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## APPENDICES

### Appendix A PLA/mEVA blends without compatibilizer

**Table A1** Mechanical properties of PLA/mEVA blends

Composition	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Pure PLA	816.11 ± 4.57	56.31 ± 0.16	5.86 ± 0.12
PLA90/mEVA10	731.25 ± 2.99	33.27 ± 0.39	6.48 ± 0.68
PLA80/mEVA20	649.20 ± 5.55	23.59 ± 0.45	7.78 ± 1.54
PLA70/mEVA30	513.38 ± 7.63	16.84 ± 0.16	9.18 ± 1.65
PLA60/mEVA40	333.28 ± 3.26	12.98 ± 0.32	7.04 ± 0.52

**Table A2** Melt flow index (MFI) of PLA/mEVA blends  
Load cell 1 kg. temperature 160 °C

Composition	MFI (g/10 min)
Pure PLA	1.01 ± 0.06
PLA90/mEVA10	3.18 ± 0.31
PLA80/mEVA20	3.99 ± 0.08
PLA70/mEVA30	7.51 ± 0.44
PLA60/mEVA40	15.81 ± 0.77



**Table A3** Weight loss (%) of PLA/mEVA blends

Composition	Time (weeks)								
	0	1	2	3	4	5	6	7	8
Pure PLA	0	1.19	9.96	16.7	20.79	22.35	24.21	25.64	27.14
PLA90/mEVA10	0	0.62	8.71	16.55	17.73	18.88	24.13	25.26	26.43
PLA80/mEVA20	0	0.30	9.41	14.22	15.80	16.64	21.70	23.24	24.15
PLA70/mEVA30	0	1.03	9.33	13.17	14.56	16.15	19.48	21.36	22.70
PLA60/mEVA40	0	1.37	9.33	12.63	13.79	15.16	17.12	18.63	19.57

**Appendix B PLA/mEVA blends with E-GMA compatibilizer****Table B1** Mechanical properties of PLA/mEVA/E-GMA blends

Composition	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Pure PLA	816.11 ± 4.57	56.31 ± 0.16	5.86 ± 0.12
PLA90/mEVA10	731.25 ± 2.99	33.27 ± 0.39	6.48 ± 0.68
E-GMA 5 phr	464.90 ± 8.05	26.58 ± 0.12	60.00 ± 5.27
E-GMA 10 phr	447.72 ± 4.23	29.43 ± 0.31	127.65 ± 11.76
E-GMA 15 phr	435.86 ± 5.34	25.14 ± 0.26	55.84 ± 8.99
PLA80/mEVA20	649.20 ± 5.55	23.59 ± 0.45	7.78 ± 1.54
E-GMA 5 phr	422.27 ± 2.21	23.22 ± 0.15	33.70 ± 4.69
E-GMA 10 phr	444.63 ± 9.38	21.78 ± 0.34	72.80 ± 0.28
E-GMA 15 phr	335.42 ± 3.84	20.16 ± 0.25	44.53 ± 3.10
PLA70/mEVA30	513.38 ± 7.63	16.84 ± 0.16	9.18 ± 1.65
E-GMA 5 phr	449.98 ± 3.26	16.47 ± 0.70	16.50 ± 0.92
E-GMA 10 phr	384.26 ± 3.02	17.47 ± 0.12	43.50 ± 0.99
E-GMA 15 phr	371.08 ± 5.13	16.78 ± 0.17	26.20 ± 0.79

PLA60/mEVA40	333.28 ± 3.26	12.98 ± 0.32	7.04 ± 0.52
E-GMA 5 phr	224.77 ± 3.68	10.47 ± 0.40	7.25 ± 0.66
E-GMA 10 phr	217.84 ± 1.42	9.39 ± 0.24	9.23 ± 0.46
E-GMA 15 phr	161.45 ± 3.67	7.34 ± 0.15	7.62 ± 0.30

**Table B2** Melt flow index (MFI) of PLA/mEVA/E-GMA blends  
Load cell 1 kg. temperature 160 °C

Composition	MFI (g/10 min)
Pure PLA	1.01 ± 0.06
PLA90/mEVA10	3.18 ± 0.31
E-GMA 5 phr	3.18 ± 0.40
E-GMA 10 phr	1.91 ± 0.23
E-GMA 15 phr	1.92 ± 0.11
PLA80/mEVA20	3.99 ± 0.08
E-GMA 5 phr	3.84 ± 0.34
E-GMA 10 phr	3.75 ± 0.40
E-GMA 15 phr	2.52 ± 0.27
PLA70/mEVA30	7.52 ± 0.44
E-GMA 5 phr	8.05 ± 0.27
E-GMA 10 phr	6.12 ± 0.46
E-GMA 15 phr	3.24 ± 0.09
PLA60/mEVA40	15.81 ± 0.77
E-GMA 5 phr	11.13 ± 0.47
E-GMA 10 phr	10.95 ± 0.39
E-GMA 15 phr	10.53 ± 0.86

