ASTM D5511-12 - Anaerobic High Solids Biodegradability - 1101170125H

To: BiologiQ, Inc.

Report Number: 1101170125H

Date: November 1, 2017

From: Thomas Poth - Eden Research Laboratory

Regarding: 614 day study of BiologiQ Sample - ERL #1344

Eden Research Laboratory

Report

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RESULTS

Thermophilic study for biodegradation, during a 18+ month period, of BiologiQ sample resulted in 98.7% biodegradation.

METHOD

The degree and rate of anaerobic biodegradability of a plastic type material may be predictive of the period required to reduce the proposed plastic from the environment depending on the given conditions. Where disposal is considered a major issue, this method may be useful to estimate the degree and persistence of biodegradable plastic in a biologically active anaerobic disposal situation. As stated in ASTM D5511, this method may also resemble some conditions in biologically active landfills where the gas generated is recovered and biogas production is actively promoted by inoculation (for example, codeposition of anaerobic sewage sludge, anaerobic leachate recirculation), moisture control (for example, leachate recircu- lation), and temperature control (for example, short-term injection of oxygen, heating of recirculated leachate)

ASTM method D5511-12 determines the degree of anaerobic biodegradation of plastic materials in a high-solids anaerobic conditions. The sample is exposed to methanogenic inoculum cultivated from a wastewater treatment facility's anaerobic digesters and post consumer pretreated household waste. Anaerobic decomposition in this case employs a high solids environment. High solids conditions are usually considered to be greater than 20% solids. The sample conditions remain static.

This method is designed to yield a percentage of conversion of carbon in the sample to carbon in the gaseous form under conditions found in high-solids anaerobic digesters, treating municipal solid waste. This can be validated using change in mass of the original sample. This method is also designed to resemble many conditions in a biologically active landfill. This method is applicable to all plastic materials that are not toxic to microorganisms present in wastewater treatment facility's anaerobic digesters that are operating on household waste.

ASTM Method D5511 determines the rate and degree of anaerobic biodegradation by measuring the volume of carbon dioxide (CO_2) and methane (CH_4), or change in mass as a function of time (days) of exposure to anaerobic-digester sludge. This method is considered an accelerated representation with respect to anaerobic environments. Landfill sites that plastics encounter in usual disposal methods are a prime example of this environment.

INOCULUM

1. Inoculum Characteristics and Preparation
    1. Sludge from Organic Compost – Bernalillo Municipal Compost Facility & Albuquerque Municipal Wastewater Facility
        1. Fifteen day hold period observed @ 53 ± 2°C
        2. Solid Content - 46.8% - The method allows anything greater than 20%.
        3. pH - 7.7 - 7.9
        4. Volatile Fatty Acids - 1.2 g/kg
        5. Ammonium Nitrogen 1.3 mg/kg

THEORETICAL CARBON

Sample	Percent Resin	Percent Carbon	Percent Additive	Percent Carbon	Total
1344	56.0	85.7	44.0	46.8	68.6

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WEEKLY GAS VOLUMES (mL) @ STP
CONTROL SET

Week Begin	IA	IB	IC	NA	NB	NC	PA	PB	PC
25-Feb-16	513.6	1434.5	1503.9	1554.8	1082.8	333.2	4599.5	4645.8	4220.1
03-Mar-16	536.8	92.5	162.0	152.7	212.9	203.6	1994.4	4090.5	2993.9
10-Mar-16	337.8	-9.3	46.3	4.6	50.9	208.2	971.7	842.2	1295.6
17-Mar-16	-32.4	-18.5	-23.1	46.3	50.9	203.6	509.0	421.1	578.4
24-Mar-16	-13.9	-13.9	23.1	69.4	37.0	194.3	351.7	916.2	370.2
31-Mar-16	4.6	18.5	23.1	4.6	27.8	189.7	64.8	148.1	74.0
07-Apr-16	-9.3	-4.6	46.3	64.8	32.4	203.6	277.6	666.3	277.6
14-Apr-16	4.6	-41.6	23.1	46.3	41.6	185.1	212.9	-930.1	212.9
21-Apr-16	4.6	-13.9	4.6	78.7	37.0	194.3	157.3	439.6	171.2
28-Apr-16	-0.0	13.9	41.6	13.9	27.8	162.0	212.9	245.2	162.0
05-May-16	-9.3	32.4	532.1	50.9	41.6	199.0	328.5	189.7	166.6
12-May-16	111.1	-4.6	379.4	69.4	27.8	189.7	175.8	83.3	27.8
19-May-16	60.2	74.0	314.7	69.4	18.5	171.2	277.6	55.5	134.2
26-May-16	-4.6	-32.4	208.2	-4.6	13.9	180.5	162.0	55.5	-0.0
02-Jun-16	-13.9	87.9	157.3	115.7	37.0	208.2	-573.8	46.3	55.5
09-Jun-16	-9.3	171.2	148.1	27.8	27.8	199.0	795.9	64.8	74.0
16-Jun-16	393.3	87.9	134.2	50.9	41.6	180.5	-18.5	92.5	41.6
23-Jun-16	888.4	467.4	74.0	50.9	37.0	212.9	60.2	610.8	92.5
30-Jun-16	199.0	-74.0	69.4	83.3	18.5	-23.1	157.3	-50.9	60.2
07-Jul-16	236.0	124.9	60.2	64.8	37.0	124.9	124.9	74.0	41.6
14-Jul-16	41.6	-23.1	46.3	69.4	37.0	-4.6	0.0	69.4	83.3
21-Jul-16	97.2	23.1	60.2	60.2	32.4	111.1	13.9	370.2	83.3
28-Jul-16	157.3	37.0	92.5	60.2	37.0	273.0	-0.0	319.3	64.8
04-Aug-16	115.7	27.8	60.2	41.6	37.0	1577.9	-0.0	111.1	69.4
11-Aug-16	148.1	27.8	50.9	64.8	23.1	64.8	-46.3	69.4	78.7
18-Aug-16	60.2	32.4	101.8	60.2	46.3	69.4	-46.3	27.8	74.0
25-Aug-16	69.4	46.3	55.5	97.2	41.6	50.9	-23.1	18.5	69.4
01-Sep-16	64.8	32.4	27.8	46.3	46.3	46.3	-23.1	-0.0	60.2
08-Sep-16	60.2	18.5	92.5	69.4	162.0	-254.5	64.8	27.8	97.2
15-Sep-16	64.8	32.4	64.8	37.0	23.1	23.1	32.4	27.8	50.9
22-Sep-16	83.3	41.6	32.4	74.0	23.1	41.6	-9.3	-18.5	69.4
29-Sep-16	64.8	32.4	83.3	60.2	46.3	32.4	60.2	55.5	69.4
06-Oct-16	37.0	32.4	64.8	55.5	18.5	18.5	37.0	32.4	74.0
13-Oct-16	74.0	46.3	55.5	74.0	13.9	23.1	69.4	37.0	87.9
20-Oct-16	46.3	27.8	27.8	74.0	13.9	13.9	23.1	-18.5	64.8
27-Oct-16	78.7	46.3	87.9	60.2	23.1	23.1	37.0	41.6	69.4
03-Nov-16	87.9	32.4	55.5	60.2	0.0	9.3	13.9	-46.3	46.3
10-Nov-16	60.2	23.1	60.2	64.8	4.6	23.1	41.6	0.0	78.7
17-Nov-16	41.6	37.0	78.7	64.8	23.1	0.0	46.3	50.9	41.6
24-Nov-16	60.2	27.8	69.4	78.7	27.8	18.5	60.2	37.0	69.4
01-Dec-16	92.5	23.1	55.5	60.2	23.1	50.9	92.5	92.5	78.7
08-Dec-16	83.3	23.1	46.3	50.9	4.6	9.3	0.0	9.3	23.1
15-Dec-16	69.4	27.8	83.3	64.8	18.5	-4.6	23.1	23.1	18.5
22-Dec-16	69.4	32.4	55.5	46.3	18.5	23.1	226.7	32.4	50.9
29-Dec-16	55.5	13.9	55.5	27.8	-4.6	4.6	106.4	-4.6	194.3
10-Jan-17	4.6	4.6	9.3	0.0	0.0	0.0	0.0	0.0	0.0
17-Jan-17	0.0	4.6	0.0	37.0	4.6	9.3	46.3	0.0	55.5

