PTP Technologies and Products B. V.

Del Mar Technology Solutions, Inc.

PETCORE PROTOCOL

Bottle Recyclability Evaluation

June 29, 2006

Bottle Recyclability Evaluation: PETCORE PROTOCOL

Objectives:

- Determine the impact of PET-M concentrations according to the protocol established by PETCORE for PET Bottle Recycling.

Materials:

- Monolayer PET Bottle Flake (Control Material)
- PET-M Bottle Flake with additives (Test Material) Invista Polyclear 1101
- Virgin PET (Voridian WA314)

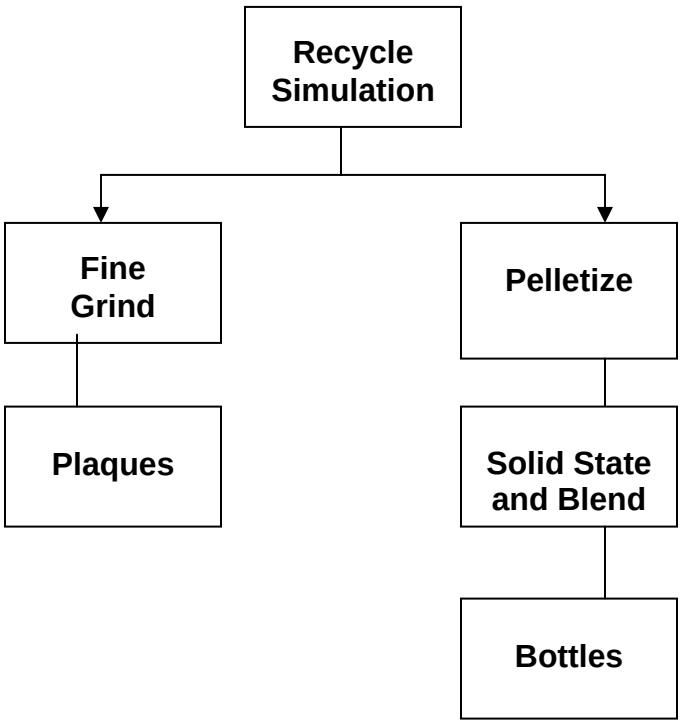
Equipment:

- Recycle System
    - Pilot Plant Wash System, 4-kg Batches
    - Convection Ovens (Surface Drying)
    - Kice Elutriator
    - Grinder with 6mm Screen
    - Desiccant Dryer
    - 38mm, 36:1 L/D Ratio TEC Extruder with Barrier Screw
    - Strand Pelletizer
- Plaque Production
    - Injection molding machine, 1 cavity 5-step plaque mold
- Bottle Production
    - Newbury injection molding machine, 4-oz capacity, 4 cavity, 23.5g
    - Blow molding machine, SBO-1, 20-oz (600mL) generic CSD mold

850 East Industrial Park Dr. Manchester, NH 03109
Tel: 603-668-7551 Fax: 603-668-7206 E-mail: info@plasticsforming.com Web: plasticsforming.com

PROCEDURE:

Overview



Experiment #1: Recycling Simulation

1. Caustic Wash: The flakes are exposed to a caustic wash of 1% NaOH and 0.3% Triton X-100 (surfactant) at 85 ^{o}C for 15 minutes. The liquid to solids ratio is 4:1 by weight and an agitator was used at 880 rpm. These conditions represent a standard wash process used to remove dirt and label adhesive during the typical reclamation process.

2. Rinse: Flakes are drained of caustic wash solution and are rinsed for at 50 ^{o} C at the same 4:1 slurry ratio and 880 rpm of agitation in order to remove the caustic solution.

3. Sink/Float: Flakes are lightly agitated with a cross current water flow to remove any floatable contamination and serve as an additional rinse.

4. Drying: Flakes are put in convection ovens at 65 ^{o}C to remove any surface moisture.

5. Elutriation: The elutriator was calibrated by running a 4.5 kg sample of 10 mm ground post consumer PET bottles with label through the elutriator at various airflow settings. Airflow capable of removing all the labels plus a small quantity of PET dust/shavings was chosen from a curve relating percent liftings to air flow. In this way the elutriator was set up as an elutriator in a recycling plant might be as opposed to the optimization of barrier layer removal.

6. Fine Grind: Flakes were put through a grinder with a 6mm screen to improve feeding flakes directly into the extruders for plaques and/or sheet.

7. Pelletization: Flakes for bottles were desiccant dried for 5 to 6 hours at 150 ^{o}C and pelletized using a 38mm TEC extruder with a 36:1 L:D barrier screw. Pellets were then crystallized at 155 ^{o}C for 1 hour to prevent sticking in the feed section of the extruders.

8. Solid Stating: Pellets were placed into the solid stater and rotated for 4 hours at 215˚ C to cleanse impurities and/or raise IV levels.

Experiment #2: Evaluation of Basic Physical Properties

1) Recycled Pellets: Pellets were used to compare IV retention, and color.
2) Plaques: A 5-step plaque was molded to evaluate flow patterns and shrinkage. The 2.0 mm plaque step was molded to evaluate color results.

Experiment #3: Evaluation of Material as End-Use Products

Preforms and Bottles: Solid stated pellets were blended at 50% with virgin PET pellets. These blends were injection molded into 23.5g preforms on a 4-cavity Newbury. The preforms were blown into bottles using a Sidel SBO-1 and a generic 20 oz. (600mL) carbonated soft drink mold. Injection and blow molding processes were evaluated. Bottles were then tested.

EXECUTIVE SUMMARY

Description	(A) 0% Content	(B) 25% Content	(C) 50% Content
Operational Effect			
Washing	No noticeable effect	No noticeable effect	No noticeable effect
Extrusion / Pellet	No noticeable effect	No noticeable effect	No noticeable effect
Solid Stating	No noticeable effect	No noticeable effect	No noticeable effect
Injection Molding	No noticeable effect	No noticeable effect	No noticeable effect
Blow Molding	No noticeable effect	No noticeable effect	No noticeable effect
Test Results			
Flake Testing			
Color (b*)	-0.34	.60	1.13
Amorphous Pellet			
IV*	.709	.631	.655
Color (b*)	1.26	2.24	3.37
Solid Stated Pellet *(same time in reactor)*			
IV*	.818	.744	.743
Color (b*)	.89	2.29	2.12
AA	.80	1.00	1.06
Preform	**(D) 0% Content**	**(E) 12.5% Content**	**(F) 25% Content**
IV	.712	.694	.706
AA	3.77	4.61	4.47
Color (b*)	4.82	5.14	5.00
Color (L*)	63.92	63.44	64.83
Haze	20.10	23.04	20.15
Bottle			
Color (b*)	.79	.97	.94
Haze	1.44	1.78	1.71
Appearance	Acceptable	Acceptable	Acceptable
Panel Section Weights	8.67	8.77	8.55
Overflow Capacity	621.4	622.2	622.1
Fillpoint Capacity	593	591.4	591.7
Burst	216	224	216
Top Load	73	77	75
Drop Impact	No failures	No failures	No failures
Stress Crack Resistance	1.5	1.5	1.25
Height	2.05	2.00	2.04
Fillpoint	.482	.475	.506
CO^2 Loss (6 weeks)	3.50	3.52	3.54

Description	(A) 0% Content	(B) 25% Content	(C) 50% Content	Comments
Plaque				Acceptable Levels
Color (b*)	2.18	2.24	2.62	<3
Color (L*)	93.53	93.40	93.09	> 87
Color (a*)	-0.45	-0.55	-0.56	> -.3
Haze	2.34	2.23	2.74	8%
Delta Ecmc	0.04	0.17	0.62	< 4

Note: *

The solution IV of the PET-m is lower than normal but the properties appear to be unaffected. All values are with the experimental error of the procedure.

Table 1: Run descriptions for experiments 1, 2 and 3

Project #: 8609-00			
Incoming Material and Virgin PET		**Pellet Blend Creation with 50% VPET**	
8609-01	Incoming Control Material Monolayer PET Bottle Flake	8609-12	8609-09 was blended with 50% VPET
8609-02	Incoming Test Material PET-M Bottle Flake	8609-13	8609-10 was blended with 50% VPET
	Virgin PET Pellets	8609-14	8609-11 was blended with 50% VPET
		8609-24	8609-23 was Blended with 50% VPET
Washed and Elutriated Flake Material		**Preform Production**	
8609-03	Washed and Elutriated Control Material Flake (from 01) at 100%	8609-15	Preforms made from 8609-12
8609-04	Washed and Elutriated Control Material Flake at 75% and Test Material Flake at 25%	8609-16	Preforms made from 8609-13
8609-05	Washed and Elutriated Control Material Flake at 50% and Test Material Flake at 50%	8609-17	Preforms made from 8609-14
8609-21	Washed and Elutriated Test Material Flake (from 02) at 100%	8609-25	Preforms made from 8609-24
Amorphous Pellets		**Bottle Production**	
8609-06	Amorphous Pellets (from 8609-03)	8609-18	Bottles made from 8609-12
8609-07	Amorphous Pellets (from 8609-04)	8609-19	Bottles made from 8609-13
8609-08	Amorphous Pellets (from 8609-05)	8609-20	Bottles made from 8609-14
8609-22	Amorphous Pellets (from 8609-21)	8609-26	Bottles made from 8609-24
Solid Stated Pellets		**Plaque Production**	
8609-09	Solid Stated Pellets (from 8609-03)	8609-27	5 Step Plaques made from 8609-12
8609-10	Solid Stated Pellets (from 8609-04)	8609-28	5 Step Plaques made from 8609-13
8609-11	Solid Stated Pellets (from 8609-05)	8609-29	5 Step Plaques made from 8609-14
8609-23	Solid Stated Pellets (from 8609-21)	8609-30	5 Step Plaques made from 8609-24

IV ANALYSIS

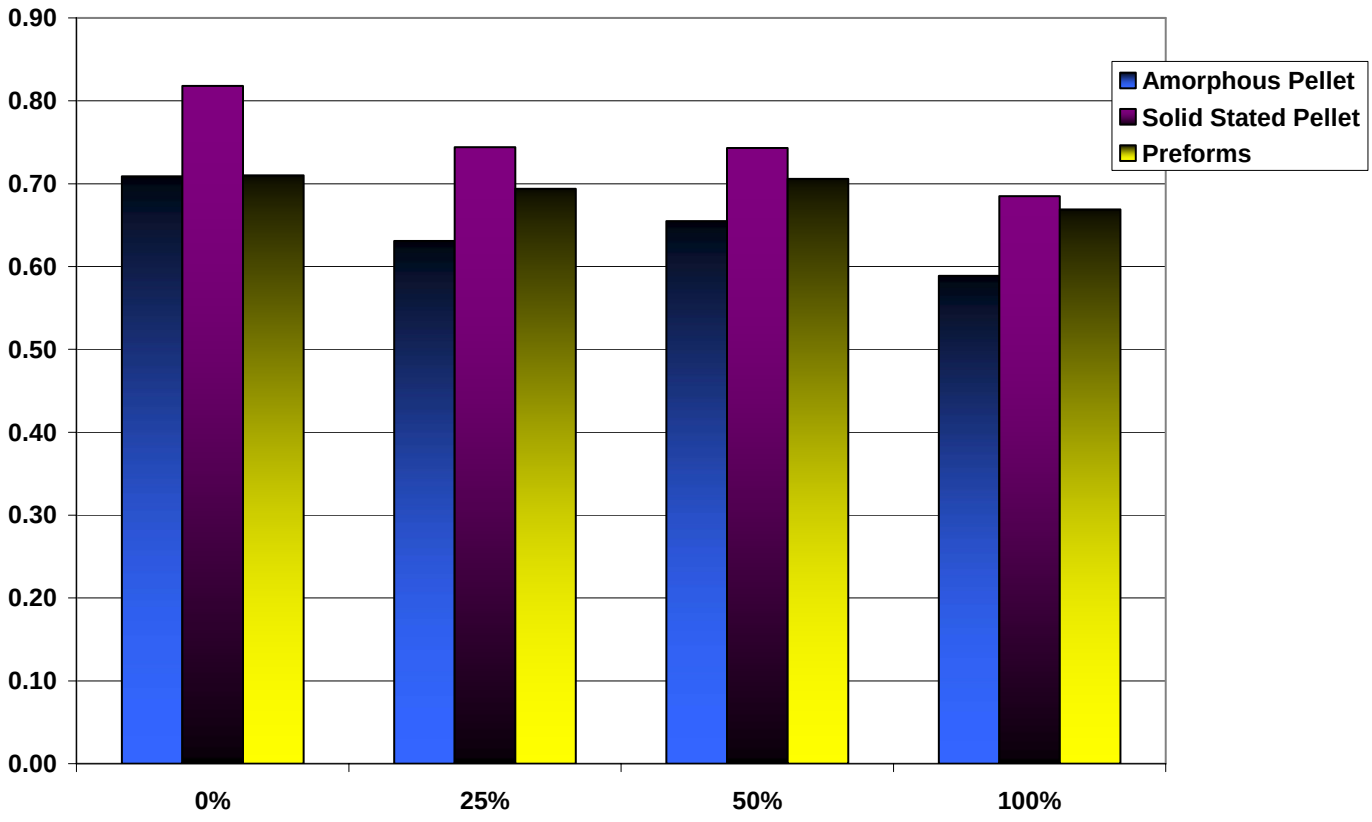
Plastics Forming Enterprises, LLC

Client: Del Mar Technology Solutions ***Contact:*** Alex Delnik

Project: Petcore Bottle to Bottle for PET-M

Project #: 8609

	0%	25%	50%	100%
Amorphous Pellet	0.71	0.63	0.66	0.59
Solid Stated Pellet	0.82	0.74	0.74	0.69
Preforms	0.71	0.69	0.71	0.67


IV Comparison (Amorph, SS Pellet and Preforms)
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0%
25%
50%
100%
Amorphous Pellet
Solid Stated Pellet
Preforms

