WESTERN MICHIGAN UNIVERSITY

OCC-E CERTIFICATION
PERFORMED AT WESTERN MICHIGAN UNIVERSITY

Repulpability & Recyclability

Repulping and Recycling Corrugated Fiberboard
With Fiber Based Packaging

Submitting Company: Chilltainers

Test Sample Name: Reflective Corrugated

Control Sample Name: WMU OCC Control

Test Dates: 9-9-21, 9-30-21

Date Report Completed: 10/7/2021

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REPORT RESULTS: REPULPABILITY PROCESS (PART 1)

Trial: Chilltainers Date Run: 7/2/2021

Sample: **Reflective Corrugated**

	Set #1:	Set #2:	Set #3: (if required)
Is sample representative of the material as a whole? (Y/N)	Y	Y	
STARTING SAMPLE			
Moisture Content	8.57 %	8.57 %	%
Temperature Range	130 °F	130 °F	°F
Amount of Fiber in Charge	25.49 g	25.16 g	g
Temp & pH Maintained? (Y/N)	Y	Y	
Hot Slurry Charged to Flat Screen, as Instructed? (Y/N)	Y	Y	
FINISHED SAMPLE: Oven dry mass			
Amount of Fiber Rejects	2.763 g	2.604 g	g
Amount of Fiber Accepts	18.1 g	17.91 g	g
Yield of Sample (% Accepts)	86.8 %	87.3 %	%
Observe and note deposition on vessel walls, screens, moving parts, etc.			
Deposition Observed? (Y/N) If yes, detail below.	N	N	
SUMMARY Operational Impact: (Pass/Fail)	Pass	Pass	
Yield: (Pass/Fail)	Pass	Pass	
To pass % accepts must be no less than 85%			

Note, details:

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REPORT RESULTS: RECYCLABILITY PROCESS (PART 2)

Trial: Reflective Corrugated Date Run: 9/9/2021

Sample: C-1 T-1

	Untreated Control	Recyclability Test Sample
Is sample representative of the lot as a whole? (Y/N)	Y	Y
Moisture Content	8.3 %	8.35 %
Pulping		
At 6% Consistency? (Y/N)	Y	Y
20/80% Charged by weight? (Y/N)		Y
If greater than 20/80%, specify ratio here:		%
Temp & pH maintained, per App. B, #3? (Y/N)	Y	Y
Number of batches required?	1	1
0.0625 Screens		
2% (note if different) Consistency, Temp & pH, per App.B, #5? (Y/N)	Y	Y
10% Volumetric Reject Rate? (Y/N)	Y	Y
0.010 Basket:		
Temp, pH, & Reject Rate, per App B, #6? (Y/N)	Y	Y
Reverse Cleaners:		
Temp & Pressure Differential, per App B, #7? (Y/N)	Y	Y
Determine Volumentric Reject Rate	15.8 gpm	15.3 gpm
Was it necessary to stop the test to clean any apparatus at any time during this procedure? (Y/N)	N	N
Deposition observed? (Y/N) If yes, detail below.	N	N
Were the required Temp & pH maintained throughout the entire protocol? (Y/N)	Y	Y

Note, details:

C-1 is 100% OCC control supplied by WMU. T-1 is 80% control 20% test material.

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TEST REPORT: HANDSHEET FORMATION AND PRODUCT PERFORMANCE

Trial: Reflective Corrugated Date Run: 9/9/2021

Sample: C-1 T-1

Was TAPPI T-205 used to form the handsheets, and were temp & pH maintained, dried to 7% mositure content under restrain at 250-275°F, per App. B, #8? (Y/N) Y

Product Performance

1. Slide Angle T-815 (Note: Test blotter side to blotter side.)

Control Handsheet #	Test Data (°)	Recyclability Test Sample Handsheet #	Test Data (°)
C-1-4, C-1-1	21	T-1-5, T-1-2	29
C-1-8, C-1-5	30	T-1-9, T-1-6	29
C-1-12, C-1-9	26	T-1-13, T-1-10	29
C-1-16, C-1-13	26	T-1-17, T-1-14	31
C-1-20, C-1-17	29	T-1-21, T-1-18	29