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Week Begin	IA	IB	IC	NA	NB	NC	PA	PB	PC
24-Jan-17	13.9	9.3	9.3	18.5	4.6	4.6	23.1	0.0	27.8
31-Jan-17	13.9	4.6	4.6	18.5	0.0	0.0	18.5	0.0	27.8
07-Feb-17	0.0	4.6	9.3	64.8	9.3	4.6	18.5	0.0	23.1
14-Feb-17	13.9	0.0	9.3	46.3	-9.3	-9.3	9.3	-13.9	13.9
21-Feb-17	4.6	4.6	0.0	64.8	4.6	13.9	18.5	4.6	13.9
28-Feb-17	9.3	0.0	4.6	41.6	0.0	0.0	9.3	41.6	18.5
07-Mar-17	0.0	9.3	9.3	74.0	9.3	0.0	27.8	0.0	32.4
14-Mar-17	18.5	4.6	4.6	37.0	4.6	0.0	13.9	0.0	13.9
21-Mar-17	4.6	9.3	0.0	37.0	0.0	0.0	13.9	0.0	13.9
28-Mar-17	9.3	9.3	0.0	27.8	-13.9	0.0	0.0	0.0	4.6
04-Apr-17	13.9	9.3	13.9	46.3	9.3	0.0	23.1	-4.6	18.5
11-Apr-17	4.6	9.3	18.5	37.0	0.0	0.0	4.6	4.6	13.9
25-Apr-17	4.6	4.6	4.6	27.8	-9.3	0.0	13.9	-18.5	13.9
09-May-17	9.3	9.3	9.3	46.3	0.0	0.0	13.9	0.0	13.9
23-May-17	4.6	9.3	4.6	23.1	0.0	0.0	9.3	0.0	4.6
06-Jun-17	18.5	9.3	0.0	23.1	-4.6	0.0	4.6	-4.6	4.6
20-Jun-17	4.6	4.6	13.9	50.9	4.6	0.0	23.1	9.3	23.1
04-Jul-17	9.3	9.3	9.3	18.5	4.6	23.1	0.0	-4.6	23.1
18-Jul-17	4.6	9.3	13.9	27.8	-9.3	0.0	4.6	0.0	0.0
01-Aug-17	4.6	4.6	4.6	13.9	0.0	0.0	18.5	-4.6	9.3
15-Aug-17	13.9	9.3	9.3	50.9	-9.3	0.0	13.9	0.0	27.8
29-Aug-17	13.9	4.6	9.3	23.1	-4.6	0.0	9.3	0.0	13.9
12-Sep-17	9.3	4.6	4.6	23.1	-4.6	0.0	4.6	0.0	13.9
26-Sep-17	13.9	4.6	4.6	50.9	18.5	0.0	41.6	0.0	27.8
10-Oct-17	9.3	9.3	9.3	37.0	0.0	0.0	18.5	4.6	23.1
24-Oct-17	4.6	4.6	4.6	13.9	0.0	0.0	4.6	-4.6	23.1