AA RESULTS

Acetaldehyde (AA) Concentration PPM						
Solid Stated Pellets		**Run # 1**	**Run #2**	**Run #3**	**Average**	**Std Dev.**
8609-09	0%	0.80	0.79	0.80	0.80	0.01
8609-10	25%	0.94	0.99	1.00	0.98	0.03
8609-11	50%	1.08	1.08	1.06	1.07	0.01
8609-23	100%	1.35	1.34	1.38	1.36	0.02
Preforms		**Run # 1**	**Run #2**	**Run #3**	**Average**	**Std Dev.**
8609-09	0%	3.75	3.79	3.76	3.77	0.02
8609-10	25%	4.64	4.60	4.59	4.61	0.03
8609-11	50%	4.46	4.48	4.46	4.47	0.01
8609-23	100%	5.59	5.56	5.59	5.58	0.02

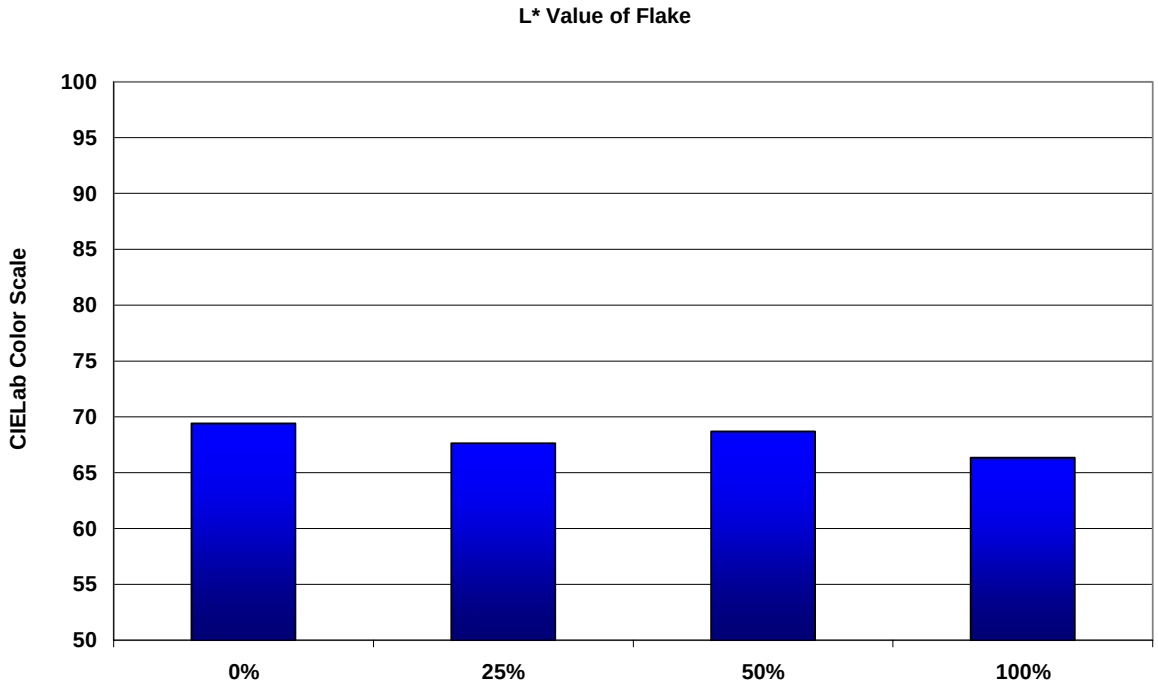
COLOR DATA

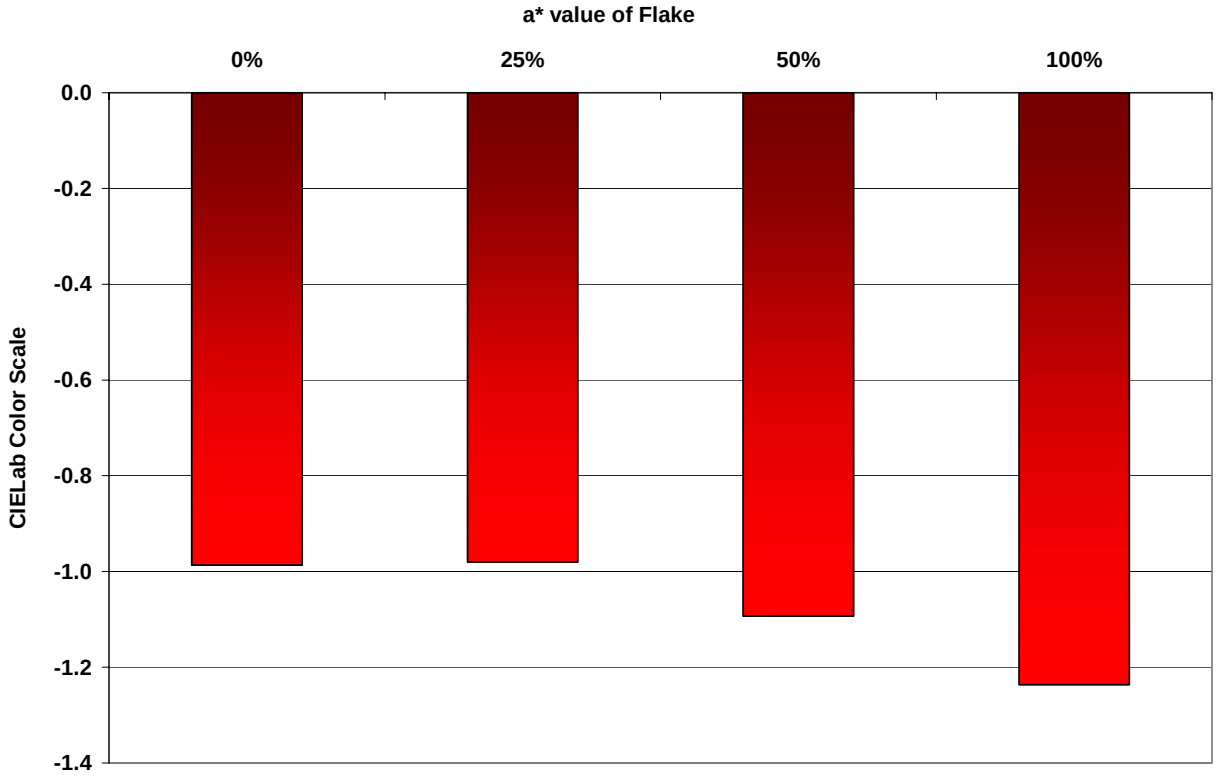
Plastics Forming Enterprises, LLC

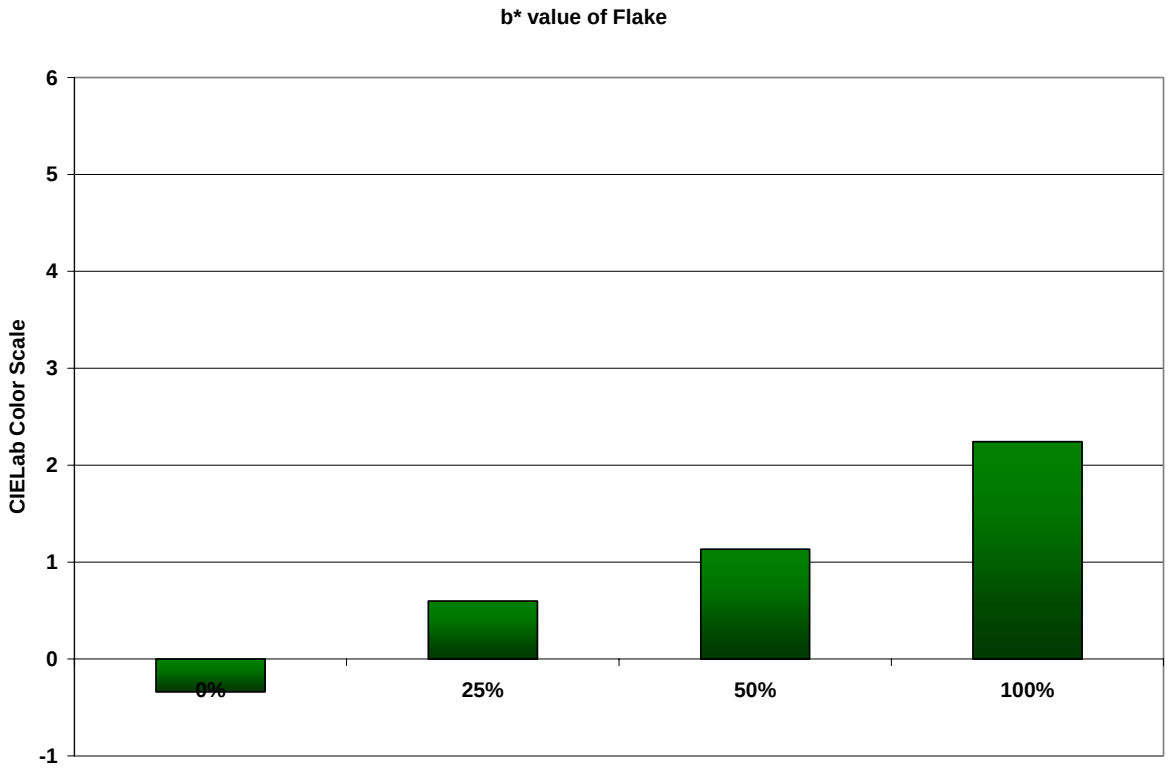
Client and #: DelMar Technologies ***Contact:*** Alex Delnik
Project: Bottle to Bottle
Experiment: Flake Production
Type of Material: Plaque ____ Bottle ____ Flake Production **X**
Project #: 8609 ***Operator:*** Dan St. Laurent

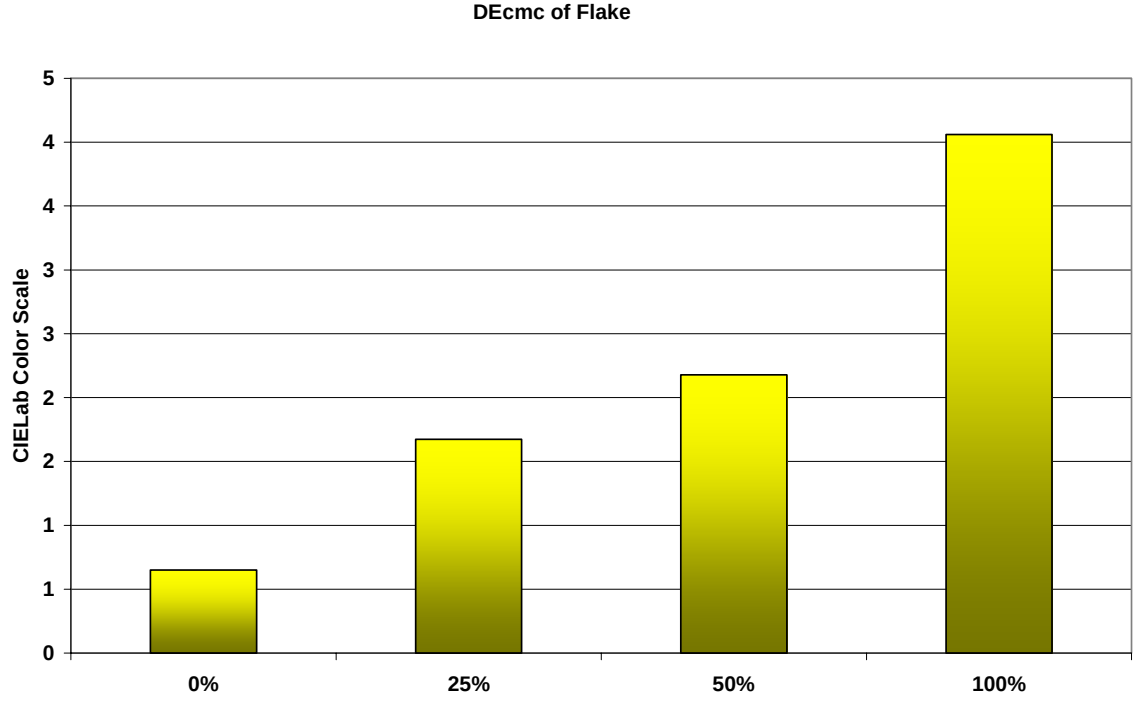
Equipment: Hunter Labs Colorquest II
Conditions: CIELab, 10 degrees, D65

Run #	Description	L* Values	a* Values	b* Values	L* Average	a* Average	b* Average	ΔEcmc	ΔEcmc Avg
8609-03	0%	69.75	-0.98	-0.05	69.42	-0.99	-0.34	0.45	0.65
		69.12	-1.03	-0.55				0.34	
		70.81	-0.99	-0.27				0.73	
		67.02	-0.90	-0.20				1.27	
		70.62	-1.03	-0.32				0.63	
		69.17	-0.99	-0.65				0.46	
8609-04	25%	68.13	-1.03	0.74	67.62	-0.98	0.60	1.69	1.67
		67.84	-0.97	0.67				1.67	
		66.55	-0.92	0.46				1.89	
		67.75	-0.98	0.61				1.62	
		68.45	-0.96	0.58				1.41	
		67.02	-1.02	0.53				1.77	
8609-05	50%	68.96	-1.09	1.22	68.69	-1.09	1.13	2.25	2.18
		68.23	-1.09	1.65				2.92	
		69.03	-1.05	1.13				2.12	
		68.20	-1.07	1.01				2.04	
		69.82	-1.06	0.90				1.79	
		67.92	-1.20	0.88				1.94	
8609-21	100%	65.88	-1.25	2.21	66.35	-1.24	2.24	4.10	4.06
		67.80	-1.11	2.21				3.75	
		65.05	-1.26	2.30				4.43	
		66.44	-1.32	2.19				3.97	
		66.88	-1.20	2.27				3.97	
		66.07	-1.28	2.27				4.14	


