February 24, 2017
Via Email: *jessw@biocaretechusa.com*

Dr. Richard Hart
Bio Care Technology, LLC
1353 East Wilshire Avenue
Santa Ana, CA 92705

SUBJECT: Results of Physical Testing on Antimicrobial Aliphatic Polyurethane Coating; KTA-Tator, Inc. Project No. 360846

Dear Dr. Hart:

In accordance with KTA-Tator, Inc. (KTA) Proposal Number PN167351 and the subsequent prepayment received on December 6, 2016, KTA has completed physical testing on one antimicrobial aliphatic polyurethane coating to determine various properties. This report contains descriptions of the testing procedures employed and the results of the testing.

SAMPLES

The samples listed in Table 1, "Samples" were received from Bio Care Technology, LLC on the dates listed below. It should be noted that at no time did KTA personnel witness the acquisition of the samples listed below.

Table 1 – Samples

Testing Performed on Samples	Description	Date Received
Tensile Adhesion Pencil Hardness Chemical Spot Testing	2 vinyl panels with clear coat	November 30, 2016
Flexibility Solvent Resistance	7 aluminum panels with clear coat	
Permeability	3 free films of clear coat	
Permeability	3 free films of clear coat	December 27, 2016
Impact Resistance	4 Q-panels with clear coat	

LABORATORY TESTING

The laboratory testing consisted of tensile adhesion, impact resistance, flexibility, pencil hardness, solvent resistance, permeability, and chemical spot testing. The test descriptions and the results of the testing are provided below.

Tensile Adhesion

Tensile adhesion (pull-off strength) was measured in accordance with ASTM D4541-09e1, "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers," Annex A4, "Self-Aligning Adhesion Tester Type V." The testing surfaces were wiped clean and abraded gently using fine sandpaper. The pull stubs used were 20 mm in diameter and were lightly abraded with sandpaper prior to being attached to the coating using a two-component epoxy adhesive (Araldite 2011), which was allowed to cure for 24 hours at ambient laboratory conditions (73.5 ± 3.5°F and 50 ± 5% RH). The pull stubs were then detached using a Defelsko® PosiTest® AT. The force (in psi) required to remove each loading fixture was recorded along with the location of break and approximate percentage of each. The location of break is defined as follows:

Adhesive Failure: A split between layers or a split between the substrate and the first layer.
Cohesive Failure: A split within a single layer.
Glue Failure: Coating strength exceeds glue strength.

The results of the testing are provided in Table 2, "Tensile Adhesion Results."

Table 2 – Tensile Adhesion Results

Pull Stub ID	Pull-Off Strength (psi)	Location of Break	Average Pull-Off Strength (psi)
A	315	100% cohesive within substrate	314
B	311	100% cohesive within substrate	
C	316	100% cohesive within substrate	

Impact Resistance

The resistance to impact was determined on four panels from each coating system in accordance with ASTM D2794-93(10), "Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)." The testing was performed with the coating facing upward (direct impact) and the coating facing downward (reverse impact) at ambient laboratory conditions. A 4-pound weight was dropped from various heights along the guide tube of the apparatus onto the steel punch which rested on the coated surface of the test panel. The steel punch had a hemispherical head with a diameter of ½″. The location of impact was inspected under 8X magnification with a comparator lens for cracks or holidays in the coating film. A minimum of seven impact locations were observed. The maximum height (inches) at which the coating exhibited no cracking was multiplied by 4-pounds to determine the impact resistance of the coating in units of inch-pounds. The impact resistance for both direct impact and reverse impact was 40 inch-pounds.

Flexibility

Flexibility testing was performed on the sample in accordance with ASTM D522/D522M-13, "Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings," Method A at a temperature of 72.8°F and a relative humidity of 53.2%. Coating

thickness measurements were obtained on each panel using a DeFelsko® PosiTector® 6000 non-destructive electronic coating thickness gage. The coating thickness ranged from 1.5 – 2.5 mils and had an average thickness of 1.9 mils. Each panel was slowly bent 180° over the conical mandrel then examined visually for cracking along the axis of curvature. No cracking was observed on the panels.

