ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

gDiapers
P.O. Box 10106
Portland, OR 97296
Attn: John Talbott

Analysis of material by aerobic biodegradation using ASTM Method D5338

Sample #:	CP8100832
Date Received:	October 24, 2009
Identification:	gDiapers Flushable Refills
Pad	fluffed wood pulp /w super absorbing polymers (SAP)
Cover	Viscose Rayon - a Lenzing Fiber

Sample Pretreatment: Cut into 1" squares. Pad and cover both tested together.

Analysis Start Date: On 12/18/08 analysis was started using approved protocol and ran for a total 67 days.

Method: The apparatus used in the analytical procedure is described in ASTM method D5338. The reactors have a capacity of 5 liters and are incubated at 58 deg. +/- 2 deg. C. typical of active compost. The inoculum used in the test was otained from Monterey Reginal Composting Facility and was derived from greenwaste composted for 80 days.

Analysis of inoculum:

Respiration Rate:	55	CO_2 per gram VS in the first ten days
pH value:	7.2	units
Moisture:	31.2	percent wet basis
Volatile Solids:	49.3	dry weight basis
Total Nitrogen (N)	1.65	percent dry wt.

To 12 reactors was added 775 grams of inoculum (screned through 9.6 mm screen) and 8 grams of ammonia chloride. To three reactors was added 100 grams powered cellulose and 175 mls water. These three reactors acted as the positive controls. To three reactors was added 100 grams of polyethylene and 125 mls water. These three reactors act as negative control. To three reactors was added 100 grams of sample plus 125 mls water. These three reactors were used to test the carbon dioxide production of the sample. The remaining three reactors was added 125 mls of water and acted as the baseline for the carbon dioxide production from the inoculum.

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

The reactors were placed in a controlled temperature incubator set at 58 deg. C for 12 weeks. Each reactor was connected to a supply of carbon dioxide free air. The flow rate was adjusted so that each reactor received a flow rate of 200 milliliters per minute. The exhaust from each reactor was connected to two individual carbon dioxide trapping units containning 20 to 40 mls of

1N NaOH. By use of solenoid valves the exhaust gases from the reactors were allowed to enter the trapping units for two minutes every two hours. The second trapping unit was connected just in case an unexpected high level of carbon dioxide was produced in the reactors.

Starting with day 3 and then day 7 followed weekly until the conclusion the trapping solutions were titrated using 0.5N HCl after adding barium chloride to precipitate the sodium carbonate produced by the carbon dioxide. The titration end point was established using phenol phthalein as indicator.

Using the titration data the total carbon dioxide produced in each reactor was calculated for each time period.

The reactors were examined on a weekly basis to establish that satisfactory composting conditions were maintained. During this examination any changes in the appearance of the contents of the reactors were noted. Also at this time the reactors were shaken to remix the contents.

Quality Control:

All the quality control criteria was met as indicated below.

1 The carbon dioxide production of the inoculum was between 50 and 150 mg per gram of volatile solids in the first 10 days. Actual value = 55 mg.
2 The pH at the end of the test was greater than seven. Actual value = 7.2
3 The biodegradation of the positive control was 70% in the first 45 days with a standard deviation of 6.2. These values should be greater than 70% and less than 20 percent respectively.
4 The temperature range of the incubator was maintained at 58 deg. C +/- 2 deg C.

Results:

1 The degree of biodegradation determined to be 117% after 67days.
2 The degree of disintigation in 12 weeks was visibly greater than 90%.
3 The concentrations of heavy metals was less than the published limits.
4 The phytotoxicity test showed no toxicity.

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Visual Observations:

The reactors containing the test material showed signs of decomposition at day 20. as the appearance became opaque and somewhat brittle. After day 56 the material started to disintegrate into smaller pieces. During the test all the reactors had satisfactory appearences, odor and moisture content.

Docmentation:

1: Amount of carbon converted from cellulose = 70 percent.
Amount of carbon converted from test material = 82 percent.

Hence amount of carbon converted from test material using cellulose as positive control = 117 percent.

The standard deviation and 95% confidence inteval for cellulose was 6.15 and 6.96 percent respectively.
The standard deviation and 95% confidence inteval for test material was 5.20 and 5.88 percent respectively.

2: Visable observation of test material retained by 2mm sieve showed greater than 90 percent disintegration.