**Table B3** Weight loss (%) of PLA90/mEVA10/E-GMA blends

Composition	Time (weeks)								
	0	1	2	3	4	5	6	7	8
Pure PLA	0	1.19	9.96	16.7	20.79	22.35	24.21	25.64	27.14
PLA90/mEVA10	0	0.62	8.71	16.55	17.73	18.88	24.13	25.26	26.43
E-GMA 5 phr	0	0.95	9.59	15.36	17.54	18.61	20.86	22.34	24.69
E-GMA 10 phr	0	0.93	7.13	14.09	16.22	17.82	19.96	21.09	22.63
E-GMA 15 phr	0	0.73	8.70	14.06	16.12	17.08	19.09	20.15	21.05

**Appendix C PLA/mEVA blends with T-GMA compatibilizer****Table C1** Mechanical properties of PLA/mEVA/T-GMA blends

Composition	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Pure PLA	816.11 ± 4.57	56.31 ± 0.16	5.86 ± 0.12
PLA90/mEVA10	731.25 ± 2.99	33.27 ± 0.39	6.48 ± 0.68
T-GMA 5 phr	552.51 ± 9.62	34.06 ± 0.21	8.47 ± 0.11
T-GMA 10 phr	463.20 ± 7.20	28.28 ± 0.12	13.25 ± 0.36
T-GMA 15 phr	455.68 ± 18.48	27.99 ± 0.14	11.50 ± 0.38
PLA80/mEVA20	649.20 ± 5.55	23.59 ± 0.45	7.78 ± 1.54
T-GMA 5 phr	502.10 ± 5.83	26.27 ± 0.32	8.37 ± 0.24
T-GMA 10 phr	404.78 ± 9.39	20.96 ± 0.28	28.31 ± 2.12
T-GMA 15 phr	397.73 ± 6.89	21.47 ± 0.26	16.06 ± 0.77
PLA70/mEVA30	513.38 ± 7.63	16.84 ± 0.16	9.18 ± 1.65
T-GMA 5 phr	364.71 ± 4.99	16.70 ± 0.09	21.50 ± 1.27
T-GMA 10 phr	366.28 ± 0.55	18.82 ± 0.14	32.20 ± 0.99
T-GMA 15 phr	320.18 ± 2.43	15.56 ± 0.07	25.00 ± 0.42

PLA60/mEVA40	333.28 ± 3.26	12.98 ± 0.32	7.04 ± 0.52
T-GMA 5 phr	237.35 ± 4.78	12.61 ± 0.40	31.70 ± 0.71
T-GMA 10 phr	252.72 ± 7.07	11.21 ± 0.13	38.90 ± 0.42
T-GMA 15 phr	219.44 ± 4.29	8.92 ± 0.36	32.23 ± 0.81

**Table C2** Melt flow index (MFI) of PLA/mEVA/T-GMA blends  
Load cell 1 kg. temperature 160 °C

Composition	MFI (g/10 min)
Pure PLA	1.01 ± 0.06
PLA90/mEVA10	3.18 ± 0.31
T-GMA 5 phr	1.96 ± 0.18
T-GMA 10 phr	1.66 ± 0.05
T-GMA 15 phr	1.67 ± 0.23
PLA80/mEVA20	3.99 ± 0.08
T-GMA 5 phr	4.12 ± 0.39
T-GMA 10 phr	3.00 ± 0.20
T-GMA 15 phr	3.00 ± 0.20
PLA70/mEVA30	7.51 ± 0.44
T-GMA 5 phr	6.62 ± 0.49
T-GMA 10 phr	3.41 ± 0.28
T-GMA 15 phr	3.53 ± 0.32
PLA60/mEVA40	15.81 ± 0.77
T-GMA 5 phr	7.21 ± 0.68
T-GMA 10 phr	7.05 ± 0.72
T-GMA 15 phr	6.98 ± 1.27

**Table C3** Weight loss (%) of PLA90/mEVA10/T-GMA blends

Composition	Time (weeks)								
	0	1	2	3	4	5	6	7	8
Pure PLA	0	1.19	9.96	16.7	20.79	22.35	24.21	25.64	27.14
PLA90/mEVA10	0	0.62	8.71	16.55	17.73	18.88	24.13	25.26	26.43
T-GMA 5 phr	0	0.62	9.33	14.39	17.24	18.20	21.83	23.09	24.02
T-GMA 10 phr	0	0.98	9.09	14.47	16.37	17.59	20.94	22.00	23.58
T-GMA 15 phr	0	1.41	10.31	15.08	16.90	17.30	20.54	21.51	22.86