Pencil Hardness

Pencil hardness testing was performed in accordance with ASTM D3363-05(11)e2, "Standard Test Method for Film Hardness by Pencil Test," using lead pencils manufactured by Mitsubishi Pencil Company. Briefly, this method involved pressing a flattened lead into the coating film at a 45° angle away from the operator. A uniform downward pressure was applied to the pencil tip sufficient to either cut or scratch the film or crumble the edge of the lead. The pencils used followed the hardness scale listed below. The testing was started with the hardest lead and continued until a pencil was found that did not rupture or scratch the coating film. The gouge hardness and scratch hardness were determined in accordance with the definitions provided by ASTM D3363-05(11)e2:
Gouge Hardness – The hardest pencil that will leave the film uncut for a stroke length of at least 3mm (⅛ in.).
Scratch Hardness – The hardest pencil that will not rupture or scratch the film.
The coating had a gouge hardness of 4H and a scratch hardness of H.

Pencil Lead Scale

6B 5B 4B 3B 2B B HB F H 2H 3H 4H 5H 6H
Softer ***Harder***

Solvent Resistance

Resistance to solvent was evaluated in accordance with ASTM D5402-15, "Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs." A clean rag was folded over the index finger and saturated with methyl ethyl ketone (MEK). 2,000 double rubs were completed along the length of the 4″ x 6″ steel panel. This was performed in duplicate on the steel panel. After 2,000 double rubs, no visible evidence of coating erosion was observed.

Permeability

Six discs of the coating were cut from the free film and tested for water vapor permeance using Condition A, Test Method B – Wet Cup Method of ASTM D1653-13, "Standard Test Methods for Water Vapor Transmission of Organic Coating Films," modified to allow for a wider range of conditions (73.5°F ± 3.5°F and 50% ± 5% rather than the ± 1°F and 2% specified by the method) in the test environment. Each disc was mounted to an aluminum dish using a gasket and screw-on cap. The dishes were filled with deionized water, weighed, and maintained at the specified conditions for a period of 16 days. The dishes were weighed separately at various recorded intervals, and the results plotted as mass versus time. The permeance was calculated

using the slope of the graphs. The graphs, the mean film thickness of the test specimens, the test temperature and relative humidity in the test chamber, and the water vapor transmission determined may also be found in the appendix. The permeance is reported in perms in Table 3, "Permeability Results."

Table 3 – Permeability Results

Replicate ID	Permeance (grains/hr./sq. ft./mmHg)	Average Permeance (grains/hr./sq. ft./mmHg)
A	3.074	2.348
B	1.832	
C	1.545	
D	2.707	
E	2.767	
F	2.160	

Chemical Spot Test

Chemical spot testing was performed at the request of Bio Care Technology, LLC. A spot of betadine solution was deposited on the panel for one hour. Following exposure, the solution was wiped away and the exposed area was scrubbed with Rejuvenate floor cleaner. Triplicate spots were tested and visual observations showed a yellow stain on the surface and could not be removed with the floor cleaner.

If you have any questions concerning the testing or this report, please contact me by telephone at 412.788.1300 extension 239, or by email at cstewart@kta.com.

Sincerely,

KTA-TATOR, INC.

Chrissy M. Stewart
Senior Chemist

Appendix: Permeability Results

CMS/KMS:tbr
JN360846

(360846 Bio Care.doc)

NOTICE: This report represents the opinion of KTA-TATOR, INC. This report is issued in conformance with generally accepted industry practices. While customary precautions were taken to verify the information gathered and presented is accurate, complete and technically correct, this report is based on the information, data, time, materials, and/or samples afforded. This report should not be reproduced except in full.