$Average_C$ = 26.4 ° $Average_R$ = 29.4 °

85% $Average_C$ = 22.44 °

Is $Average_R \geq 85\%\ Average_C$? (Y/N) Y

Initials: CW

2. Water-Drop Penetration T-831 (Note: Test five drops each on the wire and on the blotter sides.)

Control Handsheet #	Test Data (sec) Wire	Blotter	Recyclability Test Sample Handsheet #	Test Data (sec) Wire	Blotter
C-1-4	0.8	0.62	T-1-5	0.52	0.54
C-1-8	0.6	0.66	T-1-9	0.5	0.5
C-1-12	0.56	0.56	T-1-13	0.56	0.56
C-1-16	0.56	0.58	T-1-17	0.56	0.56
C-1-20	0.62	0.6	T-1-21	0.52	0.56

$Average_C$ of 10 drops = 0.616 sec $Average_R$ of 10 drops = 0.538 sec

200 + $Average_C$ = 200.616 sec

Is $Average_R \leq 200 + Average_C$? (Y/N) Y

Initials: CW

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TEST REPORT: PRODUCT PERFORMANCE (CONTINUED)

Trial: Reflective Corrugated Date Run: 9/9/2021

Sample: C-1 T-1

Product Performance

3. Short Span Compression (STFI) T-826

Control					Recyclability Test Sample				
Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	STFI Value (lbf/inch)	Indexed Value	Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	STFI Value (lbf/inch)	Indexed Value
C-1-3	2.9	29.963	12.48	0.417	T-1-4	2.96	30.583	14.41	0.471
C-1-7	3	30.996	13.15	0.424	T-1-8	3.09	31.926	14.92	0.467
C-1-11	3.01	31.099	12.8	0.412	T-1-12	3.03	31.306	14.79	0.472
C-1-15	2.93	30.273	12.84	0.424	T-1-16	2.99	30.893	14.66	0.475
C-1-19	2.97	30.686	12.75	0.415	T-1-20	3.01	31.099	14.72	0.473
Average$_C$ =		30.603	12.8	0.418	Average$_R$ =		31.161	14.7	0.472
Indexed Average$_C$ - 10% =				0.377					

Is Indexed Average$_R$ ≥ Indexed Average$_C$ - 10%? (Y/N) Y

Initials: CW

Notes:

4. Burst Strength T-403

Control					Recyclability Test Sample				
Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	Burst Value (psi)	Indexed Value	Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	Burst Value (psi)	Indexed Value
C-1-1	2.95	30.479	69	2.264	T-1-2	2.96	30.583	77.25	2.526
C-1-5	2.89	29.859	68.25	2.286	T-1-6	3.09	31.926	78.25	2.451
C-1-9	2.96	30.583	66.75	2.183	T-1-10	3.03	31.306	74.75	2.388
C-1-13	2.97	30.686	67.75	2.208	T-1-14	2.99	30.893	75.75	2.452
C-1-17	3.01	31.099	68	2.187	T-1-18	3.01	31.099	76.75	2.468
Average$_C$ =		30.541	67.95	2.225	Average$_R$ =		31.161	76.55	2.457
Indexed Average$_C$ - 10% =				2.003					

Is Indexed Average$_R$ ≥ Indexed Average$_C$ - 10%? (Y/N) Y

Initials: CW

Notes:

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TEST REPORT: PRODUCT PERFORMANCE (CONTINUED)

Trial: Reflective Corrugated Date Run: 9/9/2021

Sample: C-1 T-1

Product Appearance

STICKIES/SPOT COUNT TEST VALUES AVERAGE COUNT FOR THREE SHEETS

Material	Trial #1	Trial #2	Trial #3	Average
Control	4	6	3	4.3
Test Sample	24	25	25	24.7

Is the spot count ≤ 15, or, no more than 30% greater than the control? (Y/N) N

Initials: CW

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REPORT RESULTS: RECYCLABILITY PROCESS (PART 2)

Trial: Reflective Corrugated Date Run: 9/9/2021

Sample: C-2 T-2

	Untreated Control	Recyclability Test Sample
Is sample representative of the lot as a whole? (Y/N)	Y	Y
Moisture Content	8.3 %	8.35 %
Pulping		
At 6% Consistency? (Y/N)	Y	Y
20/80% Charged by weight? (Y/N)		Y
If greater than 20/80%, specify ratio here:		%
Temp & pH maintained, per App. B, #3? (Y/N)	Y	Y
Number of batches required?	1	1
0.0625 Screens		
2% (note if different) Consistency, Temp & pH, per App.B, #5? (Y/N)	Y	Y
10% Volumetric Reject Rate? (Y/N)	Y	Y
0.010 Basket:		
Temp, pH, & Reject Rate, per App B, #6? (Y/N)	Y	Y
Reverse Cleaners:		
Temp & Pressure Differential, per App B, #7? (Y/N)	Y	Y
Determine Volumentric Reject Rate	16.2 gpm	14.8 gpm
Was it necessary to stop the test to clean any apparatus at any time during this procedure? (Y/N)	N	N
Deposition observed? (Y/N) If yes, detail below.	N	N
Were the required Temp & pH maintained throughout the entire protocol? (Y/N)	Y	Y