Heavy Metal Concentration in Sample

Contituent		Sample mg/kg dry wt.	U.S. Limits	Canadian Limits
Arsenic	As	< 1	22	38
Cadmium	Cd	< 1	20	10
Copper	Cu	< 1	750	NA
Lead	Pb	< 1	150	250
Mercury	Hg	< 1	9	3
Nickel	Ni	< 1	210	90
Selenium	Se	< 1	50	7
Zinc	Zn	4.3	1400	925
Cobalt	Co	< 1	NA	75
Chromium	Cr	< 1	NA	NA
Molybdenum	Mo	< 1	NA	10
Fluorine	F	< 1	100	100

The above analysis for heavy metals was performed in house by the Soil Control Lab using the following methods:
EPA Method 207 (ICP) for Cd, Cu, Pb, Ni, Zn, Co, Cr and Mo
EPA Method 208 (ICPMS) for As, Se
EPA Method 245.7 (cold vapor) Hg
EPA Method 300.1 (IC) for F

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

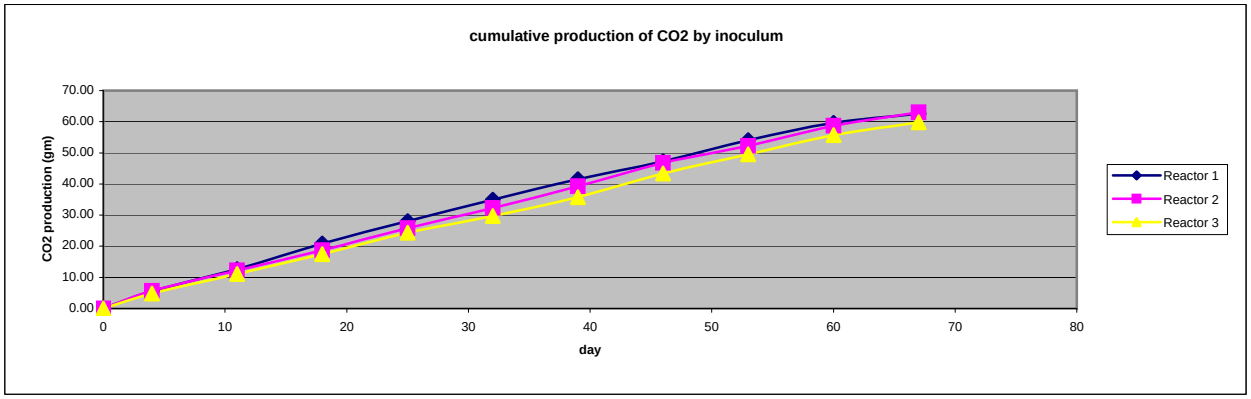
42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Carbon dioxide production from inoculum

Measured production (gm)				Cumulative production (gm)			
Day	Reactor 1	Reactor 2	Reactor 3	Day	Reactor 1	Reactor 2	Reactor 3
0	0.00	0.00	0.00	0	0.00	0.00	0.00
4	5.60	5.63	4.82	4	5.60	5.63	4.82
11	7.00	6.57	6.32	11	12.60	12.20	11.14
18	8.25	6.54	6.38	18	20.85	18.73	17.52
25	7.19	7.05	6.81	25	28.04	25.78	24.34
32	6.88	6.51	5.35	32	34.92	32.29	29.68
39	6.64	7.03	6.09	39	41.56	39.32	35.78
46	5.74	7.47	7.62	46	47.30	46.78	43.40
53	6.72	5.41	6.20	53	54.03	52.19	49.59
60	5.57	6.49	6.09	60	59.60	58.68	55.69
67	3.00	4.36	4.10	67	62.60	63.04	59.78
% Standard deviation (45 days)			4.63	% Standard deviation (45 days)			2.12
% Standard deviation (67 days)			2.86	% Standard deviation (67 days)			1.77



ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

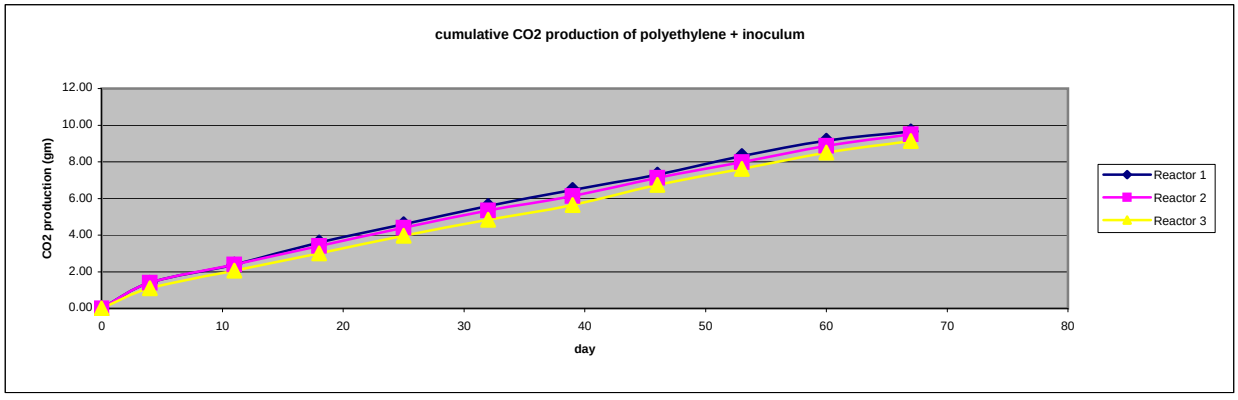
TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Carbon dioxide production of inoculum + polyethylene

Measured production (gm)				Cumulative production (gm)			
Day	Reactor 1	Reactor 2	Reactor 3	Day	Reactor 1	Reactor 2	Reactor 3
0	0.00	0.00	0.00	0	0.00	0.00	0.00
4	1.40	1.40	1.10	4	1.40	1.40	1.10
11	1.00	1.00	0.96	11	2.40	2.40	2.06
18	1.20	1.00	0.95	18	3.60	3.40	3.01
25	1.00	1.00	0.96	25	4.60	4.40	3.97
32	0.99	0.95	0.86	32	5.59	5.35	4.83
39	0.87	0.78	0.81	39	6.46	6.13	5.64
46	0.85	1.00	1.10	46	7.31	7.13	6.74
53	1.00	0.85	0.88	53	8.31	7.98	7.62
60	0.85	0.90	0.89	60	9.16	8.88	8.51
67	0.50	0.63	0.62	67	9.66	9.51	9.13

% Standard deviation (45 day)	4.14	% Standard error (45 day)	0.17
Standard deviation (45 day)	0.29	95% confidence limits (45 day)	0.33



ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

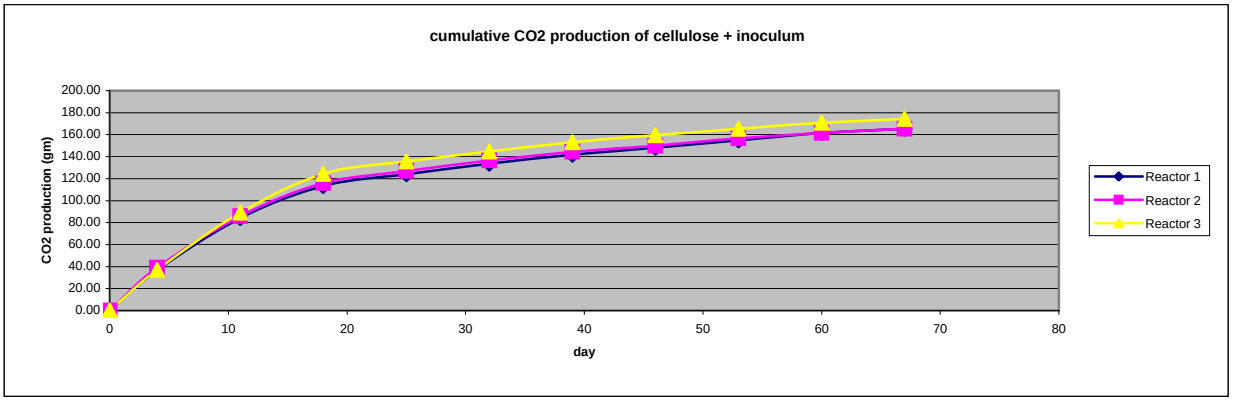
TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Carbon dioxide production of inoculum + cellulose