L* Value of Flake
CIELab Color Scale
100
95
90
85
80
75
70
65
60
55
50
0%
25%
50%
100%


a* value of Flake
0%
25%
50%
100%
CIELab Color Scale
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4


b* value of Flake
CIELab Color Scale
6
5
4
3
2
1
0
-1
0%
25%
50%
100%


DEcmc of Flake
CIELab Color Scale
5
4
4
3
3
2
2
1
1
0
0%
25%
50%
100%

COLOR DATA

Plastics Forming Enterprises, LLC

Client and #: DelMar Technologies ***Contact:*** Alex Delnik

Project: Bottle to Bottle Study

Experiment: Amorphous Pellet Production

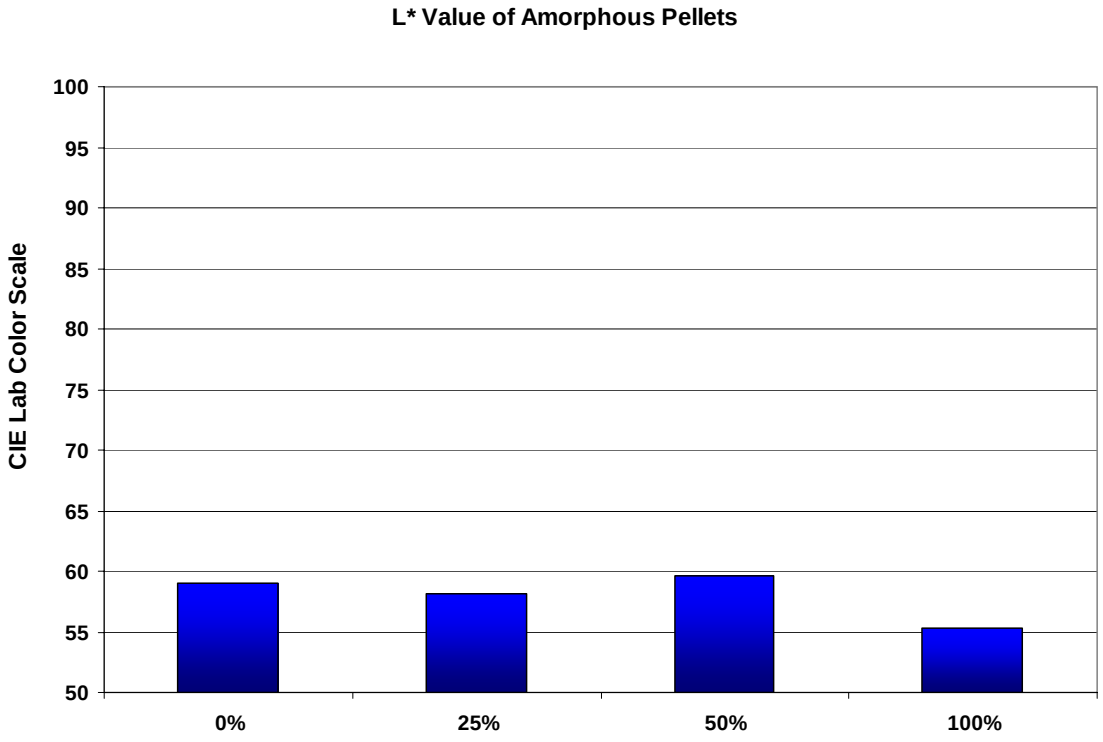
Type of Material: Plaque _____ Bottle _____ Strip _____ Pellet **Amorph**

Project #: 8609 ***Operator:*** _____

Equipment: Hunter Labs Colorquest II

Conditions: CIELab, 10 degrees, D65

Run #	Description	L* Values	a* Values	b* Values	L* Average	a* Average	b* Average	ΔEcmc	ΔEcmc Avg
8609-03	0%	58.79	-0.89	1.44	58.99	-0.92	1.26	0.27	0.21
		59.25	-0.98	1.11				0.27	
		58.86	-0.91	1.22				0.09	
		58.91	-0.88	1.12				0.20	
		58.77	-0.94	1.28				0.13	
		59.38	-0.90	1.39				0.28	
8609-04	25%	58.66	-1.07	2.29	58.20	-1.08	2.24	1.43	1.44
		58.15	-1.11	2.40				1.65	
		58.00	-1.10	2.13				1.33	
		58.60	-1.08	2.29				1.44	
		57.63	-1.06	2.02				1.30	
		58.17	-1.05	2.28				1.48	
8609-05	50%	56.98	-1.00	3.66	59.66	-1.02	3.37	3.46	3.43
		57.97	-1.03	3.57				3.21	
		68.07	-1.03	3.37				5.87	
		58.77	-1.01	3.36				2.87	
		58.55	-0.95	3.04				2.44	
		57.59	-1.10	3.19				2.76	
8609-21	100%	55.10	-1.12	4.49	55.27	-1.14	4.71	4.92	5.16
		55.06	-1.14	4.88				5.41	
		55.93	-1.17	4.73				5.04	
		55.79	-1.10	4.90				5.28	
		54.89	-1.15	4.79				5.34	
		54.85	-1.17	4.46				4.96	


L* Value of Amorphous Pellets
CIE Lab Color Scale
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95
90
85
80
75
70
65
60
55
50
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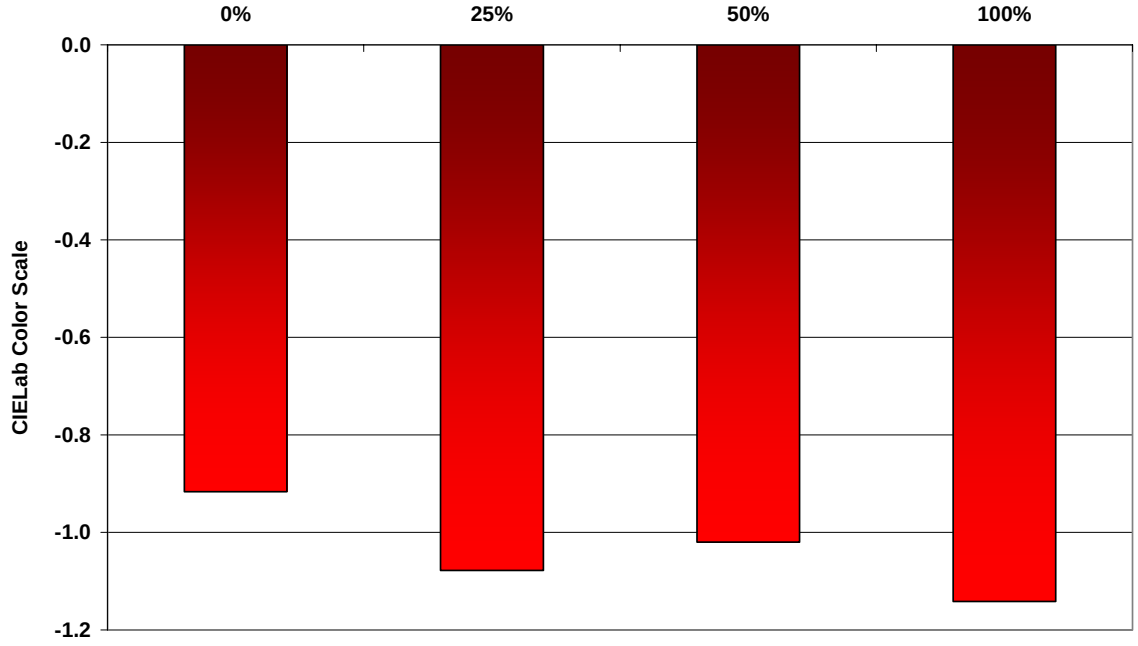
25%
50%
100%


a* value of Amorphous Pellets
0%
25%
50%
100%
CIELab Color Scale
0.0
-0.2
-0.4
-0.6
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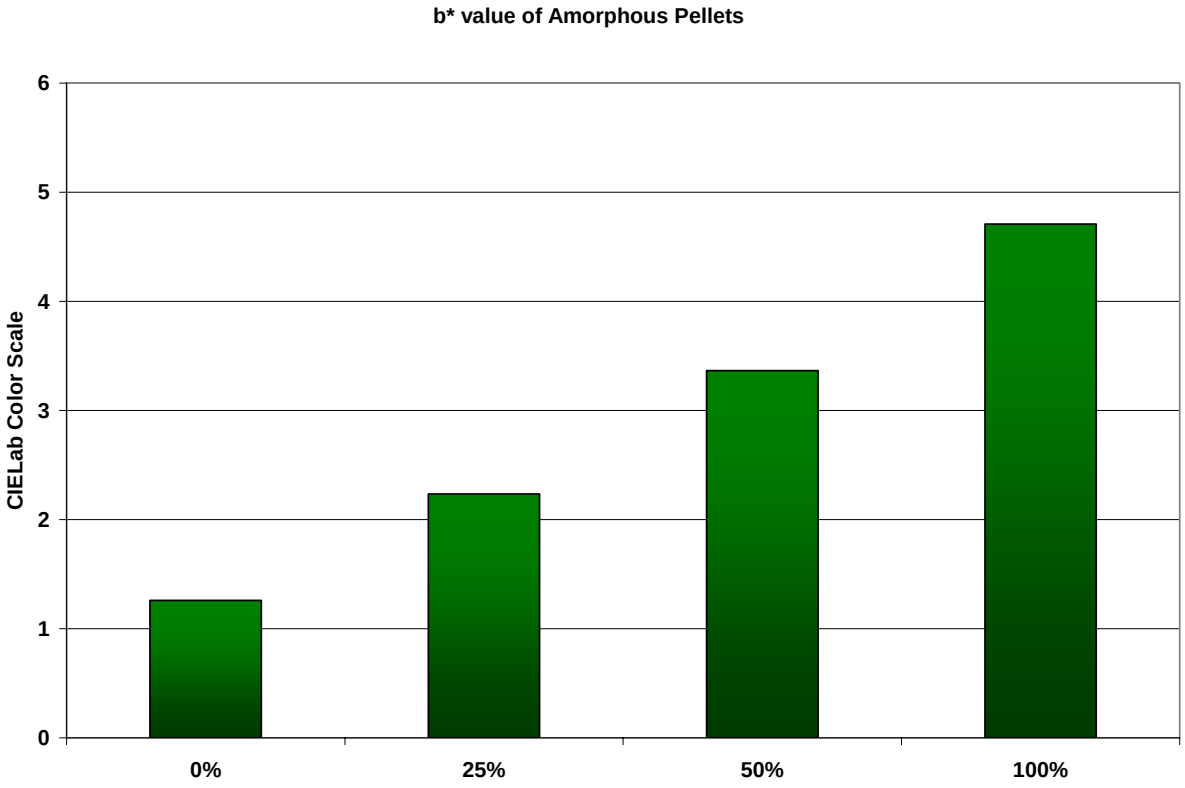
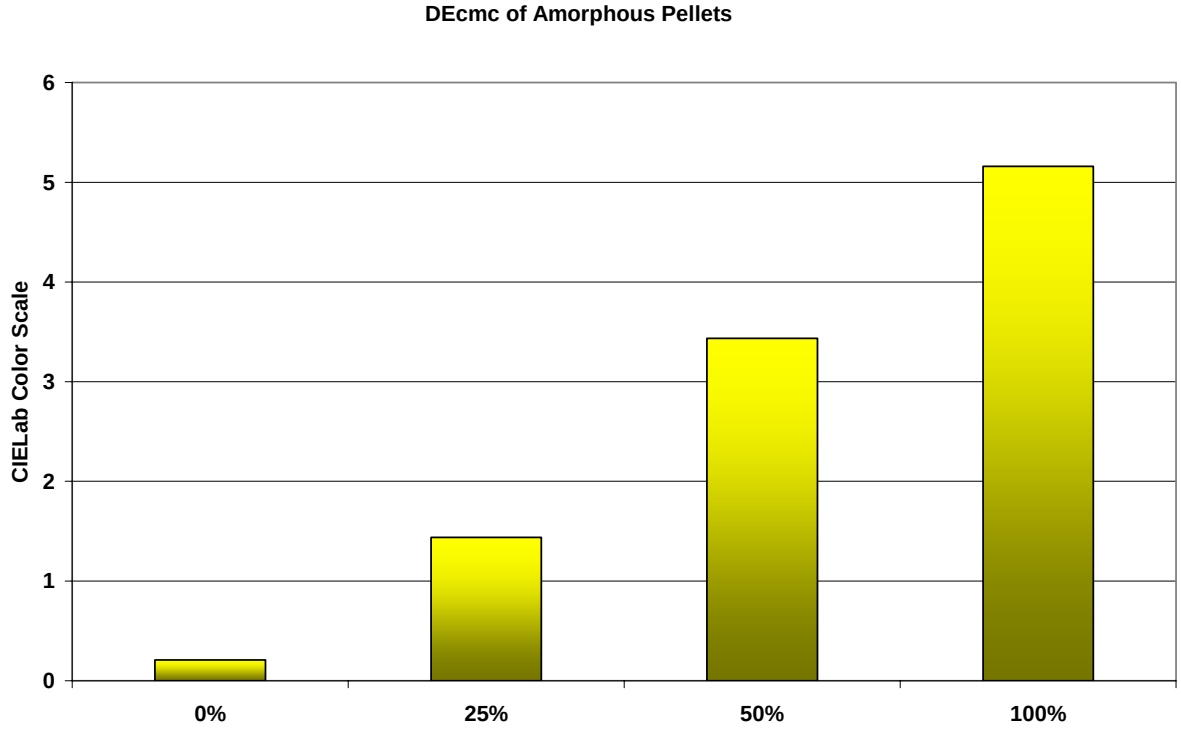
-1.0
-1.2