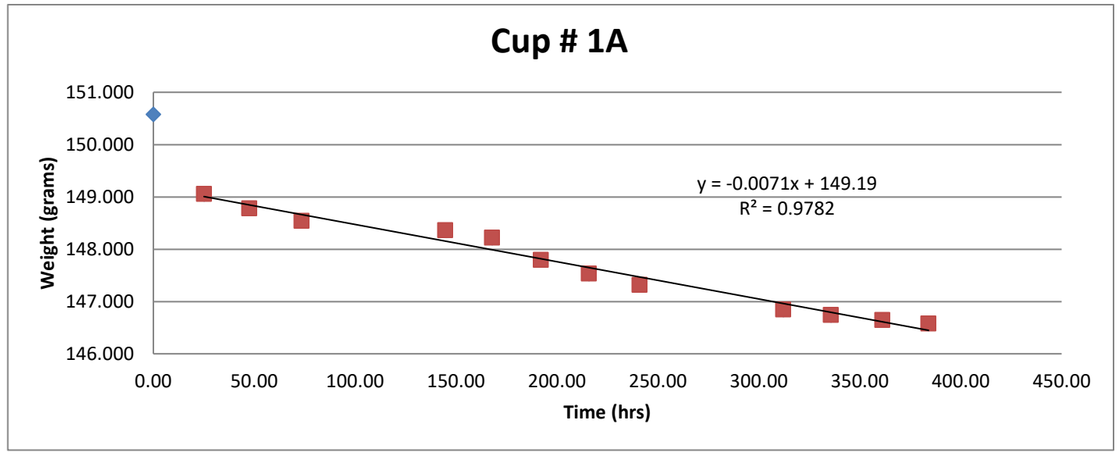
360846 Biocare											
ASTM D1653, Test Method B (Wet Cup Method), Condition A-50% Relative Humidity and 73°F											
KTA-1 First Set of Replicates											
Date	**Hours**	**Cup 1A (g)**	**Cup 1A (grain)**	**Cup 1B (g)**	**Cup 1B (grain)**	**Cup 1C (g)**	**Cup 1C (grain)**	**BLANK (g)**	**BLANK (grain)**	**Temperature (°F)**	**%Relative Humidity**
1/3/17 4:00 PM	0.00	150.578	2323.42	152.735	2356.70	150.767	2326.33			74.300	50.400
1/4/17 5:05 PM	25.08	149.056	2299.93	152.058	2346.25	149.731	2310.35			74.300	51.000
1/5/17 3:37 PM	47.62	148.777	2295.63	151.135	2332.01	149.040	2299.69			75.000	51.000
1/6/17 5:30 PM	73.50	148.539	2291.96	150.973	2329.51	148.334	2288.79			73.700	52.700
1/9/17 4:36 PM	144.60	148.360	2289.19	150.811	2327.01	147.211	2271.47			75.000	50.800
1/10/17 3:52 PM	167.87	148.217	2286.99	150.729	2325.75	147.063	2269.18			75.000	52.300
1/11/17 4:07 PM	192.12	147.797	2280.51	150.660	2324.68	146.944	2267.35			75.000	50.200
1/12/17 3:50 PM	215.83	147.532	2276.42	150.562	2323.17	146.844	2265.80			71.700	55.700
1/13/17 5:00 PM	241.00	147.315	2273.07	150.428	2321.10	146.743	2264.24			74.300	50.400
1/16/17 4:04 PM	312.07	146.845	2265.82	150.275	2318.74	146.504	2260.56			74.800	51.200
1/17/17 3:42 PM	335.70	146.742	2264.23	150.170	2317.12	146.443	2259.62			74.100	51.700
1/18/17 5:11 PM	361.18	146.647	2262.763	150.071	2315.60	146.381	2258.66			73.700	54.000
1/19/17 4:03 PM	384.05	146.578	2261.699	149.997	2314.45	146.326	2257.81			74.600	49.200

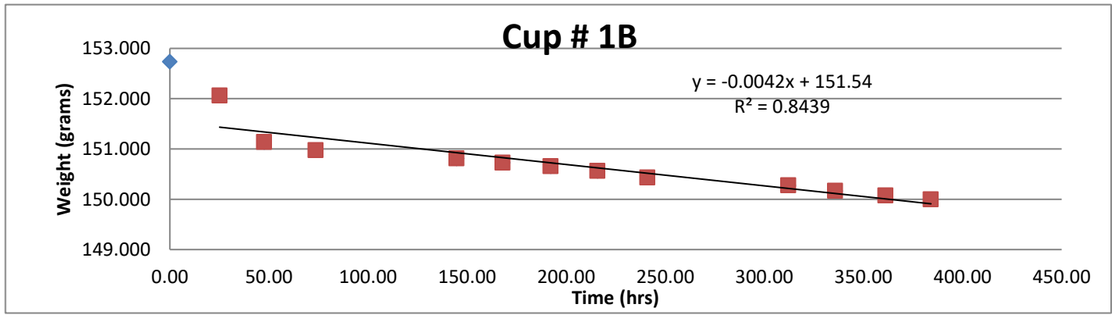
Method of coating application and curing procedure used	Prepared by client
Type of film support used	N/A
Design of cup	glass dish
Type or composition of sealant	wax blend (40% paraffin/60% microcrystalline wax)