Measured production (gm)				Cumulative production (gm)			
Day	Reactor 1	Reactor 2	Reactor 3	Day	Reactor 1	Reactor 2	Reactor 3
0	0.00	0.00	0.00	0	0.00	0.00	0.00
4	36.57	39.05	36.97	4	36.57	39.05	36.97
11	47.69	46.76	52.16	11	84.25	85.81	89.13
18	28.93	30.18	35.31	18	113.18	116.00	124.44
25	10.70	11.03	11.09	25	123.88	127.03	135.53
32	9.76	9.56	9.13	32	133.64	136.59	144.66
39	8.27	7.72	8.46	39	141.91	144.31	153.12
46	6.19	5.71	6.46	46	148.11	150.02	159.58
53	6.86	6.53	5.77	53	154.96	156.54	165.35
60	6.51	4.97	5.42	60	161.47	161.51	170.77
67	3.95	3.85	3.65	67	165.42	165.37	174.42

% Standard deviation (45 day)	4.03	% Standard error (45 day)	3.55
Standard deviation (45 day)	6.15	95% confidence limits (45 day)	6.96



ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

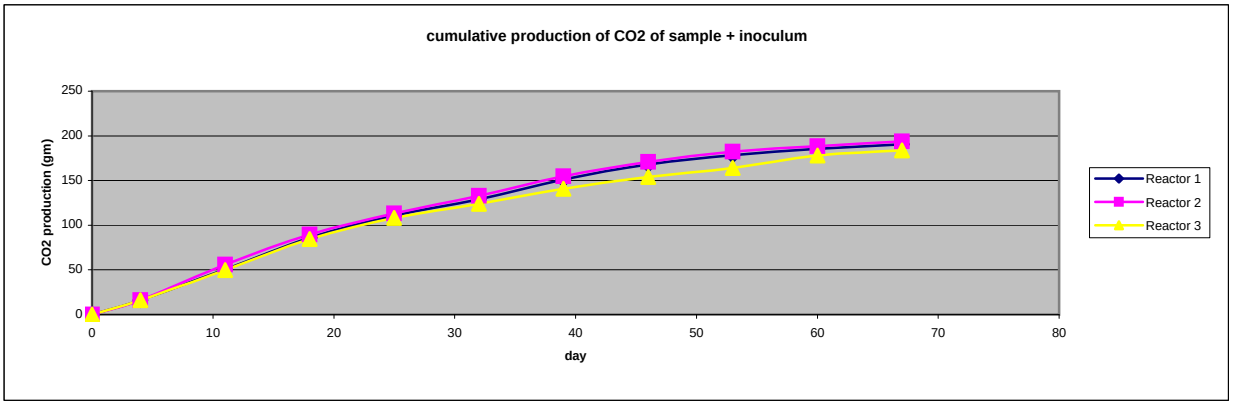
TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Carbon dioxide production of inoculum + test material

Measured production (gm)				Cumulative production (gm)			
Day	Reactor 1	Reactor 2	Reactor 3	Day	Reactor 1	Reactor 2	Reactor 3
0	0.00	0.00	0.00	0	0	0	0
4	16.06	15.95	16.25	4	16	16	16
11	34.27	40.02	33.59	11	50	56	50
18	35.70	33.58	34.83	18	86	90	85
25	24.52	23.72	23.66	25	111	113	108
32	18.49	19.59	15.52	32	129	133	124
39	22.11	21.91	16.95	39	151	155	141
46	16.94	15.93	13.14	46	168	171	154
53	10.37	11.60	10.10	53	178	182	164
60	6.91	6.25	13.83	60	185	189	178
67	5.04	5.25	5.76	67	190	194	184

% Standard deviation	2.74	% Standard error (45 day)	3.00
Standard deviation	5.20	95% confidence limits (45 day)	5.88



ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

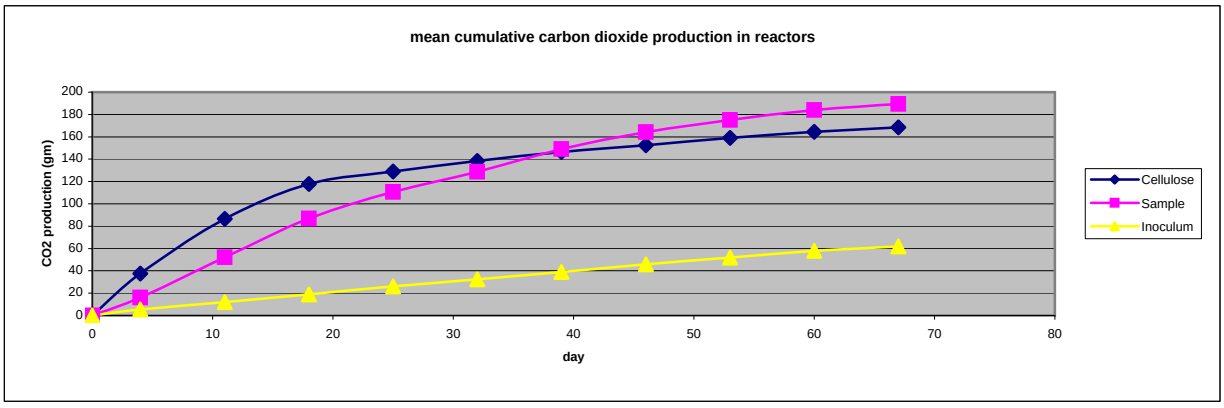
TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Mean cumulative carbon dioxide production in reactors