b* value of Amorphous Pellets
CIELab Color Scale
6
5
4
3
2
1
0
0%
25%
50%
100%


DEcmc of Amorphous Pellets
CIELab Color Scale
6
5
4
3
2
1
0
0%
25%
50%
100%

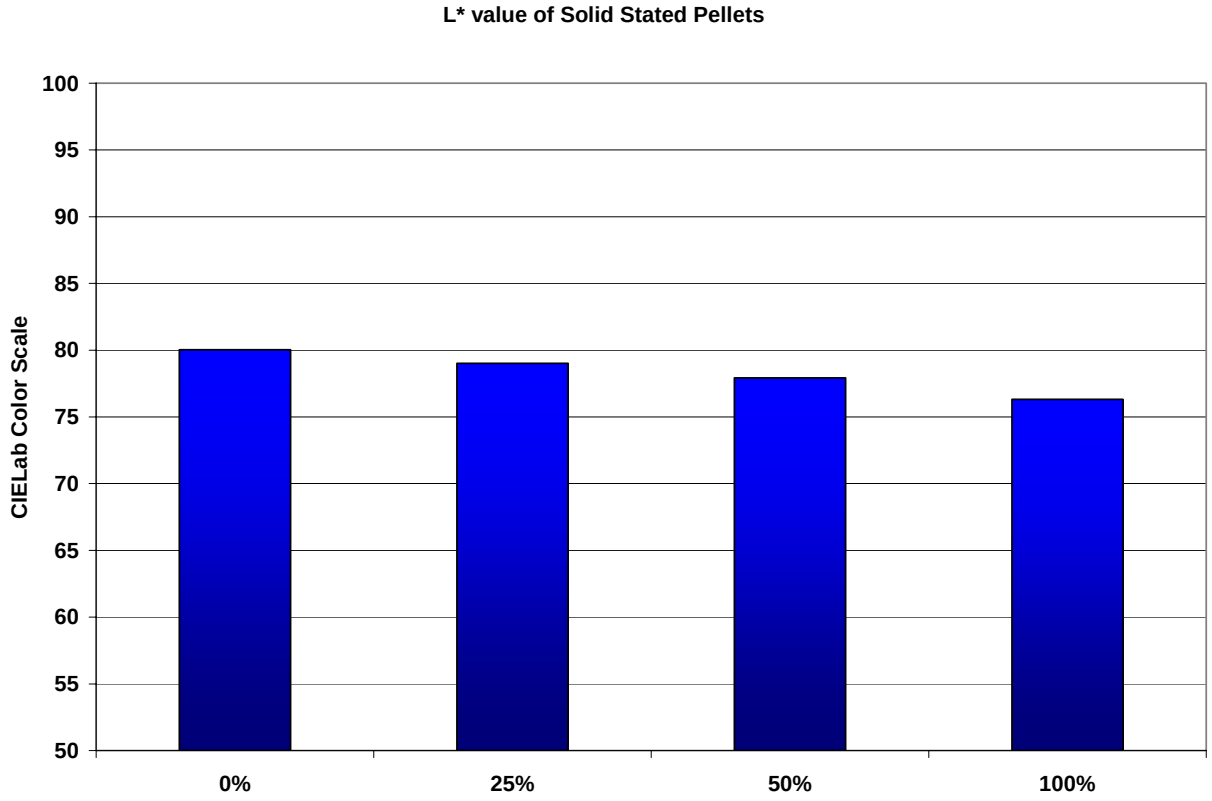
COLOR DATA

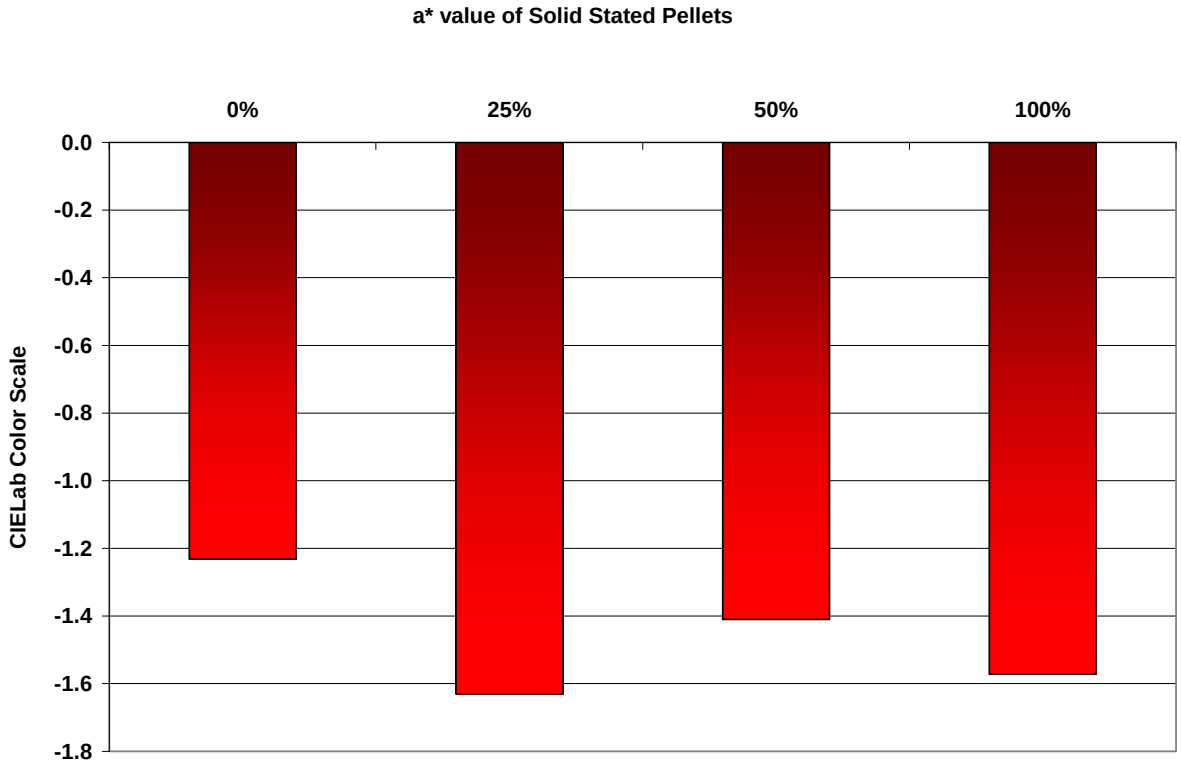
Plastics Forming Enterprises, LLC

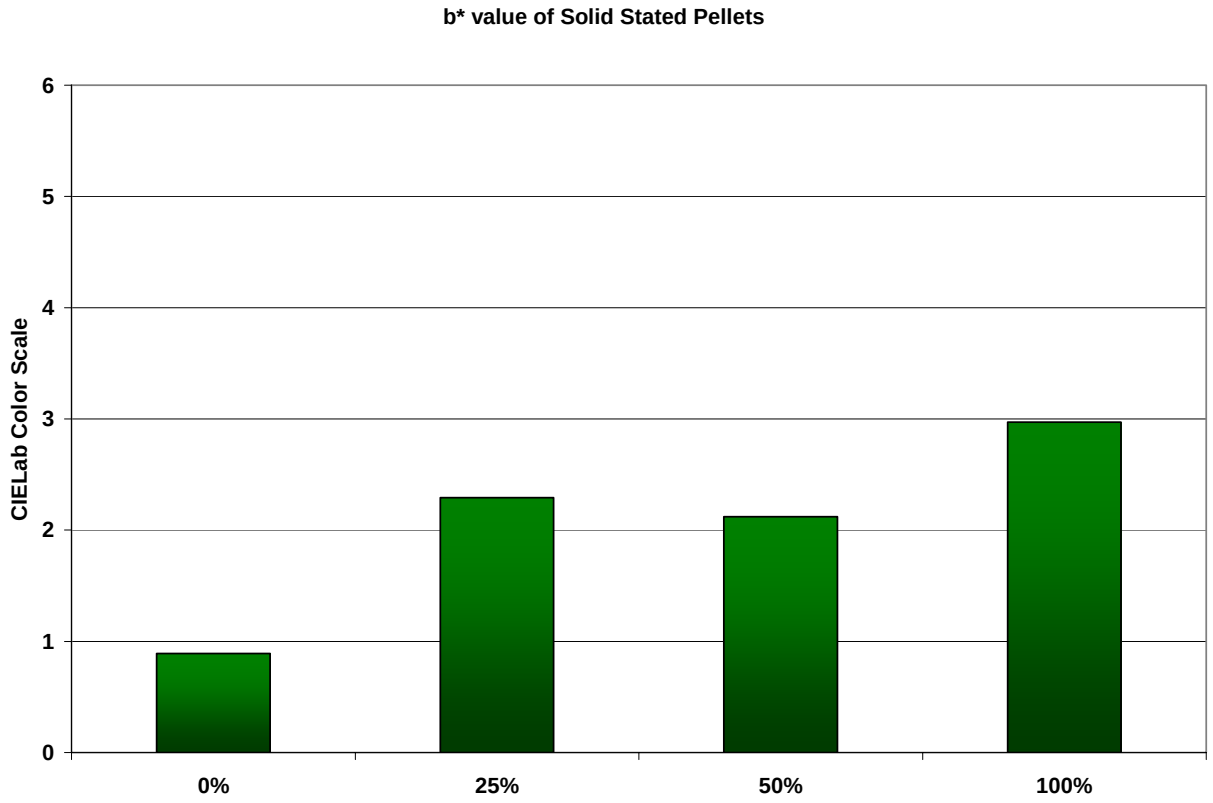
Client and #: DelMar Technologies ***Contact:*** Alex Delnik
Project: Bottle to Bottle
Experiment: Solid Stated Pellets
Type of Material: Plaque _____ Bottle _____ Strip _____ Pellets **SS**
Project #: 8609 ***Operator:*** Dan St. Laurent

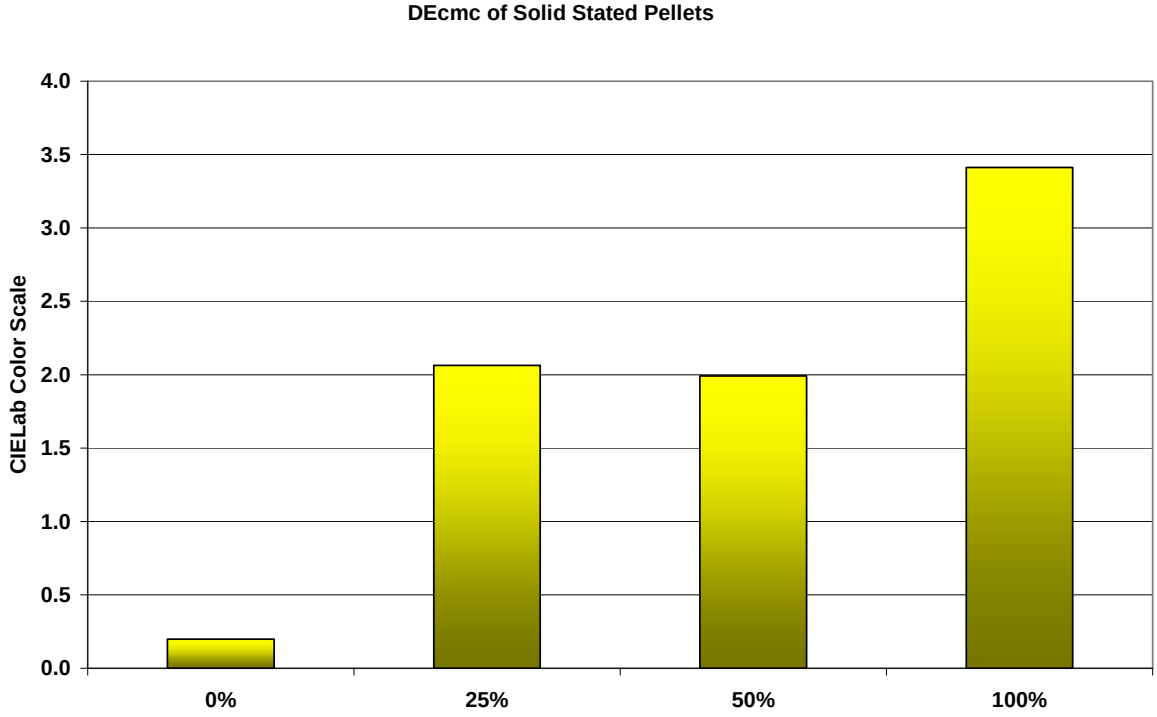
Equipment: Hunter Labs Colorquest II
Conditions: CIELab, 10 degrees, D65

Run #	Description	L* Values	a* Values	b* Values	L* Average	a* Average	b* Average	ΔEcmc	ΔEcmc Avg
8609-09	0%	79.89	-1.19	0.91	80.03	-1.23	0.89	0.09	0.20
		80.48	-1.26	0.95				0.24	
		79.90	-1.23	1.02				0.19	
		79.83	-1.23	0.86				0.11	
		80.52	-1.20	0.76				0.31	
		79.53	-1.28	0.85				0.26	
8609-10	25%	78.82	-1.64	2.27	79.01	-1.63	2.29	2.05	2.06
		79.15	-1.60	2.10				1.78	
		78.64	-1.62	2.31				2.12	
		79.28	-1.63	2.38				2.14	
		79.64	-1.65	2.41				2.16	
		78.50	-1.64	2.28				2.12	
8609-11	50%	77.63	-1.43	2.22	77.92	-1.41	2.12	2.18	1.99
		78.15	-1.41	2.04				1.84	
		77.86	-1.38	2.19				2.08	
		77.79	-1.38	2.20				2.11	
		77.76	-1.44	2.05				1.96	
		78.33	-1.42	2.02				1.78	
8609-23	100%	76.40	-1.55	2.85	76.32	-1.57	2.97	3.25	3.41
		76.61	-1.59	3.20				3.61	
		76.45	-1.56	2.65				3.01	
		76.17	-1.56	2.98				3.46	
		75.97	-1.60	3.17				3.73	
		75.68	-1.55	2.93				3.54	


L* value of Solid Stated Pellets
CIELab Color Scale
100
95
90
85
80
75
70
65
60
55
50
0%
25%
50%
100%


a* value of Solid Stated Pellets
CIELab Color Scale
0%
25%
50%
100%
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8


b* value of Solid Stated Pellets
CIELab Color Scale
6
5
4
3
2
1
0
0%
25%
50%
100%


DEcmc of Solid Stated Pellets
CIELab Color Scale
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0%
25%
50%
100%