SAMPLE SET

Week Begin	1344A	1344B	1344C
25-Feb-16	513.6	1434.5	1503.9
03-Mar-16	536.8	92.5	162.0
10-Mar-16	337.8	-9.3	46.3
17-Mar-16	-32.4	-18.5	-23.1
24-Mar-16	-13.9	-13.9	23.1
31-Mar-16	4.6	18.5	23.1
07-Apr-16	-9.3	-4.6	46.3
14-Apr-16	4.6	-41.6	23.1
21-Apr-16	4.6	-13.9	4.6
28-Apr-16	-0.0	13.9	41.6
05-May-16	-9.3	32.4	532.1
12-May-16	111.1	-4.6	379.4
19-May-16	60.2	74.0	314.7
26-May-16	-4.6	-32.4	208.2
02-Jun-16	-13.9	87.9	157.3
09-Jun-16	-9.3	171.2	148.1
16-Jun-16	393.3	87.9	134.2
23-Jun-16	888.4	467.4	74.0
30-Jun-16	199.0	-74.0	69.4
07-Jul-16	236.0	124.9	60.2

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Week Begin	1344A	1344B	1344C
14-Jul-16	41.6	-23.1	46.3
21-Jul-16	97.2	23.1	60.2
28-Jul-16	157.3	37.0	92.5
04-Aug-16	115.7	27.8	60.2
11-Aug-16	148.1	27.8	50.9
18-Aug-16	60.2	32.4	101.8
25-Aug-16	69.4	46.3	55.5
01-Sep-16	64.8	32.4	27.8
08-Sep-16	60.2	18.5	92.5
15-Sep-16	64.8	32.4	64.8
22-Sep-16	83.3	41.6	32.4
29-Sep-16	64.8	32.4	83.3
06-Oct-16	37.0	32.4	64.8
13-Oct-16	74.0	46.3	55.5
20-Oct-16	46.3	27.8	27.8
27-Oct-16	78.7	46.3	87.9
03-Nov-16	87.9	32.4	55.5
10-Nov-16	60.2	23.1	60.2
17-Nov-16	41.6	37.0	78.7
24-Nov-16	60.2	27.8	69.4
01-Dec-16	92.5	23.1	55.5
08-Dec-16	83.3	23.1	46.3
15-Dec-16	69.4	27.8	83.3
22-Dec-16	69.4	32.4	55.5
29-Dec-16	55.5	13.9	55.5
10-Jan-17	4.6	4.6	9.3
17-Jan-17	0.0	4.6	0.0
24-Jan-17	13.9	9.3	9.3
31-Jan-17	13.9	4.6	4.6
07-Feb-17	0.0	4.6	9.3
14-Feb-17	13.9	0.0	9.3
21-Feb-17	4.6	4.6	0.0
28-Feb-17	9.3	0.0	4.6
07-Mar-17	0.0	9.3	9.3
14-Mar-17	18.5	4.6	4.6
21-Mar-17	4.6	9.3	0.0
28-Mar-17	9.3	9.3	0.0
04-Apr-17	13.9	9.3	13.9
11-Apr-17	4.6	9.3	18.5
25-Apr-17	4.6	4.6	4.6
09-May-17	9.3	9.3	9.3
23-May-17	4.6	9.3	4.6
06-Jun-17	18.5	9.3	0.0
20-Jun-17	4.6	4.6	13.9
04-Jul-17	9.3	9.3	9.3
18-Jul-17	4.6	9.3	13.9
01-Aug-17	4.6	4.6	4.6
15-Aug-17	13.9	9.3	9.3
29-Aug-17	13.9	4.6	9.3

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Week Begin	1344A	1344B	1344C
12-Sep-17	9.3	4.6	4.6
26-Sep-17	13.9	4.6	4.6
10-Oct-17	9.3	9.3	9.3
24-Oct-17	4.6	4.6	4.6