Note, details:

C-2 is 100% OCC control supplied by WMU. T-2 is 80% control 20% test material.

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TEST REPORT: HANDSHEET FORMATION AND PRODUCT PERFORMANCE

Trial: Reflective Corrugated Date Run: 9/9/2021

Sample: C-2 T-2

Was TAPPI T-205 used to form the handsheets, and were temp & pH maintained, dried to 7% mositure content under restrain at 250-275°F, per App. B, #8? (Y/N) Y

Product Performance

1. Slide Angle T-815 (Note: Test blotter side to blotter side.)

Control Handsheet #	Test Data (°)	Recyclability Test Sample Handsheet #	Test Data (°)
C-2-5, C-2-2	27	T-2-4, T-2-1	27
C-2-9, C-2-6	28	T-2-8, T-2-5	32
C-2-13, C-2-10	26	T-2-12, T-2-9	29
C-2-17, C-2-14	25	T-2-16, T-2-13	30
C-2-21, C-2-18	26	T-2-20, T-2-17	33

$Average_C$ = 26.4 ° $Average_R$ = 30.2 °

85% $Average_C$ = 22.44 °

Is $Average_R \geq 85\% Average_C$? (Y/N) Y

Initials: CW

2. Water-Drop Penetration T-831 (Note: Test five drops each on the wire and on the blotter sides.)

Control Handsheet #	Test Data (sec) Wire	Blotter	Recyclability Test Sample Handsheet #	Test Data (sec) Wire	Blotter
C-2-5	0.56	0.5	T-2-4	0.54	0.56
C-2-9	0.52	0.48	T-2-8	0.58	0.56
C-2-13	0.5	0.54	T-2-12	0.56	0.56
C-2-17	0.5	0.54	T-2-16	0.56	0.56
C-2-21	0.54	0.52	T-2-20	0.54	0.56

$Average_C$ of 10 drops = 0.52 sec $Average_R$ of 10 drops = 0.558 sec

200 + $Average_C$ = 200.52 sec

Is $Average_R \leq 200 + Average_C$? (Y/N) Y

Initials: CW

WESTERN MICHIGAN UNIVERSITY

TEST REPORT: PRODUCT PERFORMANCE (CONTINUED)

Trial: Reflective Corrugated Date Run: 9/9/2021

Sample: C-2 T-2

Product Performance

3. Short Span Compression (STFI) T-826

Control					Recyclability Test Sample				
Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	STFI Value (lbf/inch)	Indexed Value	Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	STFI Value (lbf/inch)	Indexed Value
C-2-3	2.87	29.653	12.52	0.422	T-2-3	3.02	31.203	14.56	0.467
C-2-7	2.97	30.686	13.2	0.43	T-2-7	3.01	31.099	14.65	0.471
C-2-11	2.92	30.169	12.29	0.407	T-2-11	2.94	30.376	14.38	0.473
C-2-15	3.02	31.203	13.33	0.427	T-2-15	3.06	31.616	14.04	0.444
C-2-19	2.88	29.756	12.13	0.408	T-2-19	2.94	30.376	14.54	0.479
Average$_C$ =		30.293	12.69	0.419	Average$_R$ =		30.934	14.43	0.467
Indexed Average$_C$ - 10% =				0.377					

Is Indexed Average$_R$ ≥ Indexed Average$_C$ - 10%? (Y/N) Y

Initials: CW

Notes:

4. Burst Strength T-403

Control					Recyclability Test Sample				
Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	Burst Value (psi)	Indexed Value	Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	Burst Value (psi)	Indexed Value
C-2-2	3	30.996	71.5	2.307	T-2-1	2.98	30.789	71.5	2.322
C-2-6	2.9	29.963	67.75	2.261	T-2-5	3.03	31.306	76.5	2.444
C-2-10	2.93	30.273	68.75	2.271	T-2-9	2.99	30.893	73.5	2.379
C-2-14	2.94	30.376	68.25	2.247	T-2-13	3.01	31.099	70.75	2.275
C-2-18	2.91	30.066	68.5	2.278	T-2-17	2.97	30.686	71.5	2.33
Average$_C$ =		30.335	68.95	2.273	Average$_R$ =		30.955	72.75	2.35
Indexed Average$_C$ - 10% =				2.046					