Dish	1A	1B	1C	BLANK
Material Thickness (in)	0.0041	0.0036	0.0051	
Radius (in)	2.00	2.00	2.00	2.00

CALCULATIONS	
Temperature (°F)	74.3
Relative humidity in test chamber	51.6 %
Relative humidity in dish	100 %
Humidity change (as a decimal)	0.48
Vapor Pressure	21.497 mm Hg
	0.846 in Hg

	1A	1B	1C	BLANK
Radius (m)	0.0508	0.0508	0.0508	0.0508
Area (m^2)	0.00811	0.00811	0.00811	0.00811
Slope (grams/hr)	7.12E-03	4.25E-03	3.58E-03	#DIV/0!
Area (ft^2)	0.0873	0.0873	0.0873	0.0873
Slope (grains/hr)	0.10993	0.06551	5.52E-02	#DIV/0!
WVT(g/h-m^2)	0.879	0.524	0.442	#DIV/0!
WVT(g/day-m^2)	21.09	12.57	10.60	#DIV/0!
WVP (g/hr-m^2-mm Hg)	8.4E-02	5.0E-02	4.2E-02	#DIV/0!
WVP (metric perm)	2.026	1.208	1.018	#DIV/0!
WVP (g/Pa-s-m^2)	1.8E-07	1.0E-07	8.8E-08	#DIV/0!
Permeability (g-cm/hr-m^2-mm Hg)	8.8E-04	4.6E-04	5.5E-04	#DIV/0!
Permeability (g-cm/day-m^2-mm Hg)	2.1E-02	1.1E-02	1.3E-02	#DIV/0!
Permeability (g/Pa-s-m)	1.8E-11	9.7E-12	1.2E-11	#DIV/0!
WVT(grains/h-ft^2)	1.260	0.751	0.633	#DIV/0!
WVP (perm)	3.074	1.832	1.545	#DIV/0!
Permeability (perm inch)	1.3E-02	6.6E-03	7.9E-03	#DIV/0!
Permeability (perm mil)	12.68	6.64	7.92	#DIV/0!