**Appendix D PLA/mEVA blends with PE-AA compatibilizer****Table D1** Mechanical properties of PLA/mEVA/PE-AA blends

Composition	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Pure PLA	816.11 ± 4.57	56.31 ± 0.16	5.86 ± 0.12
PLA90/mEVA10	731.25 ± 2.99	33.27 ± 0.39	6.48 ± 0.68
PE-AA 5 phr	657.37 ± 4.08	29.43 ± 0.24	10.98 ± 0.52
PE-AA 10 phr	545.58 ± 6.38	25.33 ± 0.39	16.19 ± 0.86
PE-AA 15 phr	440.81 ± 3.74	25.37 ± 2.74	5.85 ± 0.28
PLA80/mEVA20	649.20 ± 5.55	23.59 ± 0.45	7.78 ± 1.54
PE-AA 5 phr	579.18 ± 5.74	23.66 ± 0.08	16.51 ± 0.31
PE-AA 10 phr	402.42 ± 8.76	16.76 ± 0.14	55.75 ± 1.06
PE-AA 15 phr	375.92 ± 5.00	12.90 ± 0.10	8.84 ± 0.61
PLA70/mEVA30	513.38 ± 7.63	16.84 ± 0.16	9.18 ± 1.65
PE-AA 5 phr	502.57 ± 7.36	15.97 ± 0.35	9.90 ± 0.33
PE-AA 10 phr	343.33 ± 10.54	12.71 ± 0.33	17.99 ± 1.31
PE-AA 15 phr	334.05 ± 5.51	12.41 ± 0.17	10.90 ± 0.25

PLA60/mEVA40	333.28 ± 3.26	12.98 ± 0.32	7.04 ± 0.52
PE-AA 5 phr	283.51 ± 8.79	14.23 ± 0.18	51.00 ± 1.41
PE-AA 10 phr	220.99 ± 0.90	11.23 ± 0.48	53.13 ± 0.50
PE-AA 15 phr	171.32 ± 0.95	9.46 ± 0.14	15.83 ± 0.84

**Table D2** Melt flow index (MFI) of PLA/mEVA/PE-AA blends  
Load cell 1 kg, temperature 160 °C

Composition	MFI (g/10 min)
Pure PLA	1.01 ± 0.06
PLA90/mEVA10	3.18 ± 0.31
PE-AA 5 phr	1.61 ± 0.08
PE-AA 10 phr	3.87 ± 0.21
PE-AA 15 phr	11.47 ± 0.41
PLA80/mEVA20	3.99 ± 0.08
PE-AA 5 phr	2.49 ± 0.12
PE-AA 10 phr	6.41 ± 0.15
PE-AA 15 phr	10.97 ± 0.59
PLA70/mEVA30	7.51 ± 0.44
PE-AA 5 phr	2.47 ± 0.09
PE-AA 10 phr	7.80 ± 0.29
PE-AA 15 phr	12.11 ± 0.32
PLA60/mEVA40	15.81 ± 0.77
PE-AA 5 phr	2.75 ± 0.12
PE-AA 10 phr	5.24 ± 0.26
PE-AA 15 phr	11.73 ± 0.21

**Table D3** Weight loss (%) of PLA90/mEVA10/PE-AA blends

Composition	Time (weeks)								
	0	1	2	3	4	5	6	7	8
Pure PLA	0	1.19	9.96	16.7	20.79	22.35	24.21	25.64	27.14
PLA90/mEVA10	0	0.62	8.71	16.55	17.73	18.88	24.13	25.26	26.43
PE-AA 5 phr	0	0.20	3.03	13.42	20.12	23.09	26.96	28.40	30.01
PE-AA 10 phr	0	0.02	4.53	13.30	20.06	22.97	25.87	26.98	27.96
PE-AA 15 phr	0	0.05	4.22	13.95	19.25	23.01	25.09	26.50	27.97