Is Indexed Average$_R$ ≥ Indexed Average$_C$ - 10%? (Y/N) Y

Initials: CW

Notes:

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TEST REPORT: PRODUCT PERFORMANCE (CONTINUED)

Trial: Reflective Corrugated Date Run: 9/9/2021

Sample: C-2 T-2

Product Appearance

STICKIES/SPOT COUNT TEST VALUES AVERAGE COUNT FOR THREE SHEETS

Material	Trial #1	Trial #2	Trial #3	Average
Control	4	9	3	5.3
Test Sample	1	4	7	4.0

Is the spot count ≤ 15, or, no more than 30% greater than the control? (Y/N) Y

Initials: CW

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REPORT RESULTS: RECYCLABILITY PROCESS (PART 2)

Trial: Reflective Corrugated Date Run: 9/30/2021

Sample: C-3 T-3

	Untreated Control	Recyclability Test Sample
Is sample representative of the lot as a whole? (Y/N)	Y	Y
Moisture Content	7.28 %	7.01 %
Pulping		
At 6% Consistency? (Y/N)	Y	Y
20/80% Charged by weight? (Y/N)		Y
If greater than 20/80%, specify ratio here:		%
Temp & pH maintained, per App. B, #3? (Y/N)	Y	Y
Number of batches required?	1	1
0.0625 Screens		
2% (note if different) Consistency, Temp & pH, per App.B, #5? (Y/N)	Y	Y
10% Volumetric Reject Rate? (Y/N)	Y	Y
0.010 Basket:		
Temp, pH, & Reject Rate, per App B, #6? (Y/N)	Y	Y
Reverse Cleaners:		
Temp & Pressure Differential, per App B, #7? (Y/N)	Y	Y
Determine Volumentric Reject Rate	14.2 gpm	14.1 gpm
Was it necessary to stop the test to clean any apparatus at any time during this procedure? (Y/N)	N	N
Deposition observed? (Y/N) If yes, detail below.	N	N
Were the required Temp & pH maintained throughout the entire protocol? (Y/N)	Y	Y

Note, details:

C-3 is 100% OCC control supplied by WMU. T-3 is 80% control 20% test material.

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TEST REPORT: HANDSHEET FORMATION AND PRODUCT PERFORMANCE

Trial: Reflective Corrugated Date Run: 9/30/2021

Sample: C-3 T-3

Was TAPPI T-205 used to form the handsheets, and were temp & pH maintained, dried to 7% mositure content under restrain at 250-275°F, per App. B, #8? (Y/N) Y

Product Performance

1. Slide Angle T-815 (Note: Test blotter side to blotter side.)

Control Handsheet #	Test Data (°)	Recyclability Test Sample Handsheet #	Test Data (°)
C-3-5, C-3-2	30	T-3-4, T-3-1	33
C-3-9, C-3-6	34	T-3-8, T-3-5	36
C-3-13, C-3-10	34	T-3-12, T-3-9	33
C-3-17, C-3-14	35	T-3-16, T-3-13	34
C-3-21, C-3-18	32	T-3-20, T-3-17	36

$Average_C$ = 33 ° $Average_R$ = 34.4 °

85% $Average_C$ = 28.05 °

Is $Average_R \geq 85\% Average_C$? (Y/N) Y

Initials: CW

2. Water-Drop Penetration T-831 (Note: Test five drops each on the wire and on the blotter sides.)

Control Handsheet #	Test Data (sec) Wire	Blotter	Recyclability Test Sample Handsheet #	Test Data (sec) Wire	Blotter
C-3-5	0.54	0.52	T-3-4	0.56	0.52
C-3-9	0.52	0.54	T-3-8	0.54	0.54
C-3-13	0.52	0.52	T-3-12	0.56	0.52
C-3-17	0.54	0.54	T-3-16	0.54	0.56
C-3-21	0.56	0.52	T-3-20	0.5	0.54