WEEKLY GAS QUALITY (mL)
METHANE CONTROL SET

Week Begin	IA	IB	IC	NA	NB	NC	PA	PB	PC
25-Feb-16	37.5	120.5	79.7	54.4	41.1	13.7	1642.0	1588.9	1426.4
03-Mar-16	147.1	22.2	53.8	56.5	72.4	72.3	761.8	1607.6	892.2
10-Mar-16	114.2	-3.1	16.9	1.7	17.6	73.9	380.9	355.4	401.7
17-Mar-16	-16.5	-10.4	-13.1	27.4	28.3	121.3	303.4	250.1	323.9
24-Mar-16	-7.0	-7.9	13.2	41.6	20.8	115.6	199.0	547.0	198.4
31-Mar-16	2.4	10.4	13.2	2.8	16.1	114.2	36.5	92.4	40.1
07-Apr-16	-4.6	-2.7	26.8	37.8	18.4	118.7	165.2	407.8	147.1
14-Apr-16	2.5	-24.9	13.1	28.7	23.7	113.1	122.0	-565.5	118.1
21-Apr-16	2.4	-8.3	2.7	46.0	22.0	118.7	87.9	266.4	93.1
28-Apr-16	-0.0	8.0	24.2	8.3	15.7	94.7	123.7	155.7	92.2
05-May-16	-4.7	18.5	307.0	29.5	23.1	117.0	189.6	115.3	91.5
12-May-16	58.5	-2.7	222.0	43.1	16.3	117.4	100.1	52.2	15.6
19-May-16	30.5	42.8	190.1	42.5	10.5	101.9	158.5	34.4	72.6
26-May-16	-2.3	-18.8	122.0	-2.8	8.3	108.6	95.2	34.3	-0.0
02-Jun-16	-6.8	48.5	95.0	71.4	21.0	124.1	-326.5	28.3	30.1
09-Jun-16	-4.7	97.4	88.5	16.9	15.1	123.0	471.2	40.7	40.1
16-Jun-16	199.4	51.5	78.9	29.7	22.8	111.7	-10.5	54.9	22.5
23-Jun-16	475.3	266.4	42.9	32.0	20.9	127.7	35.1	376.3	50.6
30-Jun-16	103.9	-42.2	40.0	51.6	10.6	-13.7	90.5	-30.7	33.0
07-Jul-16	119.9	73.6	34.8	40.0	21.5	76.2	71.6	45.8	22.7
14-Jul-16	20.6	-13.0	26.0	42.3	20.6	-2.8	0.0	42.8	46.6
21-Jul-16	48.6	13.9	34.2	37.0	18.0	68.0	7.8	222.1	47.6
28-Jul-16	80.1	20.5	50.9	36.6	21.3	157.3	-0.0	202.1	36.1
04-Aug-16	62.1	15.5	35.7	25.4	21.0	956.2	-0.0	67.4	38.9
11-Aug-16	76.0	16.4	28.9	38.9	12.7	39.8	-26.4	42.5	44.0
18-Aug-16	31.2	18.3	60.4	36.9	26.0	40.8	-26.7	16.4	40.4
25-Aug-16	35.0	26.3	31.0	59.4	22.8	31.8	-13.3	10.9	38.8
01-Sep-16	33.1	19.4	15.3	28.0	25.7	27.7	-13.4	-0.0	33.0
08-Sep-16	31.3	11.0	55.3	41.7	92.3	-154.0	38.0	16.8	52.8
15-Sep-16	32.7	19.2	35.9	22.7	12.6	13.8	19.0	16.6	28.5
22-Sep-16	42.0	23.7	18.6	43.7	12.7	24.8	-5.2	-11.5	37.0
29-Sep-16	33.1	18.2	47.6	36.9	25.9	19.5	34.8	33.9	37.9
06-Oct-16	19.1	19.5	37.6	32.8	10.1	11.0	20.2	19.7	41.7
13-Oct-16	36.4	26.9	31.2	46.3	7.7	13.8	39.1	22.1	49.0
20-Oct-16	22.5	15.3	16.8	45.5	7.8	8.7	13.1	-11.5	35.3
27-Oct-16	42.3	27.0	50.4	37.7	12.7	14.0	20.8	25.3	36.9
03-Nov-16	44.7	17.9	33.1	36.6	0.0	5.6	7.9	-28.5	26.0
10-Nov-16	30.7	13.7	35.8	40.5	2.5	14.1	24.5	0.0	42.5
17-Nov-16	20.7	21.4	46.3	41.1	13.3	0.0	26.1	31.4	23.4
24-Nov-16	30.8	16.6	40.7	49.6	15.4	11.1	33.3	22.2	38.6
01-Dec-16	45.4	13.3	32.5	36.7	13.3	30.7	52.9	54.7	43.0

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Week Begin	IA	IB	IC	NA	NB	NC	PA	PB	PC
08-Dec-16	41.9	13.1	26.0	31.7	2.6	5.8	0.0	5.5	12.9
15-Dec-16	35.1	16.2	47.8	39.3	10.6	-2.8	13.0	14.3	9.8
22-Dec-16	36.5	19.3	31.9	27.9	10.5	14.3	130.4	20.5	28.7
29-Dec-16	29.0	8.3	32.0	16.3	-2.6	2.9	60.6	-2.9	104.6
10-Jan-17	2.3	2.8	5.4	0.0	0.0	0.0	0.0	0.0	0.0
17-Jan-17	0.0	2.6	0.0	22.8	2.7	5.7	27.4	0.0	30.4
24-Jan-17	7.0	5.3	5.5	11.6	2.7	2.8	13.3	0.0	14.8
31-Jan-17	6.8	2.7	2.8	11.3	0.0	0.0	10.4	0.0	15.0
07-Feb-17	0.0	2.6	5.2	40.4	5.2	2.8	10.6	0.0	12.7
14-Feb-17	6.9	0.0	5.6	28.6	-5.2	-5.5	5.4	-8.5	7.3
21-Feb-17	2.3	2.7	0.0	38.5	2.7	8.3	10.4	2.7	7.4
28-Feb-17	4.7	0.0	2.8	25.3	0.0	0.0	5.4	25.0	9.9
07-Mar-17	0.0	5.4	5.3	44.0	5.2	0.0	15.4	0.0	17.5
14-Mar-17	9.6	2.6	2.7	22.9	2.5	0.0	7.7	0.0	7.7
21-Mar-17	2.4	5.2	0.0	22.9	0.0	0.0	7.7	0.0	7.7
28-Mar-17	4.8	5.2	0.0	17.2	-7.6	0.0	0.0	0.0	2.6
04-Apr-17	7.2	5.2	8.0	28.6	5.1	0.0	12.9	-2.9	10.2
11-Apr-17	2.4	5.2	10.6	22.9	0.0	0.0	2.6	2.9	7.7
25-Apr-17	2.4	2.6	2.7	17.2	-5.1	0.0	7.7	-11.6	7.7
09-May-17	4.8	5.2	5.3	28.6	0.0	0.0	7.7	0.0	7.7
23-May-17	2.4	5.2	2.7	14.3	0.0	0.0	5.1	0.0	2.6
06-Jun-17	9.6	5.2	0.0	14.3	-2.5	0.0	2.6	-2.9	2.6
20-Jun-17	2.4	2.6	8.0	31.5	2.5	0.0	12.9	5.8	12.8
04-Jul-17	4.8	5.2	5.3	11.4	2.5	14.2	0.0	-2.9	12.8
18-Jul-17	2.4	5.2	8.0	17.2	-5.1	0.0	2.6	0.0	0.0
01-Aug-17	2.4	2.6	2.7	8.6	0.0	0.0	10.3	-2.9	5.1
15-Aug-17	7.2	5.2	5.3	31.5	-5.1	0.0	7.7	0.0	15.4
29-Aug-17	7.2	2.6	5.3	14.3	-2.5	0.0	5.1	0.0	7.7
12-Sep-17	4.8	2.6	2.7	14.3	-2.5	0.0	2.6	0.0	7.7
26-Sep-17	7.2	2.6	2.7	31.5	10.1	0.0	23.2	0.0	15.4
10-Oct-17	4.8	5.2	5.3	22.9	0.0	0.0	10.3	2.9	12.8
24-Oct-17	2.4	2.6	2.7	8.6	0.0	0.0	2.6	-2.9	12.8