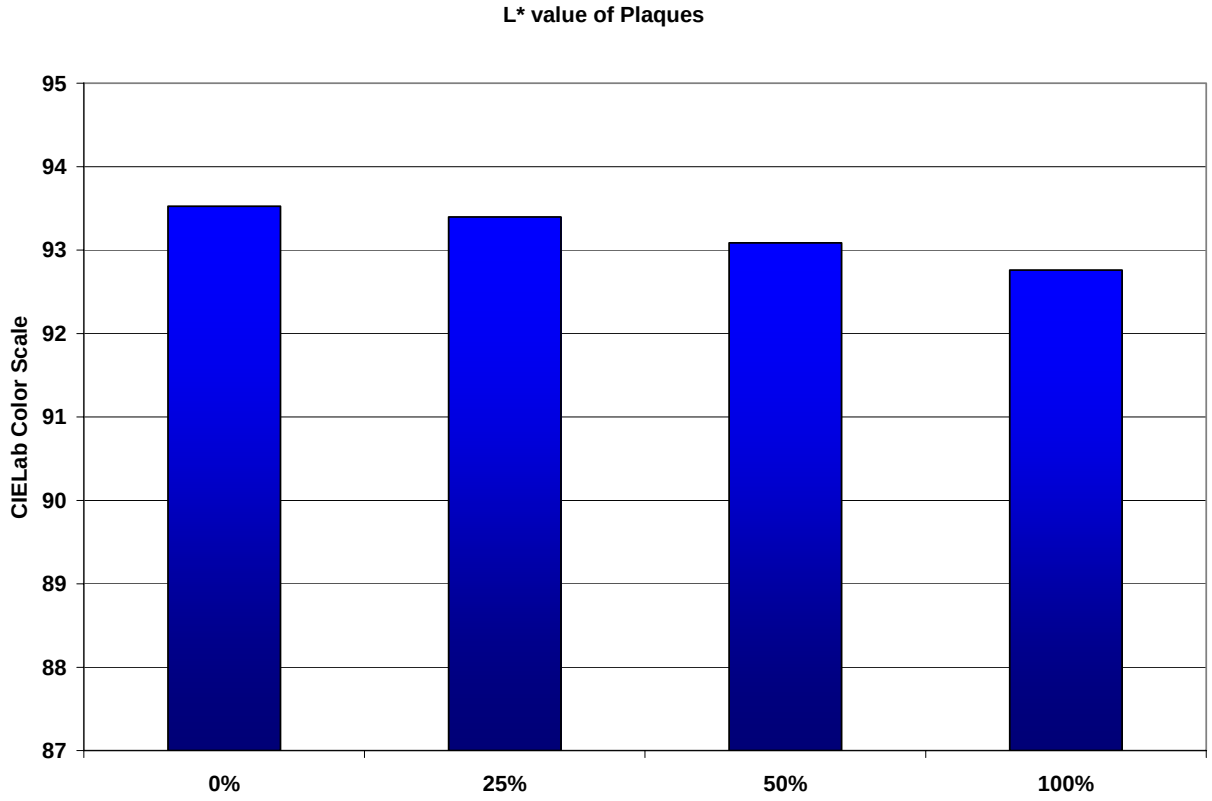
COLOR DATA

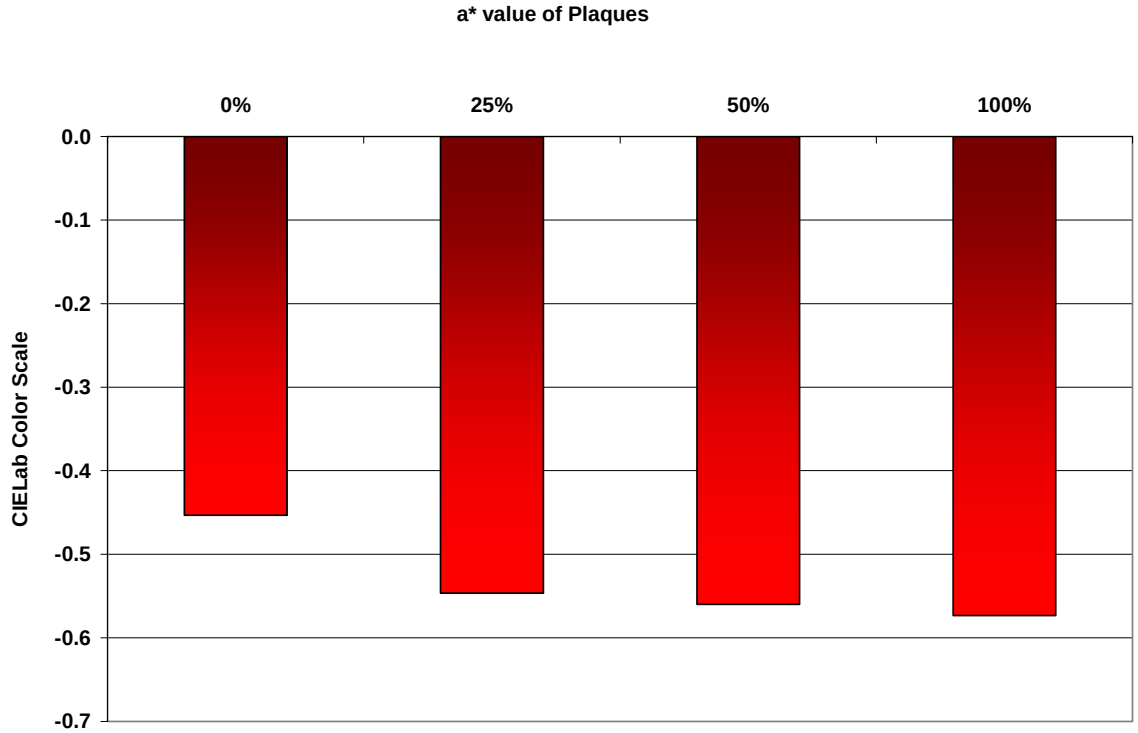
Plastics Forming Enterprises, LLC **Date:** 4/26/2006

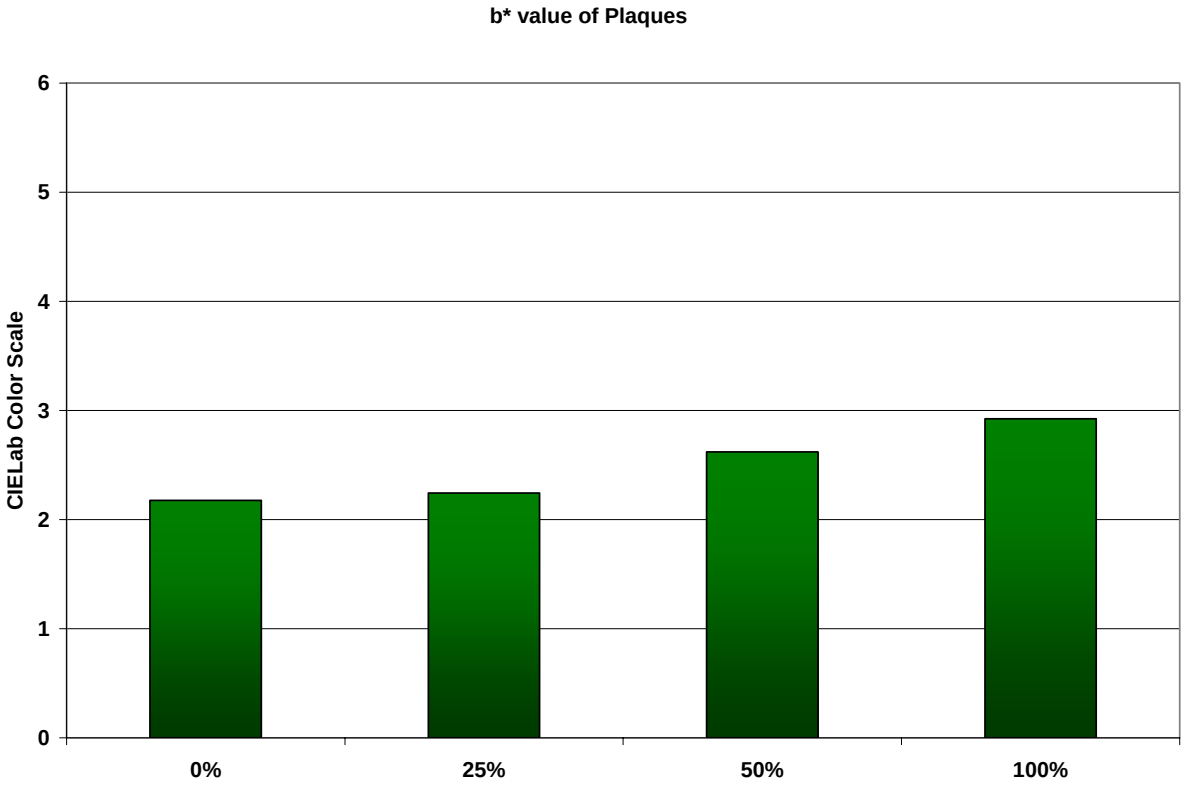
Client and #: DelMar Technologies ***Contact:*** Alex Delnik
Project: Bottle to Bottle Study
Experiment: Plaque Production
Type of Material: Plaque **3 MM** Bottle _____ Strip _____ Other _____
Project #: _____ ***Operator:*** Dan St. Laurent

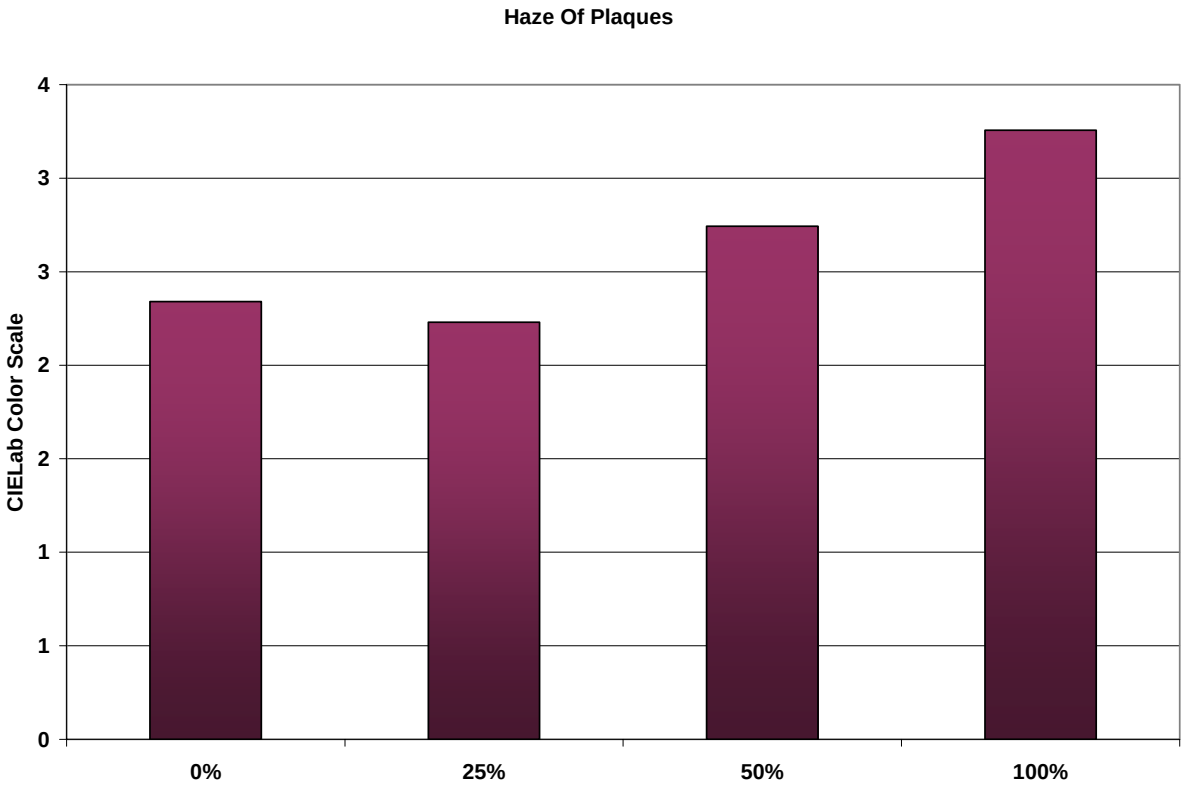
Equipment: Hunter Labs Colorquest II
Conditions: CIELab, 10 degrees, D65

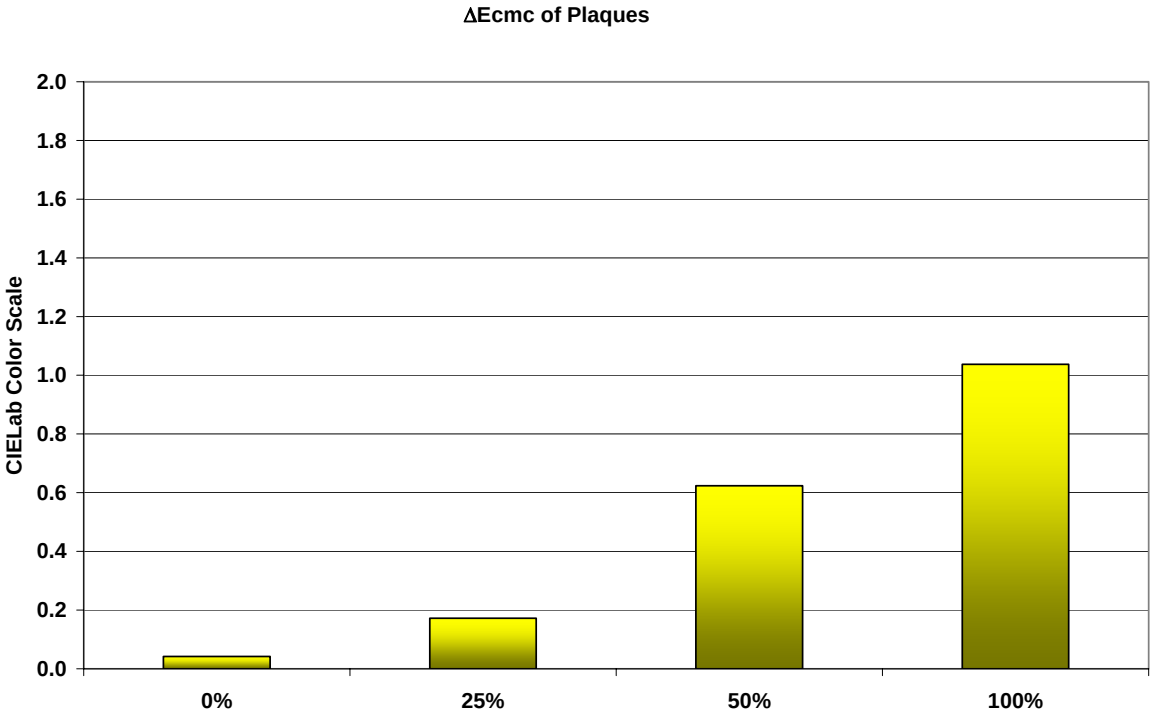
Run #	Description	L* Values	a* Values	b* Values	L* Average	a* Average	b* Average	Haze	Haze Avg	ΔEcmc	ΔEcmc Avg
8609-27	0% (Sample D)	93.44	-0.45	2.21	93.53	-0.45	2.18	2.51	2.34	0.06	0.04
		93.58	-0.45	2.17				2.26		0.03	
		93.56	-0.46	2.15				2.25		0.04	
8609-28	25% (Sample E)	93.25	-0.54	2.22	93.40	-0.55	2.24	2.21	2.23	0.18	0.17
		93.44	-0.55	2.24				2.23		0.16	
		93.50	-0.55	2.27				2.25		0.18	
8609-29	50% (Sample F)	92.99	-0.53	2.66	93.09	-0.56	2.62	2.72	2.74	0.68	0.62
		93.10	-0.57	2.59				2.72		0.59	
		93.17	-0.58	2.61				2.79		0.60	
8609-30	100%	92.76	-0.59	2.93	92.76	-0.57	2.92	3.31	3.26	1.05	1.04
		92.73	-0.56	2.91				3.20		1.02	
		92.79	-0.57	2.93				3.26		1.04	