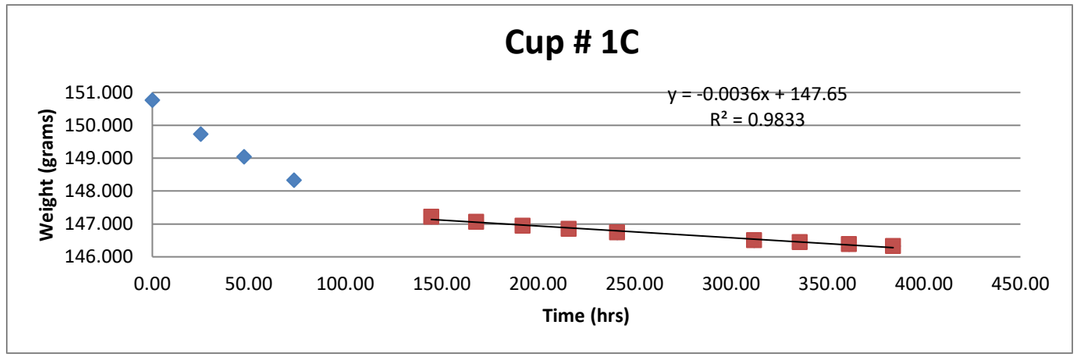


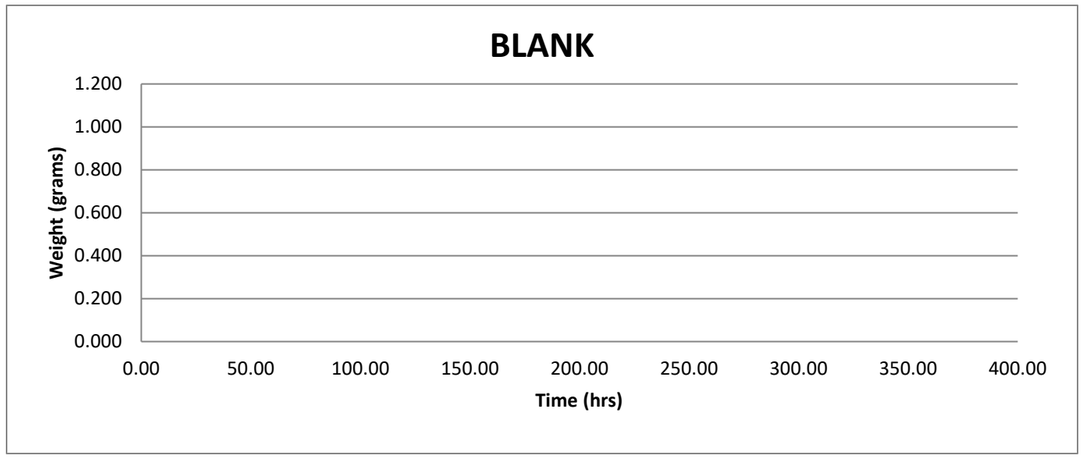


RESULTS

METRIC AVERAGES:	
WVT(g/h-m^2)	0.6
WVT(g/day-m^2)	15
WVP (g/hr-m^2-mm Hg)	5.9E-02
WVP (metric perm)	1.4
WVP (g/Pa-s-m^2)	1.2E-07
Permeability (g-cm/hr-m^2-mm Hg)	6.3E-04
Permeability (g-cm/day-m^2-mm Hg)	1.5E-02
Permeability (g/Pa-s-m)	1.3E-11

ENGLISH AVERAGES:	
WVT(grains/h-ft^2)	0.9
WVP (perm)	2.2
Permeability (perm inch)	9.1E-03
Permeability (perm mil)	9





Analyst CMS date 1/20/2017

QC Review by RL date 2/24/2017

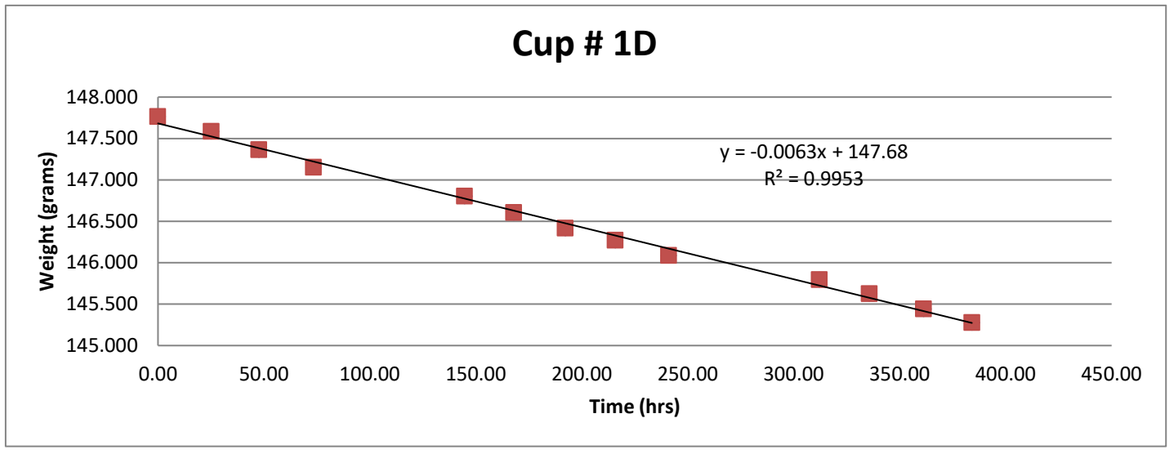
360846 Biocare											
ASTM D1653, Test Method B (Wet Cup Method), Condition A-50% Relative Humidity and 73°F											
KTA-1 Second Set of Replicates											
Date	**Hours**	**Cup 1D (g)**	**Cup 1D (grain)**	**Cup 1E (g)**	**Cup 1E (grain)**	**Cup 1F (g)**	**Cup 1F (grain)**	**BLANK (g)**	**BLANK (grain)**	**Temperature (°F)**	**%Relative Humidity**
1/3/17 4:00 PM	0.00	147.763	2279.98	151.710	2340.89	149.202	2302.19			74.300	50.400
1/4/17 5:05 PM	25.08	147.583	2277.21	151.500	2337.65	148.584	2292.65			74.300	51.000
1/5/17 3:37 PM	47.62	147.362	2273.80	151.274	2334.16	148.383	2289.55			75.000	51.000
1/6/17 5:30 PM	73.50	147.154	2270.59	151.065	2330.93	148.197	2286.68			73.700	52.700
1/9/17 4:36 PM	144.60	146.802	2265.15	150.721	2325.63	147.870	2281.63			75.000	50.800
1/10/17 3:52 PM	167.87	146.607	2262.15	150.529	2322.66	147.701	2279.03			75.000	52.300
1/11/17 4:07 PM	192.12	146.415	2259.18	150.354	2319.96	147.512	2276.11			75.000	50.200
1/12/17 3:50 PM	215.83	146.270	2256.95	150.173	2317.17	147.388	2274.20			71.700	55.700
1/13/17 5:00 PM	241.00	146.088	2254.14	149.989	2314.33	147.205	2271.37			74.300	50.400
1/16/17 4:04 PM	312.07	145.795	2249.62	149.685	2309.64	146.957	2267.55			74.800	51.200
1/17/17 3:42 PM	335.70	145.627	2247.02	149.505	2306.86	146.907	2266.78			74.100	51.700
1/18/17 5:11 PM	361.18	145.442	2244.170	149.319	2303.99	146.853	2265.94			73.700	54.000
1/19/17 4:03 PM	384.05	145.275	2241.593	149.153	2301.43	146.802	2265.15			74.600	49.200