METHANE SAMPLE SET

Week Begin	1344A	1344B	1344C
25-Feb-16	123.8	110.9	302.7
03-Mar-16	242.0	573.3	390.7
10-Mar-16	243.4	858.4	617.7
17-Mar-16	254.3	596.7	388.7
24-Mar-16	228.1	975.2	481.4
31-Mar-16	145.1	730.6	631.1
07-Apr-16	87.1	613.7	565.8
14-Apr-16	848.5	22.4	953.4
21-Apr-16	1000.9	23.6	735.9
28-Apr-16	999.4	25.3	380.9
05-May-16	721.5	124.0	22.8
12-May-16	292.6	343.3	32.7
19-May-16	819.5	1188.5	22.1
26-May-16	734.5	407.2	24.8

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ASTM D5511-12 - Anaerobic High Solids Biodegradability - 1101170125H

Week Begin	1344A	1344B	1344C
02-Jun-16	449.6	1240.8	349.5
09-Jun-16	760.8	1113.8	477.9
16-Jun-16	419.2	832.3	907.9
23-Jun-16	606.4	63.0	718.8
30-Jun-16	589.0	395.8	1004.7
07-Jul-16	589.9	531.9	482.9
14-Jul-16	284.8	1056.8	826.0
21-Jul-16	339.9	447.5	528.7
28-Jul-16	94.8	421.6	484.5
04-Aug-16	81.6	215.7	156.2
11-Aug-16	35.6	127.9	133.6
18-Aug-16	62.2	150.4	154.0
25-Aug-16	177.2	72.0	67.4
01-Sep-16	183.6	60.2	84.1
08-Sep-16	120.1	74.1	39.0
15-Sep-16	141.6	50.1	69.9
22-Sep-16	64.7	56.1	86.2
29-Sep-16	53.8	54.3	10.4
06-Oct-16	70.0	23.4	23.4
13-Oct-16	52.0	36.9	165.4
20-Oct-16	74.6	12.2	22.4
27-Oct-16	47.8	52.2	259.1
03-Nov-16	4.9	99.1	211.7
10-Nov-16	67.2	212.8	167.4
17-Nov-16	816.6	163.6	106.3
24-Nov-16	572.6	182.9	150.0
01-Dec-16	556.6	85.1	70.6
08-Dec-16	830.8	66.3	76.1
15-Dec-16	201.6	63.5	546.0
22-Dec-16	604.9	37.9	427.1
29-Dec-16	316.3	10.0	144.9
10-Jan-17	2.5	-185.6	-48.6
17-Jan-17	40.6	-90.6	-24.1
24-Jan-17	27.4	-95.5	-24.4
31-Jan-17	23.6	156.1	13.1
07-Feb-17	63.5	122.7	0.0
14-Feb-17	31.3	21.1	0.0
21-Feb-17	36.4	10.3	0.0
28-Feb-17	110.8	10.3	0.0
07-Mar-17	-7.8	0.0	21.4
14-Mar-17	46.4	36.5	50.8
21-Mar-17	26.9	26.8	181.9
28-Mar-17	51.3	0.0	251.4
04-Apr-17	73.3	53.5	0.0
11-Apr-17	39.1	26.8	0.0
25-Apr-17	9.8	24.3	0.0
09-May-17	68.4	0.0	0.0
23-May-17	0.0	-41.4	0.0
06-Jun-17	0.0	-21.9	0.0

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ASTM D5511-12 - Anaerobic High Solids Biodegradability - 1101170125H

Week Begin	1344A	1344B	1344C
20-Jun-17	0.0	-21.9	0.0
04-Jul-17	0.0	12.2	0.0
18-Jul-17	0.0	0.0	0.0
01-Aug-17	0.0	0.0	0.0
15-Aug-17	0.0	0.0	0.0
29-Aug-17	0.0	0.0	0.0
12-Sep-17	0.0	17.0	0.0
26-Sep-17	0.0	9.7	0.0
10-Oct-17	0.0	17.0	0.0
24-Oct-17	0.0	21.9	13.4

CARBON DIOXIDE CONTROL SET (mL)