L* value of Plaques
CIELab Color Scale
95
94
93
92
91
90
89
88
87
0%
25%
50%
100%


a* value of Plaques
CIELab Color Scale
0%
25%
50%
100%
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7


b* value of Plaques
CIELab Color Scale
6
5
4
3
2
1
0
0%
25%
50%
100%


Haze Of Plaques
CIELab Color Scale
4
3
3
2
2
1
1
0
0%
25%
50%
100%


ΔEcmc of Plaques
CIELab Color Scale
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0%
25%
50%
100%

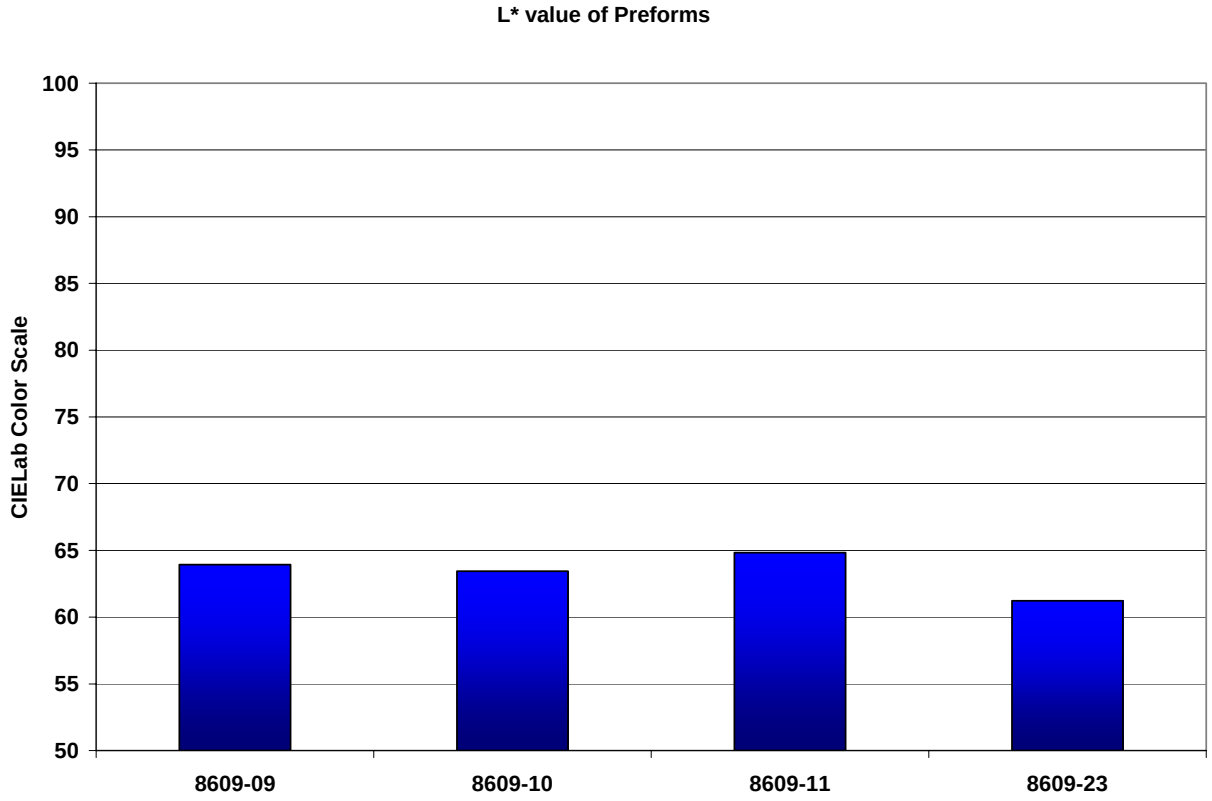
COLOR DATA

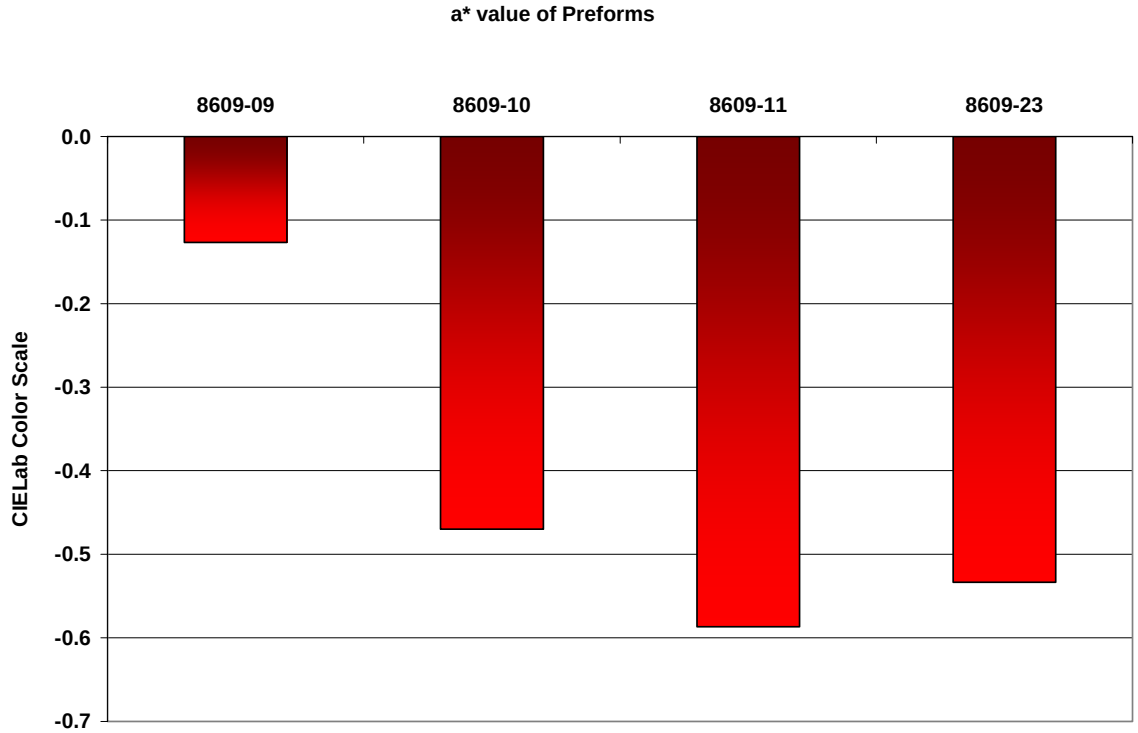
Plastics Forming Enterprises, LLC **Date:** 18-May-06

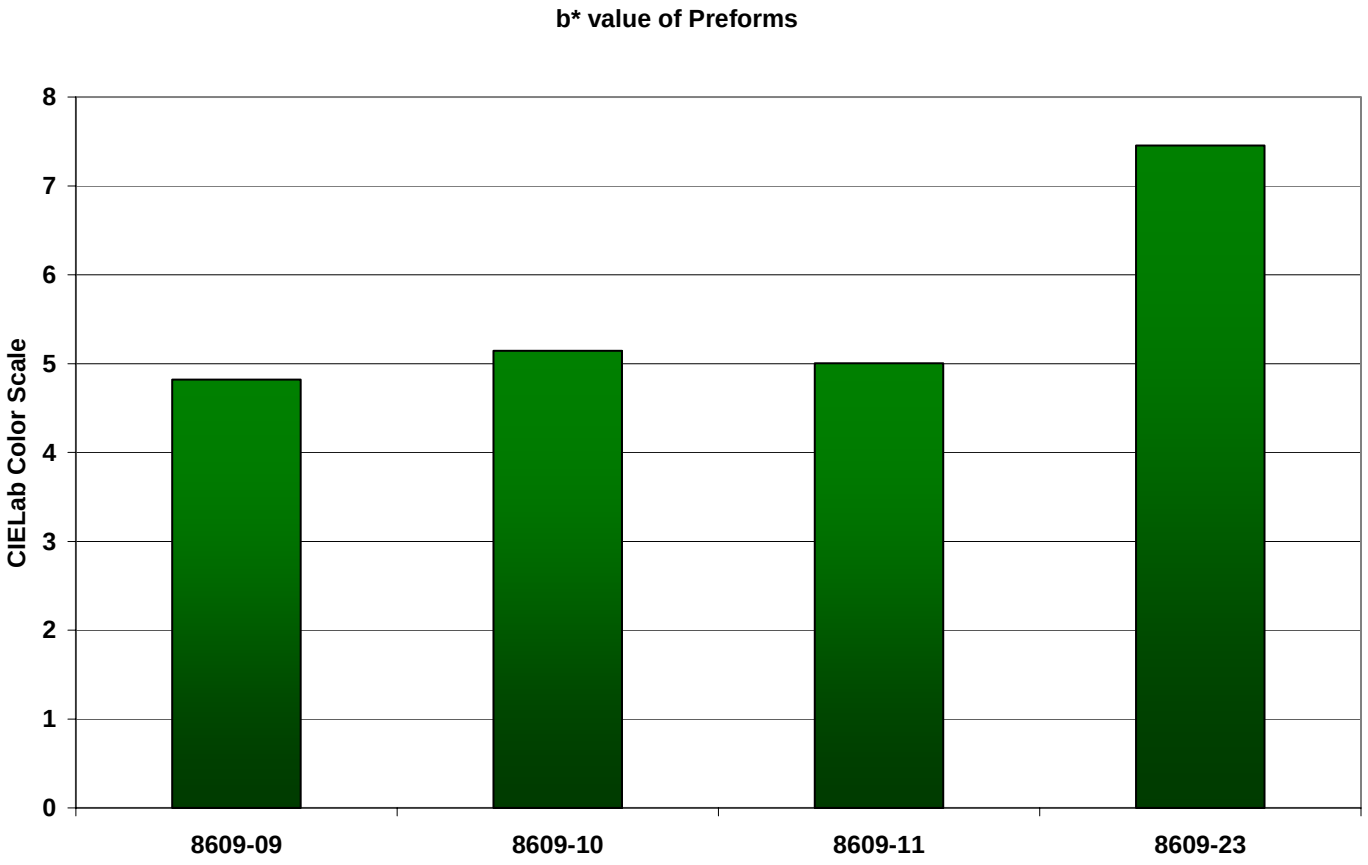
Client and #: Delmar Technologies ***Contact:*** Alex Delnik
Project: Bottle to Bottle
Experiment: Preform Production
Type of Material: Plaque _____ Bottle _____ Strip _____ Preforms **X**
Project #: Preform Production ***Operator:*** Dan St. Laurent

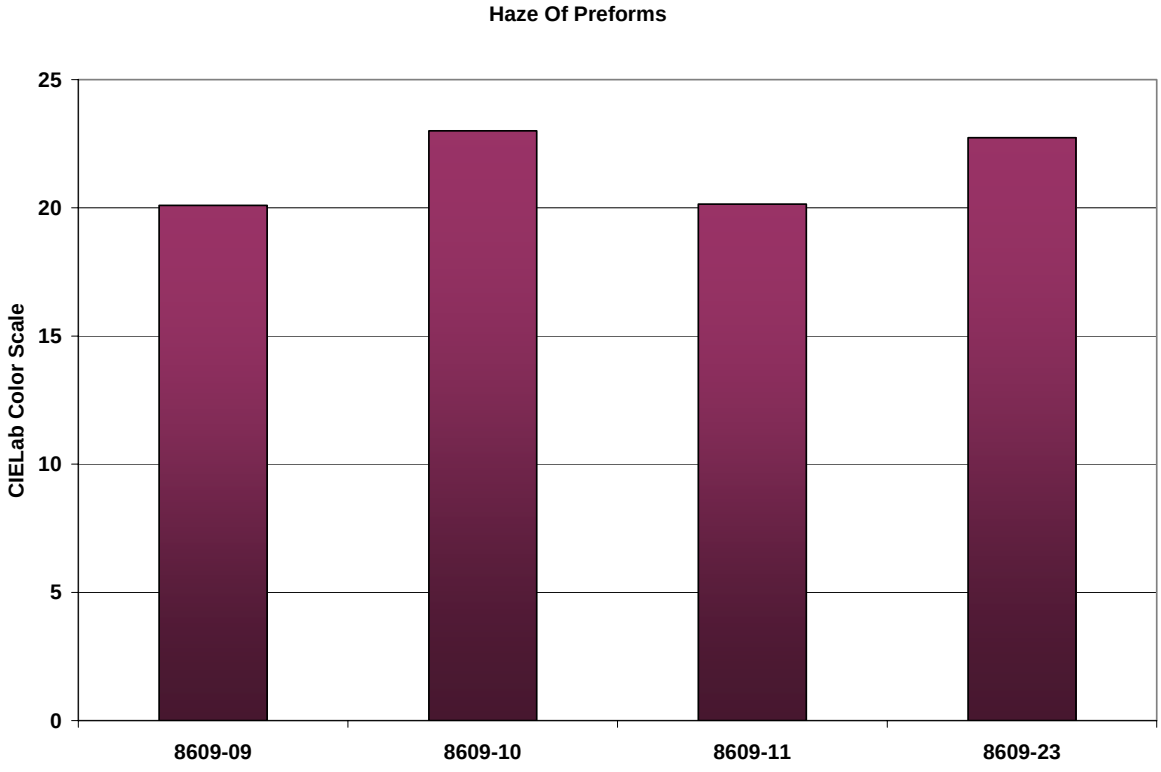
Equipment: Hunter Labs Colorquest II
Conditions: CIELab, 10 degrees, D65