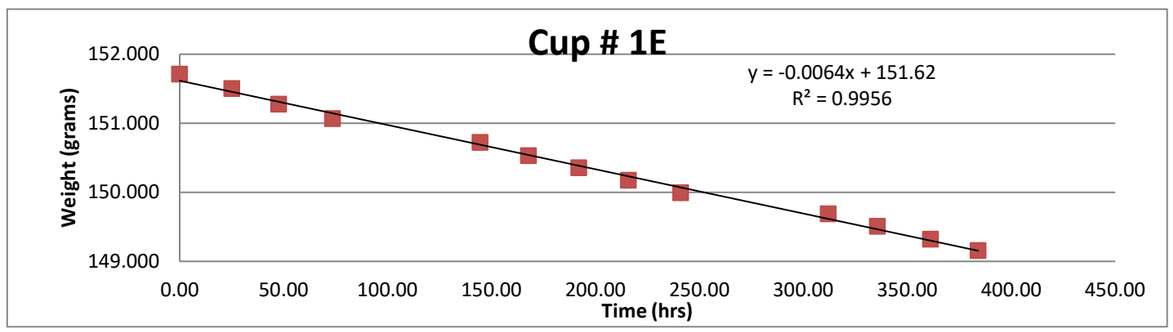
Method of coating application and curing procedure used	Prepared by client
Type of film support used	N/A
Design of cup	glass dish
Type or composition of sealant	wax blend (40% paraffin/60% microcrystalline wax)

Dish	1D	1E	1F	BLANK
Material Thickness (in)	0.0031	0.0041	0.0046	
Radius (in)	2.00	2.00	2.00	2.00

CALCULATIONS	
Temperature (°F)	74.3
Relative humidity in test chamber	51.6 %
Relative humidity in dish	100 %
Humidity change (as a decimal)	0.48
Vapor Pressure	21.497 mm Hg
	0.846 in Hg

	1D	1E	1F	BLANK
Radius (m)	0.0508	0.0508	0.0508	0.0508
Area (m^2)	0.00811	0.00811	0.00811	0.00811
Slope (grams/hr)	6.27E-03	6.41E-03	5.01E-03	#DIV/0!
Area (ft^2)	0.0873	0.0873	0.0873	0.0873
Slope (grains/hr)	0.09679	0.09894	7.72E-02	#DIV/0!
WVT(g/h-m^2)	0.774	0.791	0.617	#DIV/0!
WVT(g/day-m^2)	18.57	18.98	14.82	#DIV/0!
WVP (g/hr-m^2-mm Hg)	7.4E-02	7.6E-02	5.9E-02	#DIV/0!
WVP (metric perm)	1.784	1.824	1.424	#DIV/0!
WVP (g/Pa-s-m^2)	1.5E-07	1.6E-07	1.2E-07	#DIV/0!
Permeability (g-cm/hr-m^2-mm Hg)	5.9E-04	8.0E-04	7.0E-04	#DIV/0!
Permeability (g-cm/day-m^2-mm Hg)	1.4E-02	1.9E-02	1.7E-02	#DIV/0!
Permeability (g/Pa-s-m)	1.2E-11	1.7E-11	1.5E-11	#DIV/0!
WVT(grains/h-ft^2)	1.109	1.134	0.885	#DIV/0!
WVP (perm)	2.707	2.767	2.160	#DIV/0!
Permeability (perm inch)	8.5E-03	1.1E-02	1.0E-02	#DIV/0!
Permeability (perm mil)	8.46	11.41	9.99	#DIV/0!