Week Begin	IA	IB	IC	NA	NB	NC	PA	PB	PC
25-Feb-16	283.0	806.2	648.2	609.5	519.7	146.9	2447.0	2374.0	2219.8
03-Mar-16	238.3	46.5	72.4	66.9	82.8	81.2	857.6	1656.7	1125.7
10-Mar-16	152.3	-4.6	18.4	2.0	20.3	90.2	400.4	345.3	484.6
17-Mar-16	-10.6	-5.9	-7.4	14.9	17.9	65.8	182.7	143.6	198.4
24-Mar-16	-4.7	-4.1	8.3	22.9	13.3	66.9	122.4	292.3	127.0
31-Mar-16	1.4	6.0	8.3	1.6	10.2	62.0	22.7	48.0	23.5
07-Apr-16	-3.1	-1.4	16.8	20.9	11.0	64.7	97.5	205.2	98.0
14-Apr-16	1.5	-13.2	7.6	15.8	14.8	60.0	80.5	-292.0	71.1
21-Apr-16	1.4	-4.7	1.7	26.0	13.8	61.2	57.4	145.9	54.1
28-Apr-16	-0.0	4.4	14.0	4.6	9.7	55.1	72.8	80.0	54.3
05-May-16	-3.1	10.4	173.5	16.2	15.6	67.3	118.6	61.1	54.0
12-May-16	35.9	-1.6	121.8	22.1	9.3	58.6	62.2	27.3	9.3
19-May-16	19.4	23.1	105.1	24.2	6.9	56.0	91.1	18.7	43.2
26-May-16	-1.6	-9.8	73.1	-1.4	5.1	57.7	57.3	16.9	-0.0
02-Jun-16	-4.7	29.4	52.4	36.7	13.5	72.7	-203.7	14.6	19.7
09-Jun-16	-3.0	56.5	54.9	9.4	10.0	61.9	284.1	20.1	23.6
16-Jun-16	124.3	28.3	44.1	16.4	14.8	55.8	-6.6	30.6	14.7
23-Jun-16	274.5	152.8	25.2	16.1	12.7	66.0	21.5	195.5	29.4
30-Jun-16	69.4	-25.4	24.3	27.7	6.6	-7.7	58.1	-15.9	19.8
07-Jul-16	79.1	41.5	20.0	22.2	12.5	41.4	44.2	24.7	14.1
14-Jul-16	12.6	-7.6	15.8	24.2	12.8	-1.5	0.0	22.3	28.2
21-Jul-16	32.5	7.4	20.3	20.9	11.6	36.0	4.7	118.8	28.3
28-Jul-16	52.5	11.3	34.1	19.1	13.5	88.7	-0.0	99.6	22.1
04-Aug-16	38.1	9.6	20.9	14.5	13.4	503.4	-0.0	36.0	22.6
11-Aug-16	45.6	8.6	18.4	21.6	8.1	21.4	-16.2	23.0	25.0
18-Aug-16	20.6	10.3	33.0	20.9	16.2	22.1	-16.0	9.4	22.9
25-Aug-16	23.4	14.3	18.5	34.0	15.3	15.4	-8.0	6.2	22.8
01-Sep-16	22.5	11.4	9.8	15.4	17.0	15.0	-8.1	-0.0	18.9
08-Sep-16	19.5	6.3	31.5	22.2	56.5	-77.6	21.6	8.5	32.7
15-Sep-16	22.2	10.4	21.8	11.5	8.4	7.4	11.8	9.7	17.4
22-Sep-16	25.9	14.0	11.9	23.7	8.6	13.2	-3.2	-6.3	22.7
29-Sep-16	22.7	10.5	29.2	20.9	17.2	11.3	21.7	19.0	22.8
06-Oct-16	12.1	9.9	23.3	18.0	7.0	6.5	12.9	10.6	24.6
13-Oct-16	24.3	15.3	19.8	24.5	5.1	7.8	24.1	12.1	29.5
20-Oct-16	15.3	9.4	10.2	23.5	5.0	4.2	7.9	-5.8	22.3
27-Oct-16	27.0	15.2	28.9	19.1	7.6	7.9	13.8	13.6	23.3

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ASTM D5511-12 - Anaerobic High Solids Biodegradability - 1101170125H

Week Begin	IA	IB	IC	NA	NB	NC	PA	PB	PC
03-Nov-16	29.5	10.4	18.5	19.5	0.0	3.0	4.9	-15.0	16.1
10-Nov-16	20.2	7.5	20.2	20.7	1.7	8.0	14.9	0.0	24.7
17-Nov-16	13.7	12.3	26.8	21.5	8.8	0.0	15.3	16.7	13.4
24-Nov-16	20.4	9.3	25.0	26.1	9.9	5.8	21.8	12.3	24.0
01-Dec-16	30.3	7.9	18.0	19.2	8.0	16.6	32.5	30.2	25.6
08-Dec-16	28.0	7.6	16.7	16.2	1.6	2.8	0.0	2.9	7.6
15-Dec-16	23.5	8.5	29.3	20.5	6.2	-1.5	8.4	7.6	6.2
22-Dec-16	23.7	10.7	18.9	15.5	6.1	7.4	80.0	11.0	17.0
29-Dec-16	17.9	4.6	20.3	9.1	-1.7	1.5	38.0	-1.5	66.9
10-Jan-17	1.6	1.6	3.1	0.0	0.0	0.0	0.0	0.0	0.0
17-Jan-17	0.0	1.6	0.0	12.8	1.7	3.1	16.5	0.0	18.5
24-Jan-17	4.5	3.1	3.1	6.4	1.7	1.6	8.0	0.0	9.0
31-Jan-17	4.5	1.5	1.6	5.9	0.0	0.0	7.0	0.0	9.1
07-Feb-17	0.0	1.5	3.2	20.9	3.3	1.6	6.7	0.0	7.8
14-Feb-17	4.7	0.0	3.2	15.4	-3.2	-3.2	3.4	-4.5	4.8
21-Feb-17	1.6	1.5	0.0	21.5	1.6	4.6	6.6	1.4	4.4
28-Feb-17	3.2	0.0	1.6	13.3	0.0	0.0	3.4	13.2	6.3
07-Mar-17	0.0	2.8	3.1	23.6	3.2	0.0	10.0	0.0	11.0
14-Mar-17	6.4	1.6	1.5	12.7	1.6	0.0	4.8	0.0	4.7
21-Mar-17	1.6	3.3	0.0	12.7	0.0	0.0	4.8	0.0	4.7
28-Mar-17	3.2	3.3	0.0	9.5	-4.9	0.0	0.0	0.0	1.6
04-Apr-17	4.8	3.3	4.6	15.9	3.2	0.0	8.1	-1.5	6.3
11-Apr-17	1.6	3.3	6.1	12.7	0.0	0.0	1.6	1.5	4.7
25-Apr-17	1.6	1.6	1.5	9.5	-3.2	0.0	4.8	-5.9	4.7
09-May-17	3.2	3.3	3.1	15.9	0.0	0.0	4.8	0.0	4.7
23-May-17	1.6	3.3	1.5	7.9	0.0	0.0	3.2	0.0	1.6
06-Jun-17	6.4	3.3	0.0	7.9	-1.6	0.0	1.6	-1.5	1.6
20-Jun-17	1.6	1.6	4.6	17.5	1.6	0.0	8.1	3.0	7.8
04-Jul-17	3.2	3.3	3.1	6.3	1.6	7.5	0.0	-1.5	7.8
18-Jul-17	1.6	3.3	4.6	9.5	-3.2	0.0	1.6	0.0	0.0
01-Aug-17	1.6	1.6	1.5	4.8	0.0	0.0	6.5	-1.5	3.1
15-Aug-17	4.8	3.3	3.1	17.5	-3.2	0.0	4.8	0.0	9.4
29-Aug-17	4.8	1.6	3.1	7.9	-1.6	0.0	3.2	0.0	4.7
12-Sep-17	3.2	1.6	1.5	7.9	-1.6	0.0	1.6	0.0	4.7
26-Sep-17	4.8	1.6	1.5	17.5	6.5	0.0	14.5	0.0	9.4
10-Oct-17	3.2	3.3	3.1	12.7	0.0	0.0	6.5	1.5	7.8
24-Oct-17	1.6	1.6	1.5	4.8	0.0	0.0	1.6	-1.5	7.8