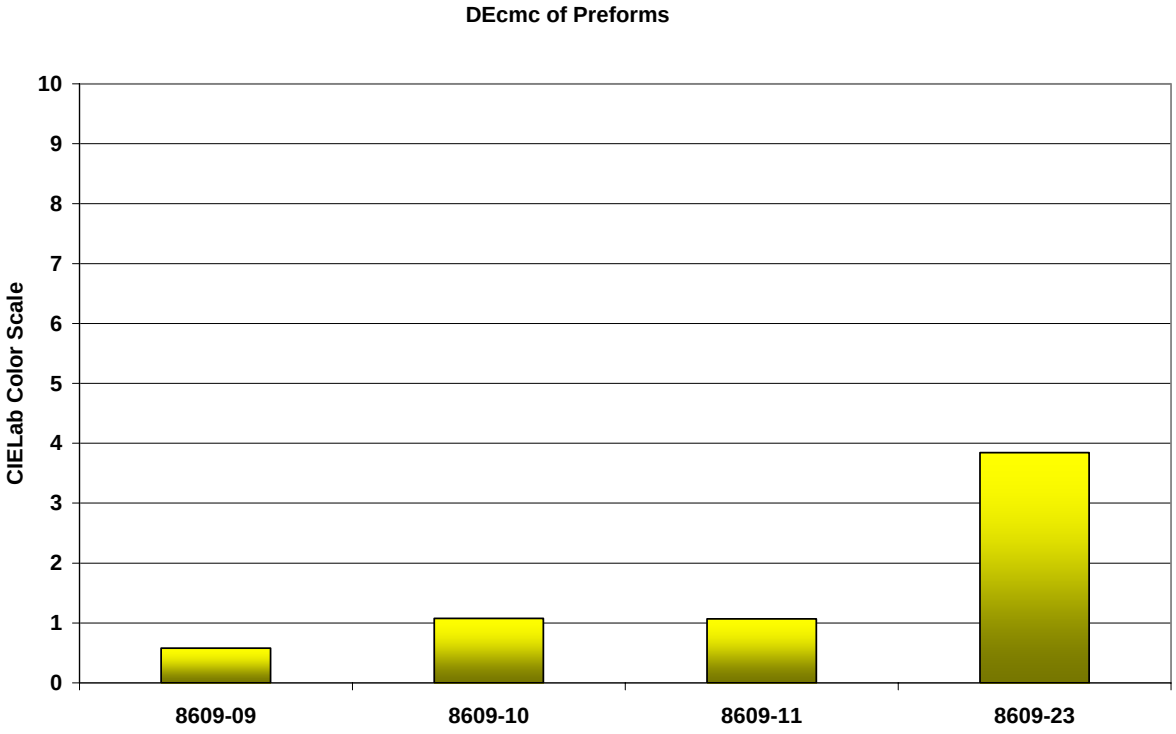
Run #	L* Values	a* Values	b* Values	L* Average	a* Average	b* Average	Haze	Haze Avg	ΔEcmc	ΔEcmc Avg
8609-09	62.93	0.01	6.24	63.92	-0.13	4.82	19.68	20.10	0.37	0.58
	65.25	-0.17	3.81				19.94		0.80	
	63.59	-0.22	4.41				20.68		0.56	
8609-10	63.93	-0.47	5.01	63.44	-0.47	5.14	22.06	23.01	0.85	1.08
	63.23	-0.47	5.39				23.95		1.34	
	63.17	-0.51	5.03				19.68		1.05	
8609-11	63.98	-0.61	4.93	64.83	-0.59	5.00	19.17	20.15	0.87	1.07
	66.07	-0.57	4.88				21.45		1.25	
	64.44	-0.58	5.20				19.82		1.08	
8609-23	61.15	-0.53	7.42	61.21	-0.53	7.45	22.86	22.73	3.83	3.85
	61.49	-0.57	7.18				22.40		3.51	
	61.00	-0.50	7.76				22.93		4.20	


L* value of Preforms
CIELab Color Scale
100
95
90
85
80
75
70
65
60
55
50
8609-09
8609-10
8609-11
8609-23


a* value of Preforms
CIELab Color Scale
8609-09
8609-10
8609-11
8609-23
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7


b* value of Preforms
CIELab Color Scale
0
1
2
3
4
5
6
7
8
8609-09
8609-10
8609-11
8609-23


Haze Of Preforms
CIELab Color Scale
0
5
10
15
20
25
8609-09
8609-10
8609-11
8609-23


DEcmc of Preforms
CIELab Color Scale
10
9
8
7
6
5
4
3
2
1
0
8609-09
8609-10
8609-11
8609-23

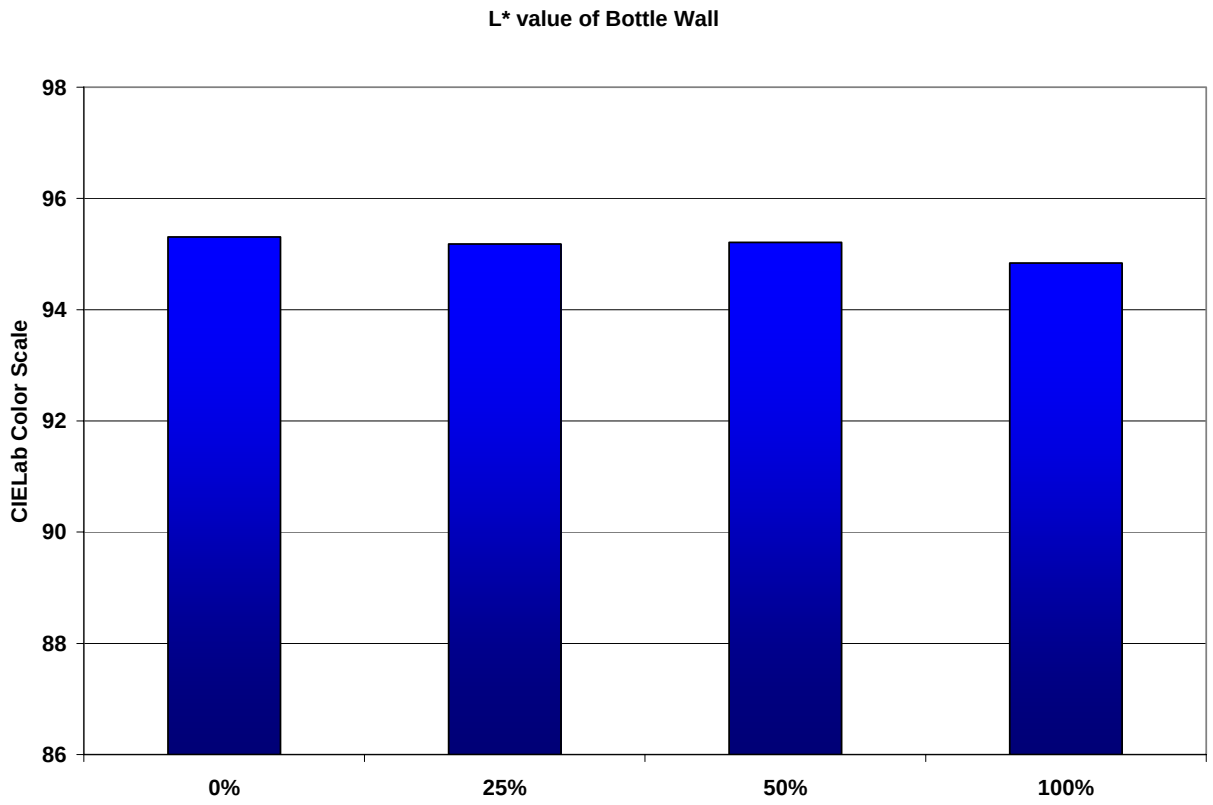
COLOR DATA

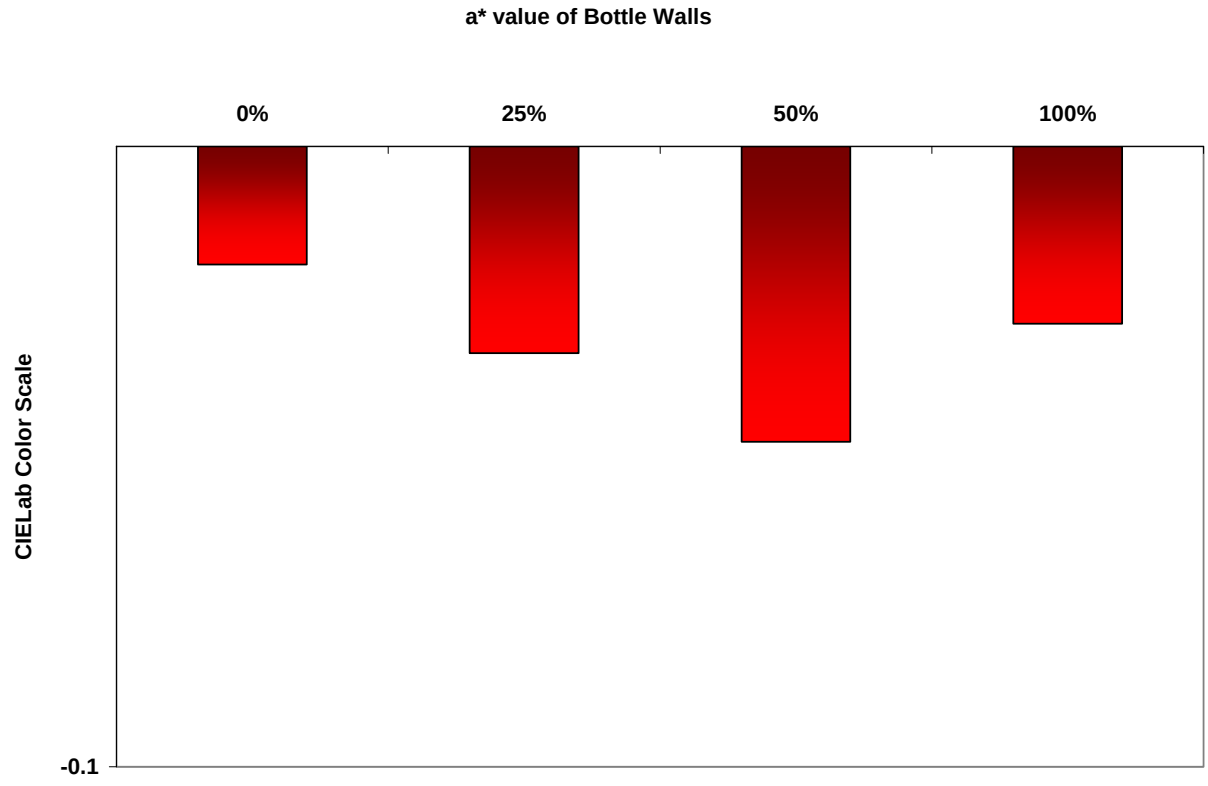
Plastics Forming Enterprises, LLC **Date:** 5/10/2006

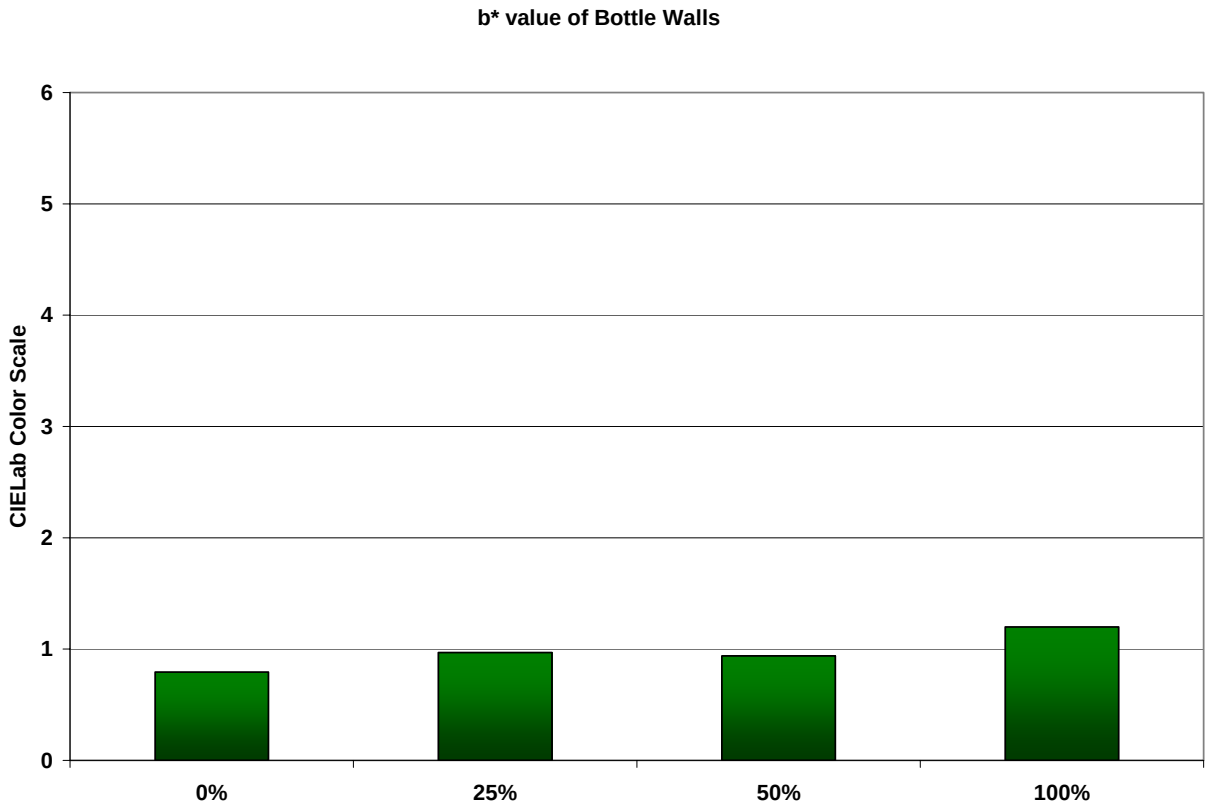
Client and #: DelMar Technologies ***Contact:*** Alex Delnik
Project: Bottle to Bottle
Experiment: Bottle Production
Type of Material: Plaque _____ Bottle **"Walls"** Strip _____ Other _____
Project #: 8609 ***Operator:*** Dan St. Laurent