**Appendix E PLA/mEVA blends with Oxa compatibilizer****Table E1** Mechanical properties of PLA/mEVA/Oxa blends

Composition	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Pure PLA	816.11 ± 4.57	56.31 ± 0.16	5.86 ± 0.12
PLA90/mEVA10	731.25 ± 2.99	33.27 ± 0.39	6.48 ± 0.68
Oxa 5 phr	620.76 ± 20.48	35.92 ± 0.67	7.56 ± 0.28
Oxa 10 phr	553.10 ± 20.77	28.18 ± 0.65	11.07 ± 1.26
Oxa 15 phr	414.78 ± 5.07	25.27 ± 0.25	30.40 ± 1.32
PLA80/mEVA20	649.20 ± 5.55	23.59 ± 0.45	7.78 ± 1.54
Oxa 5 phr	552.85 ± 3.79	26.87 ± 0.19	7.29 ± 0.24
Oxa 10 phr	457.04 ± 5.62	20.28 ± 0.19	9.62 ± 0.37
Oxa 15 phr	374.38 ± 17.09	19.59 ± 1.43	28.94 ± 0.50
PLA70/mEVA30	513.38 ± 7.63	16.84 ± 0.16	9.18 ± 1.65
Oxa 5 phr	390.95 ± 8.87	17.50 ± 0.18	14.42 ± 1.31
Oxa 10 phr	363.90 ± 3.99	15.03 ± 0.10	16.57 ± 0.42
Oxa 15 phr	245.66 ± 5.16	12.85 ± 0.11	19.13 ± 0.62

PLA60/mEVA40	333.28 ± 3.26	12.98 ± 0.32	7.04 ± 0.52
Oxa 5 phr	243.06 ± 0.35	10.95 ± 0.13	8.24 ± 1.87
Oxa 10 phr	221.56 ± 2.46	9.61 ± 0.28	11.42 ± 0.59
Oxa 15 phr	215.00 ± 5.15	9.29 ± 0.06	16.51 ± 0.71

**Table E2** Melt flow index (MFI) of PLA/mEVA/Oxa blends  
Load cell 1 kg. temperature 160 °C

Composition	MFI (g/10 min)
Pure PLA	1.01 ± 0.06
PLA90/mEVA10	3.18 ± 0.31
Oxa 5 phr	3.16 ± 0.34
Oxa 10 phr	4.09 ± 0.67
Oxa 15 phr	10.79 ± 0.59
PLA80/mEVA20	3.99 ± 0.08
Oxa 5 phr	4.81 ± 0.56
Oxa 10 phr	9.06 ± 0.08
Oxa 15 phr	20.03 ± 0.28
PLA70/mEVA30	7.51 ± 0.44
Oxa 5 phr	10.51 ± 0.06
Oxa 10 phr	22.78 ± 0.44
Oxa 15 phr	30.67 ± 1.52
PLA60/mEVA40	15.81 ± 0.77
Oxa 5 phr	17.60 ± 0.40
Oxa 10 phr	32.11 ± 1.12
Oxa 15 phr	32.72 ± 0.82



**Table E3** Weight loss (%) of PLA/mEVA/Oxa blends

Composition	Time (weeks)								
	0	1	2	3	4	5	6	7	8
Pure PLA	0	1.19	9.96	16.7	20.79	22.35	24.21	25.64	27.14
PLA90/mEVA10	0	0.62	8.71	16.55	17.73	18.88	24.13	25.26	26.43
Oxa 5 phr	0	2.43	8.49	14.88	15.67	19.25	23.13	24.67	26.06
Oxa 10 phr	0	2.87	9.72	19.95	22.29	26.27	30.94	32.82	34.05
Oxa 15 phr	0	5.80	13.67	24.05	32.19	35.23	40.25	41.73	42.94

## CURRICULUM VITAE

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**Proceedings:**

1. Vipachon, J., Magaraphan, R., (2013, April 23) Reactive Compatibilized PLA-Modified EVA blends for Injection Products. Proceeding at The 4<sup>th</sup> Research Symposium on Petroleum, Petrochemical, and Polymers, Ballroom Queen Sirikit National Convention Center, Bangkok, Thailand.

**Presentations:**

1. Vipachon, J., Magaraphan, R., (2012, December 11-15) Thermal and Mechanical Properties of Reactive Compatibilized PLA-Modified EVA Blends. Poster presented at The 28<sup>th</sup> International Conference of the polymer Processing Society (PPS-28), Pattaya, Thailand.
2. Vipachon, J., Magaraphan, R., (2013, April 23) Reactive Compatibilized PLA-Modified EVA blends for Injection Products. Poster presented at The 4<sup>th</sup> Research Symposium on Petroleum, Petrochemical, and Polymers, Ballroom Queen Sirikit National Convention Center, Bangkok, Thailand.
3. Vipachon, J., Magaraphan, R., (2013, May 21-23) Morphology, Thermal and Mechanical Properties of PLA/Modified EVA Blends Compatibilized by Reactive Compatibilizer. Poster presented at The 3<sup>rd</sup> International Symposium Frontiers in Polymer Science, Sitges, Spain.