CARBON DIOXIDE SAMPLE SET

Week Begin	1344A	1344B	1344C
25-Feb-16	1004.8	1340.4	1482.9
03-Mar-16	308.0	719.1	430.4
10-Mar-16	274.4	1043.7	650.6
17-Mar-16	271.2	652.7	379.4
24-Mar-16	174.1	757.7	391.5
31-Mar-16	106.8	586.9	498.1
07-Apr-16	65.4	475.9	426.5
14-Apr-16	663.9	18.3	678.2
21-Apr-16	785.5	18.9	539.0

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Week Begin	1344A	1344B	1344C
28-Apr-16	755.9	20.7	276.6
05-May-16	546.5	99.6	17.1
12-May-16	221.5	298.0	26.6
19-May-16	649.4	1063.1	16.0
26-May-16	524.1	352.4	18.3
02-Jun-16	337.2	1026.8	245.8
09-Jun-16	627.5	953.8	354.6
16-Jun-16	330.8	665.5	688.2
23-Jun-16	463.2	49.4	582.2
30-Jun-16	459.1	328.9	753.1
07-Jul-16	437.2	416.6	383.6
14-Jul-16	229.0	831.6	637.2
21-Jul-16	250.5	357.0	438.1
28-Jul-16	72.3	341.4	375.2
04-Aug-16	59.4	172.2	120.4
11-Aug-16	24.4	99.4	97.7
18-Aug-16	48.7	116.6	112.8
25-Aug-16	133.8	53.2	50.4
01-Sep-16	140.2	47.1	63.5
08-Sep-16	94.2	60.4	28.4
15-Sep-16	104.7	39.9	50.3
22-Sep-16	56.0	44.2	66.9
29-Sep-16	36.5	41.5	8.5
06-Oct-16	52.2	18.0	19.7
13-Oct-16	38.1	29.3	117.1
20-Oct-16	50.9	10.5	16.8
27-Oct-16	40.8	42.8	221.4
03-Nov-16	3.7	80.5	152.7
10-Nov-16	51.1	177.4	121.9
17-Nov-16	601.6	144.4	79.8
24-Nov-16	445.9	152.6	114.9
01-Dec-16	440.3	72.2	57.4
08-Dec-16	675.4	53.5	59.2
15-Dec-16	156.7	49.2	382.7
22-Dec-16	477.0	30.7	353.2
29-Dec-16	268.2	8.4	107.4
10-Jan-17	1.8	-150.3	-36.4
17-Jan-17	30.9	-67.8	-18.0
24-Jan-17	20.4	-76.9	-17.6
31-Jan-17	20.2	132.5	10.2
07-Feb-17	50.3	99.8	0.0
14-Feb-17	25.5	17.0	0.0
21-Feb-17	29.4	8.3	0.0
28-Feb-17	83.7	8.3	0.0
07-Mar-17	-5.4	0.0	16.0
14-Mar-17	26.0	21.6	28.6
21-Mar-17	15.1	15.8	102.3
28-Mar-17	28.8	0.0	141.4
04-Apr-17	41.1	31.7	0.0