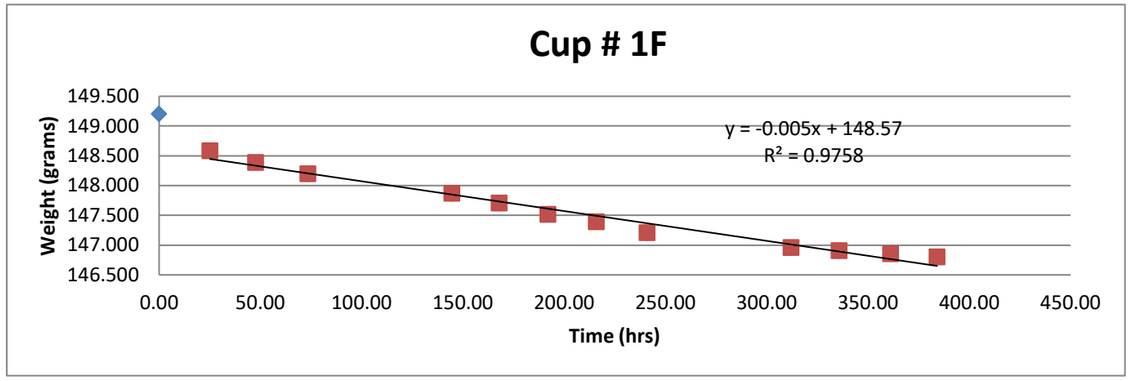


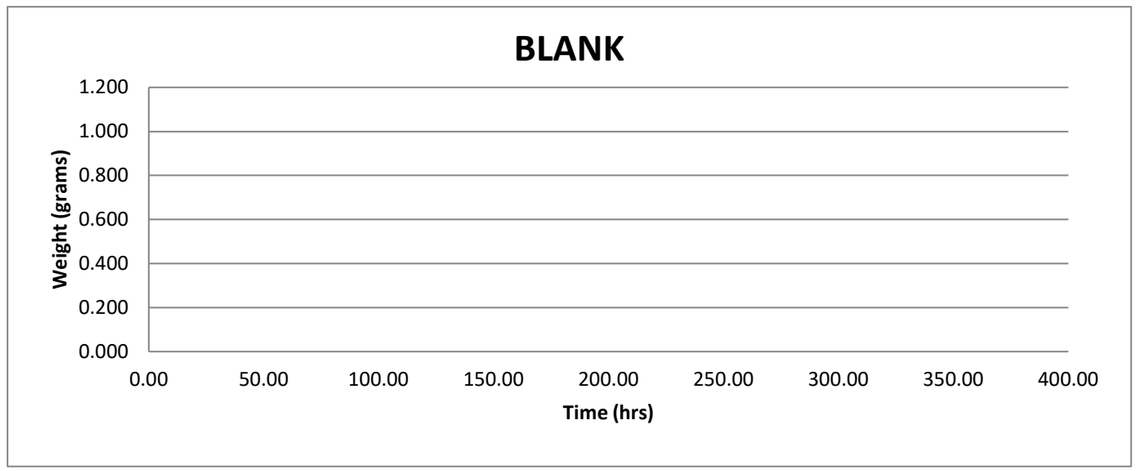


RESULTS

METRIC AVERAGES:	
WVT(g/h-m^2)	0.7
WVT(g/day-m^2)	17
WVP (g/hr-m^2-mm Hg)	7.0E-02
WVP (metric perm)	1.7
WVP (g/Pa-s-m^2)	1.5E-07
Permeability (g-cm/hr-m^2-mm Hg)	6.9E-04
Permeability (g-cm/day-m^2-mm Hg)	1.7E-02
Permeability (g/Pa-s-m)	1.4E-11

ENGLISH AVERAGES:	
WVT(grains/h-ft^2)	1.0
WVP (perm)	2.5
Permeability (perm inch)	1.0E-02
Permeability (perm mil)	10





Analyst CMS date 1/20/2017

QC Review by RBL date 2/24/2017