Carbon dioxide production (grams)

Day	Cellulose	Sample	Inoculum
0	0	0	0
4	38	16	5
11	86	52	12
18	118	87	19
25	129	111	26
32	138	129	32
39	146	149	39
46	153	164	46
53	159	175	52
60	165	184	58
67	168	189	62



ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

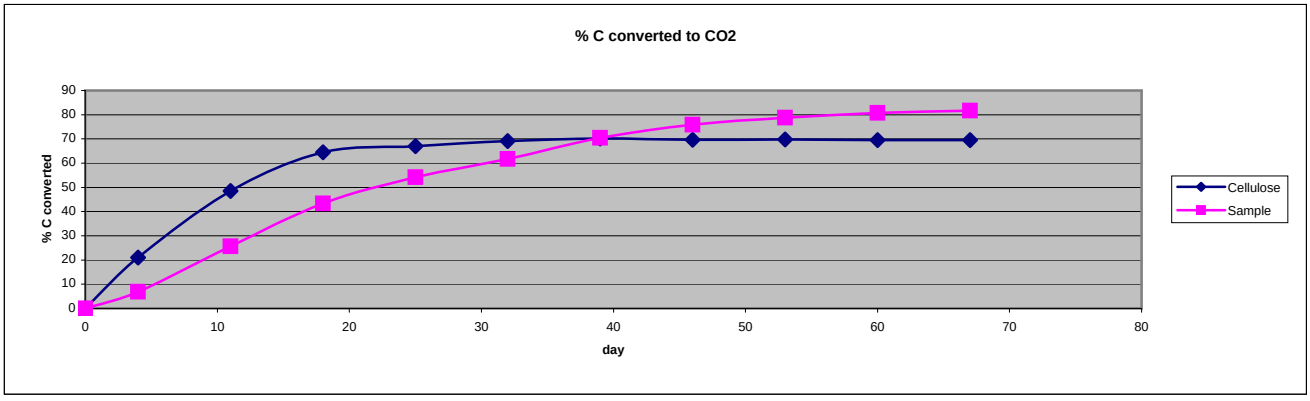
TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Cumulative added carbon converted to CO2 in reactors (mean of three)

Cellulose	Sample	
41.80	42.57	gm C/100gm

			Percent Converted	
gm	gm	Day	Cellulose	Sample
0.00	0.00	0	0	0
8.78	2.93	4	21	7
20.30	10.93	11	49	26
26.96	18.47	18	64	43
28.03	23.09	25	67	54
28.91	26.26	32	69	62
29.34	30.01	39	70	70
29.11	32.30	46	70	76
29.19	33.55	53	70	79
29.07	34.35	60	70	81
29.07	34.76	67	70	82



ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

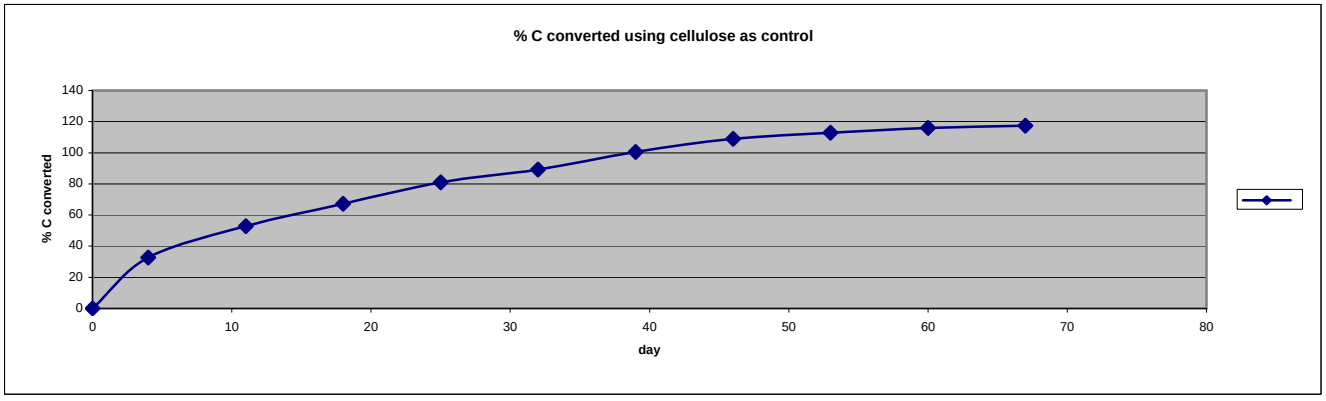
42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Amount of Carbon converted to Carbon Dioxide
(as compared to cellulose as positive control)

Day	% converted
0	0
4	33
11	53
18	67
25	81
32	89
39	100
46	109
53	113
60	116
67	117



ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

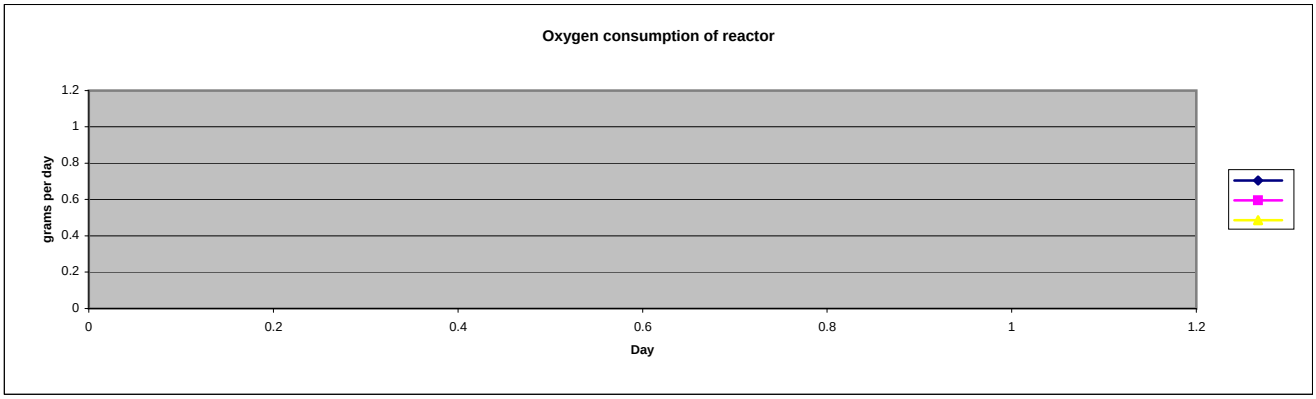
42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Mean oxygen consumption in reactors

	Oxygen consumption (grams per day)		
Day	Cellulose	Sample	Inoculum
0	0.00	0.00	0.00
4	6.82	2.93	0.97
11	6.85	3.79	0.78
18	4.57	2.98	0.66
25	5.25	3.54	0.76
32	4.40	2.60	0.72
39	2.62	2.69	0.87
46	2.65	3.38	0.72
53	2.12	2.30	0.68
60	2.09	2.43	0.69
67	1.75	1.97	0.58



ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Work Order #: 8100832-1
Batch: ASTMD6400
CODE: Bio-plastic

Plant Growth Study

	Cucumber			
	Germination		Heigth	
Init.Dilution.(sample:vermiculite v/v)	25:75		25:75	
# Seeds per pot	20		20	
# of replicates	3		3	
Average	97	% germ	106	mm
% STDEV (Less than 20)	5.8		4.04	
% of Control (Greater than 80)	115		89	
Pass/Fail	Pass		Pass	

	Rye Grass			
	Germination		Heigth	
Init. Dilution.(sample:vermiculite)	25:75		25:75	
# Seeds per pot	20		20	
# of replicates	3		3	
Average	95	% germ	48	mm
% STDEV (Less than 20)	5.0		10.4	
% of Control (Greater than 80)	87		87	
Pass/Fail	Pass		Pass	