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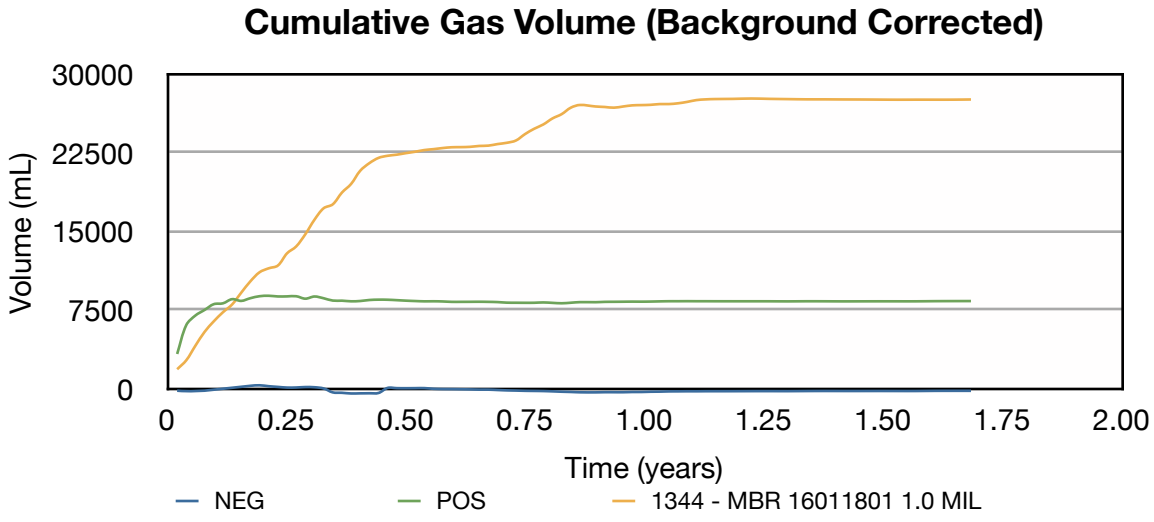
Week Begin	1344A	1344B	1344C
11-Apr-17	21.9	15.8	0.0
25-Apr-17	5.5	14.4	0.0
09-May-17	38.4	0.0	0.0
23-May-17	0.0	-24.5	0.0
06-Jun-17	0.0	-13.0	0.0
20-Jun-17	0.0	-13.0	0.0
04-Jul-17	0.0	7.2	0.0
18-Jul-17	0.0	0.0	0.0
01-Aug-17	0.0	0.0	0.0
15-Aug-17	0.0	0.0	0.0
29-Aug-17	0.0	0.0	0.0
12-Sep-17	0.0	10.1	0.0
26-Sep-17	0.0	5.8	0.0
10-Oct-17	0.0	10.1	0.0
24-Oct-17	0.0	13.0	7.5

DATA ANALYSIS

	Inculum	Negative	Positive	1344 - MBR 1601180 1 1.0 MIL
Cumulative Gas Volume (mL)	4766.1	4593.4	13149.3	32368.0
Percent CH_4 (%)	41.6	46.4	43.2	47.7
Volume CH_4 (mL)	1984.2	2130.5	5679.2	15435.1
Mass CH_4 (g)	1.42	1.52	4.06	11.03
Percent CO_2 (%)	38.3	35.7	42.0	42.2
Volume CO_2 (mL)	1824.8	1639.8	5523.6	13648.7
Mass CO_2 (g)	3.58	3.22	10.85	26.81
Sample Mass (g)	10	10	10	20
Theoretical Sample Mass (g)	0.0	8.6	4.2	13.7
Biodegraded Mass (g)	2.04	2.02	6.00	15.58
Percent Biodegraded (%)		-0.2	93.9	98.7



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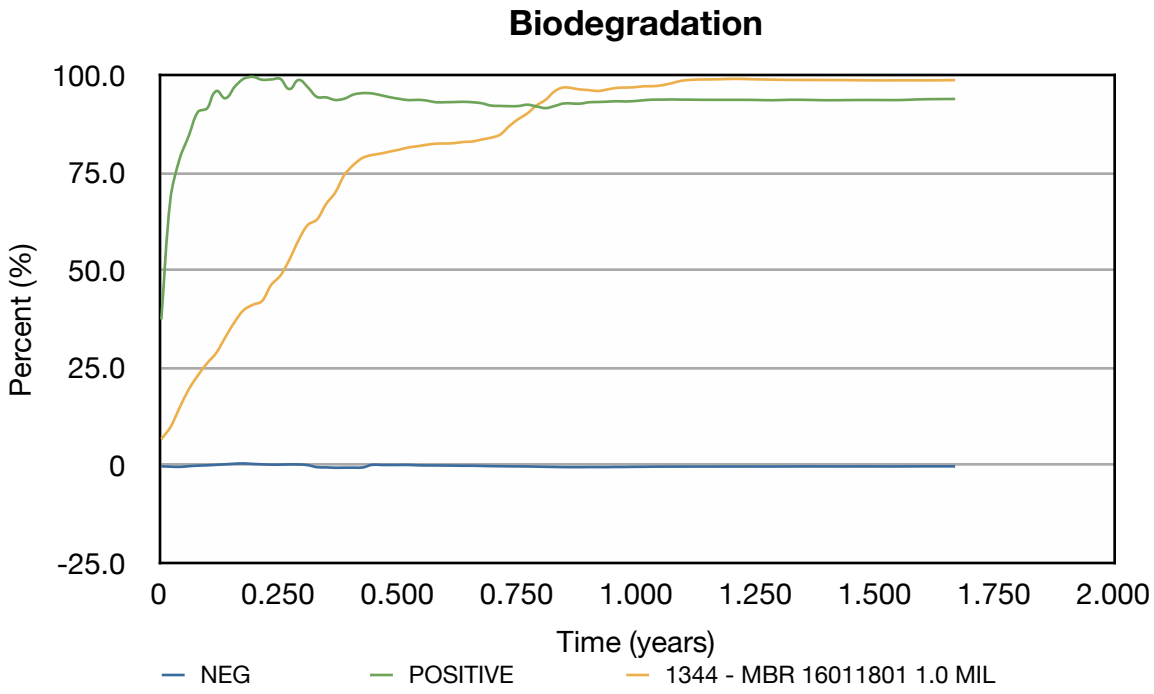
ASTM D5511-12 - Anaerobic High Solids Biodegradability - 1101170125H

CONCLUSION

Upon consideration of gas production, it becomes obvious that biodegradation has occurred in the BiologiQ Sample (ERL#1344). It appears that a linear slope has developed for this sample and it has plateaued.



Over a 614 day period the Biologiq Sample indicates about 98.7% biodegradation. Sample #1344 easily surmounted the let down rate of the additive. It is important to note that negative movement in biodegradation is the result of the inoculum outperforming the sample or control.

The positive control has achieved the required 70%+ biodegradation. These samples will go through many biological cycles as they biodegrade. It seems the syntrophic effect of the microbes has been fulfilled for this sample. It is not uncommon for this to take up to 90+ days before the microbial colonies reach a quorum. In this method, temperature and moisture are optimized and these results are not expected in all landfills.

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