
48	0.68	0.64	0.55	0.43
94	0.83	0.73	0.60	0.46
118	0.85	0.73	0.66	0.49
145	0.87	0.76	0.66	0.52
215.5	0.87	0.76	0.66	0.52

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A23. Data for Moisture Absorption of 10% Starch Blend Films at Various Amount of EVA

Time (hrs)	Moisture Absorption (%)			
	0% EVA	5% EVA	10% EVA	20% EVA
0	0	0	0	0
1	0.36	0.26	0.20	0.22
2	0.62	0.40	0.40	0.39
3	0.70	0.60	0.52	0.47
4	0.79	0.72	0.70	0.50
5	0.83	0.80	0.76	0.65
6	0.83	0.80	0.81	0.70
23	1.23	1.15	1.06	0.90
26	1.34	1.15	1.09	0.97
48	1.50	1.40	1.25	1.09
94	1.66	1.56	1.44	1.26
118	1.75	1.62	1.50	1.37
145	1.79	1.62	1.53	1.40
215.5	1.81	1.64	1.53	1.40

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A24. Data for Moisture Absorption of 15% Starch Blend Films at Various Amount of EVA

Time (hrs)	Moisture Absorption (%)			
	0% EVA	5% EVA	10% EVA	20% EVA
0	0	0	0	0
1	0.50	0.48	0.47	0.46
2	0.65	0.60	0.53	0.52
3	0.68	0.62	0.59	0.54
4	0.80	0.76	0.68	0.58
5	0.83	0.78	0.73	0.71
6	1.06	0.91	0.86	0.83
23	2.10	1.98	1.89	1.72
26	2.18	2.09	1.94	1.78
48	2.48	2.39	2.23	2.11
94	2.71	2.58	2.35	2.14
118	2.83	2.62	2.39	2.22
145	2.92	2.67	2.43	2.27
215.5	2.92	2.67	2.43	2.27

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A25. Data for Moisture Absorption of 20% Starch Blend Films at Various Amount of EVA

Time (hrs)	Moisture Absorption (%)			
	0% EVA	5% EVA	10% EVA	20% EVA
0	0	0	0	0
1	0.92	0.87	0.83	0.75
2	1.11	0.90	0.88	0.85
3	1.20	1.00	0.98	0.95
4	1.35	1.14	1.09	1.05
5	1.44	1.23	1.20	1.08
6	1.58	1.30	1.20	1.27
23	3.50	3.16	2.76	2.62
26	3.54	3.28	3.00	2.80
48	3.80	3.62	3.40	3.15
94	4.21	3.93	3.79	3.52
118	4.35	4.15	3.88	3.70
145	4.44	4.29	3.96	3.73
215.5	4.49	4.29	4.00	3.74

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VITA

Miss Kanjana Charoenkongthum was born in Samutsakhon, Thailand, on August 29, 1977. She received a Bachelor of Science degree with a major in Industrial Chemistry from Chiangmai University in 1999. She started as a graduate student in Department of Materials Science with a major in Applied Polymer Science and Textile Technology, Chulalongkorn University in June 1999, and completed the programme in October 2001.



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