$Average_C$ of 10 drops = 0.532 sec $Average_R$ of 10 drops = 0.538 sec

200 + $Average_C$ = 200.532 sec

Is $Average_R \leq 200 + Average_C$? (Y/N) Y

Initials: CW

WESTERN MICHIGAN UNIVERSITY

TEST REPORT: PRODUCT PERFORMANCE (CONTINUED)

Trial: Reflective Corrugated Date Run: 9/30/2021

Sample: C-3 T-3

Product Performance

3. Short Span Compression (STFI) T-826

Control					Recyclability Test Sample				
Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	STFI Value (lbf/inch)	Indexed Value	Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	STFI Value (lbf/inch)	Indexed Value
C-3-4	2.98	30.789	11.77	0.382	T-3-2	2.87	29.653	14.66	0.494
C-3-8	3.01	31.099	12.75	0.41	T-3-6	2.77	28.62	15.49	0.541
C-3-12	3	30.996	13.09	0.422	T-3-10	2.75	28.413	14.51	0.511
C-3-16	3.01	31.099	13.13	0.422	T-3-14	2.74	28.31	14.77	0.522
C-3-20	3.11	32.133	13.59	0.423	T-3-18	2.77	28.62	15.71	0.549
Average$_C$ =		31.223	12.87	0.412	Average$_R$ =		28.723	15.03	0.523
Indexed Average$_C$ - 10% =				0.371					

Is Indexed Average$_R$ ≥ Indexed Average$_C$ - 10%? (Y/N) Y

Initials: CW

Notes:

4. Burst Strength T-403

Control					Recyclability Test Sample				
Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	Burst Value (psi)	Indexed Value	Handsheet #	Handsheet Weight (g)	Basis Wt. (lbs/1000ft^2)	Burst Value (psi)	Indexed Value
C-3-2	3.06	31.616	70.25	2.222	T-3-1	2.81	29.033	72.75	2.506
C-3-6	2.98	30.789	65.5	2.127	T-3-5	2.79	28.826	76.25	2.645
C-3-10	3.04	31.409	71.5	2.276	T-3-9	2.76	28.516	72.25	2.534
C-3-14	3.07	31.719	71	2.238	T-3-13	2.79	28.826	74.25	2.576
C-3-18	3.07	31.719	68	2.144	T-3-17	2.81	29.033	74	2.549
Average$_C$ =		31.451	69.25	2.202	Average$_R$ =		28.847	73.9	2.562
Indexed Average$_C$ - 10% =				1.981					

Is Indexed Average$_R$ ≥ Indexed Average$_C$ - 10%? (Y/N) Y

Initials: CW

Notes:

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TEST REPORT: PRODUCT PERFORMANCE (CONTINUED)

Trial: Reflective Corrugated Date Run: 9/30/2021

Sample: C-3 T-3

Product Appearance

STICKIES/SPOT COUNT TEST VALUES AVERAGE COUNT FOR THREE SHEETS

Material	Trial #1	Trial #2	Trial #3	Average
Control	4	9	2	5.0
Test Sample	4	2	3	3.0

Is the spot count ≤ 15, or, no more than 30% greater than the control? (Y/N) Y

Initials: CW

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PASS/FAIL SUMMARY

	Trial #1	Trial #2	Trial #3
1. For both treated and untreated were the substrate, samples, specimens appropriate? (Y/N)	Y	Y	Y
2. Fibre Yield ≥ 85%? (Y/N)	Y	Y	Y
3. Operational impact acceptable? (Y/N)	Y	Y	Y
4. Product performance acceptable? (Y/N)	Y	Y	Y
5. Product appearance/spot count acceptable? (Y/N)	N	Y	Y
Overall Pass / Fail - by trial: (Pass/Fail)	Fail	Pass	Pass

MATERIAL AS SUBMITTED "PASSES" VOLUNTARY STANDARD.

Pass or Fail: Pass

Signed: 

Print name: Shawn Mortimore

WESTERN MICHIGAN UNIVERSITY

TEST REPORT (CONTINUED)

Affirmation:

The facilities and equipment in this lab are suitable for testing the tendered product within the instructions and tolerances of the current voluntary standard.

Personnel running and reporting these tests are competent and trained to accurately do so. They have followed the letter and spirit of the subject voluntary standard.

Objective and subjective information, as contained herein, is accurate.

Signed: _____ Lab Manager

Shawn Mortimore Print Name

Director Pilot Plants Title

269-276-3532 Phone

10/7/2021 Date

WMU Pilot Plants
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