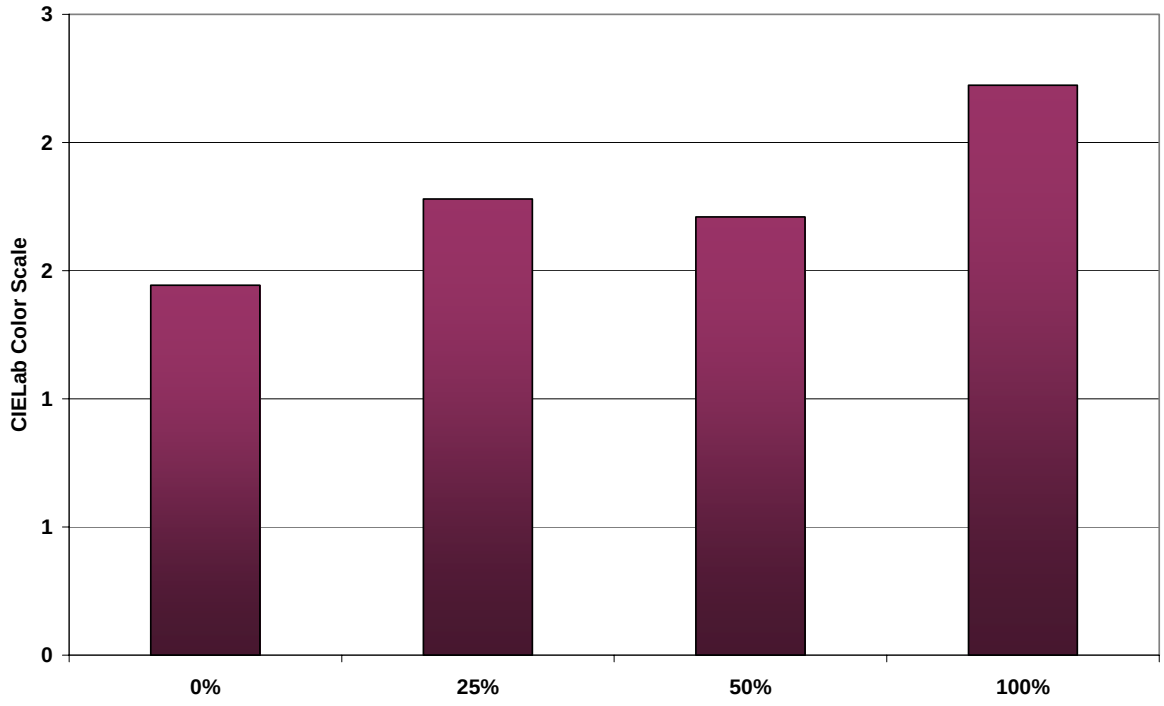
Equipment: Hunter Labs Colorquest II
Conditions: CIELab, 10 degrees, D65

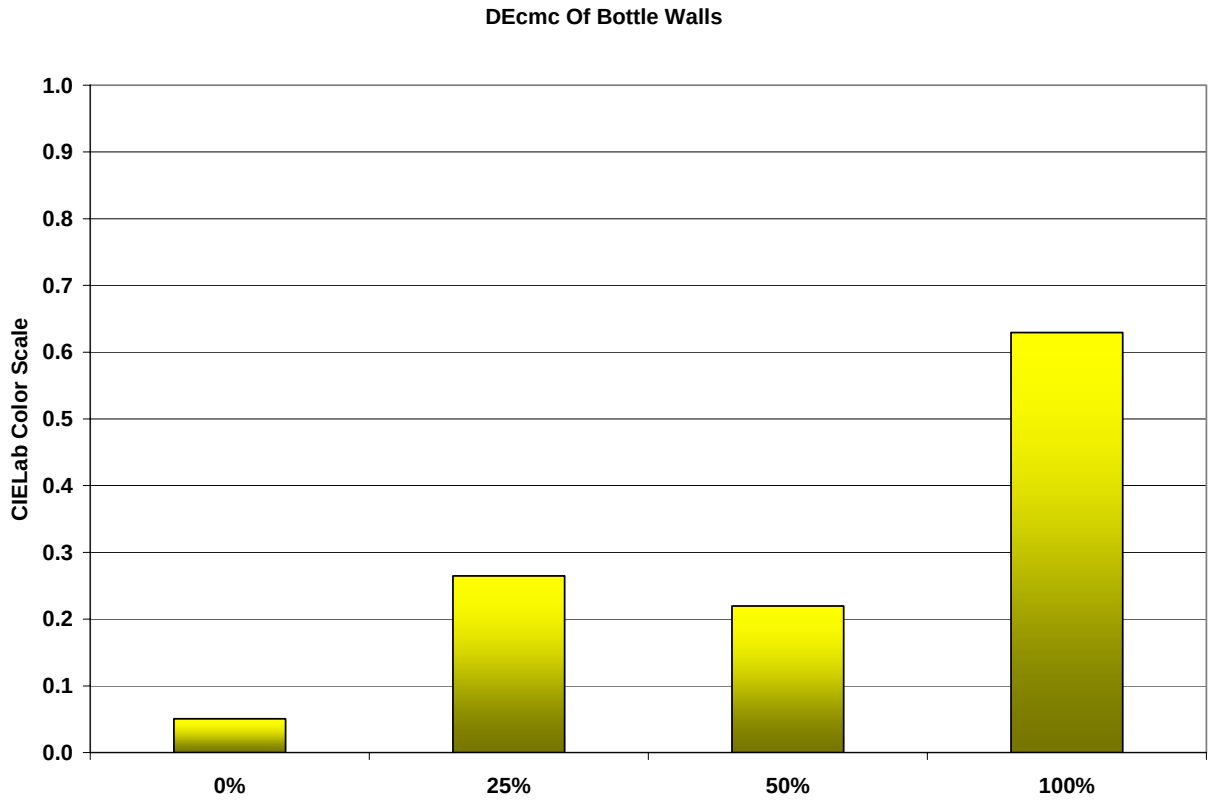
Run #	Description	L* Values	a* Values	b* Values	L* Average	a* Average	b* Average	Haze	Haze Avg	ΔEcmc	ΔEcmc Avg
8609-18	0%	95.35	-0.01	0.76	95.31	-0.01	0.79	1.39	1.44	**0.05**	0.05
		95.24	-0.01	0.84				1.53		**0.07**	
		95.33	-0.02	0.78				1.41		**0.02**	
8609-19	25%	95.25	-0.03	0.91	95.18	-0.02	0.97	1.65	1.78	**0.17**	0.26
		95.26	-0.03	0.89				1.62		**0.14**	
		95.03	-0.01	1.11				2.07		**0.48**	
8609-20	50%	95.20	-0.03	0.96	95.21	-0.03	0.94	1.75	1.71	**0.25**	0.22
		95.22	-0.04	0.92				1.68		**0.19**	
		95.21	-0.03	0.94				1.70		**0.22**	
8609-26	100%	94.68	0.00	1.34	94.84	-0.02	1.20	2.51	2.22	**0.84**	0.63
		94.87	-0.03	1.15				2.11		**0.56**	
		94.96	-0.03	1.11				2.05		**0.49**	


L* value of Bottle Wall
CIELab Color Scale
98
96
94
92
90
88
86
0%
25%
50%
100%


a* value of Bottle Walls
CIELab Color Scale
0%
25%
50%
100%
-0.1


b* value of Bottle Walls
CIELab Color Scale
6
5
4
3
2
1
0
0%
25%
50%
100%


Haze Of Bottle Walls
CIELab Color Scale
3
2
2
1
1
0
0%
25%
50%
100%


DEcmc Of Bottle Walls
CIELab Color Scale
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0%
25%
50%
100%

CONCLUSIONS:

The evaluation of the PET-m material for recyclability was conducted with a few objectives:

1) Generate a complete data set to determine the acceptability of this container in the recycle stream
2) PETCORE Protocol was followed for levels 0-25-50% concentration in the waste stream. This translated at a 50% content level would be 0 – 12.5 – 25% levels in the recycled bottle.
3) APR Protocol guidelines are also at 0 and 50% content levels which were added to the overall experiment.
4) Bottle testing for the PETCORE Protocol was conducted only at the three levels specified of 0 – 12.5 - 25% PCR content.

The overall results were very positive and did not indicate any noticeable effect on any processes involved in the recycle testing.

The test results met all PETCORE requirements in the guidelines. The control bottles performance was within the 5% limit of the test bottles for all bottle testing.

At the time of this report, the CO^2 testing was at 6 weeks and did not indicate any issues with the bottle performance.

There were no indications of delaminating which would affect the bulk density. Also, no pressure build up on the filter screen was observed which would indicate non-melts or degradation.

Due to the nature of these symmetrical silicones, the accuracy of the solution IV test may need to be evaluated against a melt viscosity test. The components in the polymer could be behaving differently in the polymer melt.

By all standards tested, it appears that the PET-m bottle will not cause any detrimental effect on the waste stream.

Photo of Storyboard (s):


BOTTLE TO BOTTLE
RECYCLABILITY

APPENDIX

PR06-380 20oz Generic PFE

0% 8609-09

								Date of Completion:	5/10/2006
	Test Required Y/N		**Spec +/-**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Comments**	
Section Weights	Y	Shoulder		9.69	9.92	9.81	0.070		
	Y	Panel		8.38	8.87	8.67	0.142		
	Y	Base		4.58	5.05	4.91	0.156		
Weight & Capacity	Y	Weight	+/- 0.3g	23.2	23.6	23.3	0.113	Fillpoint Level =	**1.604**
	Y	Fill Point Capacity	591 -0 ml +8 ml	592.6	594.1	593.3	0.532		**Pass**
	Y	Overflow Capacity		620.9	622.5	621.4	0.539		
AA	Y	CSD:	<10ppm						
Burst	Y	CSD:	x-4s > 8.2 Bar (120 psig)	191	225	216	6.088	192	
CO_2 Retention	Y	4.2 GV		Weeks:	On Test (6 weeks)	3.50			
Drop Impact	Y	Vertical	No Failures	0				**No Failures**	**Pass**
	Y	Horizontal	No Failures	0				**No Failures**	**Pass**
Top Load								x - 3s >35 lbf	
a. Empty Non-Vented	Y		x - 3s >35 lbf	69	76	73	2.474	66	**Pass**
b. Filled and Capped									
Thermal Stability	Y	Height	< 2.75%	1.71	2.29	2.05			
	Y	Mid-Panel	< 3.0%	1.2	1.7	1.6			
	Y	Base Ctr.	No rockers	0.008	0.055	0.029		No rockers	**Pass**
	Y	Perpend.	<0.150"	0.010	0.032	0.021			**Pass**
	Y	Fillpt. Drop	<0.790 inches	0.418	0.517	0.482			**Pass**
Stress Crack	Y	Bottles ≤1L :	≥5 minutes	TBD	TBD	TBD	TBD	**TBD**	**TBD**

PR06-380 20oz Generic PFE

25% 8609-10

								Date of Completion:	5/10/2006
	Test Required Y/N		**Spec +/-**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Comments**	
Section Weights	Y	Shoulder		9.74	10.03	9.88	0.084		
	Y	Panel		8.60	8.93	8.77	0.107		
	Y	Base		4.63	5.09	4.83	0.135		
Weight & Capacity	Y	Weight	+/- 0.3g	23.2	23.6	23.4	0.123	Fillpoint Level =	**1.604**
	Y	Fill Point Capacity	591 -0 ml +8 ml	590.1	593.1	591.4	0.910		**Pass**
	Y	Overflow Capacity		621.3	623.1	622.2	0.577		
AA	Y	CSD:	<10ppm						
Burst	Y	CSD:	x-4s > 8.2 Bar (120 psig)	208	233	224	5.503	202	**Pass**
CO_2 Retention	Y	4.2 GV		Weeks:	On Test (6 weeks)	3.52			
Drop Impact	Y	Vertical	No Failures	0				**No Failures**	**Pass**
	Y	Horizontal	No Failures	0				**No Failures**	**Pass**
Top Load								x - 3s >35 lbf	
a. Empty Non-Vented	Y		x - 3s >35 lbf	72	80	77	2.408	69	**Pass**
b. Filled and Capped									
Thermal Stability	Y	Height	< 2.75%	1.70	2.18	2.00			
	Y	Mid-Panel	< 3.0%	1.5	1.7	1.6			
	Y	Base Ctr.	No rockers	0.015	0.044	0.034		No Rockers	**Pass**
	Y	Perpend.	<0.150"	0.018	0.039	0.027			**Pass**
	Y	Fillpt. Drop	<0.790 inches	0.429	0.500	0.475			**Pass**
Stress Crack	Y	Bottles <1L :	>5 minutes	TBD	TBD	TBD	TBD	**TBD**	**TBD**

PR06-380 20oz Generic PFE

50% 8609-11

								Date of Completion:	5/10/2006
	Test Required Y/N		**Spec +/-**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Comments**	
Section Weights	Y	Shoulder		9.57	9.85	9.72	0.109		
	Y	Panel		8.30	8.74	8.55	0.161		
	Y	Base		4.93	5.47	5.18	0.194		
Weight & Capacity	Y	Weight	+/- 0.3g	23.3	23.6	23.5	0.091	Fillpoint Level =	**1.604**
	Y	Fill Point Capacity	591 -0 ml +8 ml	590.6	592.6	591.7	0.652		**Pass**
	Y	Overflow Capacity		621.2	623.1	622.1	0.612		
AA	Y	CSD:	<10ppm						
Burst	Y	CSD:	x-4s > 8.2 Bar (120 psig)	209	225	216	4.935	197	**Pass**
CO_2 Retention	Y	4.2 GV		Weeks:	On Test (6 weeks)	3.54			
Drop Impact	Y	Vertical	No Failures	0				**No Failures**	**Pass**
	Y	Horizontal	No Failures	0				**No Failures**	**Pass**
Top Load								x - 3s >35 lbf	
a. Empty Non-Vented	Y		x - 3s >35 lbf	69	80	75	3.167	66	**Pass**
b. Filled and Capped									
Thermal Stability	Y	Height	< 2.75%	1.94	2.18	2.07			
	Y	Mid-Panel	< 3.0%	1.6	1.9	1.7			
	Y	Base Ctr.	No rockers	0.006	0.041	0.022		No Rockers	**Pass**
	Y	Perpend.	<0.150"	0.027	0.051	0.039			**Pass**
	Y	Fillpt. Drop	<0.790 inches	0.450	0.557	0.506			**Pass**
Stress Crack	Y	Bottles <1L :	>5 minutes	TBD	TBD	TBD	TBD	**TBD**	**TBD**