



## **Ready/Ultime Biodegradability**

### **ISO 14593**

**Date of Report: March 26, 2008**

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## Report on ISO 14593 Biodegradability

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Advanced Lubrication Technologies, Inc.: Test Product C-200  
ISO 14593 Ultimate Biodegradability Determination  
3/26/2008

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### Summary

The ISO 14593 biodegradability testing monitors the degree of activity of microorganisms exposed to a material that is being tested for a biodegradable status. In the test, if the microorganisms recognize the material as a food source, then an increase in biological activity is observed through data collection specifically designed to assess biological conversion of organic carbon to inorganic carbon. If the material is not a recognizable food source or is toxic or inhibitory, then there is no measurable increase in biological activity or, in some cases, there is a marked decrease in activity relative to a biodegradable control.

Positive Control: Dextrose @ 20 mg/L

Carbon Analyzer: High Sensitivity Shimadzu TOCvch

TIC Analysis Employed: Basified Aqueous Phase Inorganic Carbon via TOCvch

Test bottles were setup in triplicate for statistical validation of results, and a total of 9 sampling events were executed. The inoculum was preconditioned in the test medium via method guidance to remove organic carbon and inorganic carbon prior to testing. The inoculum source is the Escatawpa, MS municipal wastewater treatment facility.

### Results

Based on the testing conducted in accordance with the specified method above, test product C-200 achieved 67% biodegradation within 10 days. The method classifies greater than 60% biodegradation within 28 days as Ultimate Biodegradability.





**Report Date: March 26, 2008**

**Project Initiation Date: March 4, 2008**

**Test Method: ISO 14593**

**Test Classification: Ultimate Biodegradability**

**Test Chemicals**

TC1: C-200

**Prepared for Advanced Lubrication Technologies, Inc.**

**Prepared by RespirTek, Inc.**

The enclosed data relates only to those samples received by the laboratory.

This report shall not be reproduced, except in full, without written approval of the laboratory.



PC: Positive Control - Dextrose  
TC1: C-200

	Day 0	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 28	
Blank 1	1.072	1.119	1.321	1.166	N/A	N/A	N/A	N/A	N/A	N/A
Blank 2	1.48	0.9906	1.327	1.183	N/A	N/A	N/A	N/A	N/A	N/A
Blank 3	1.071	1.43	1.085	1.191	N/A	N/A	N/A	N/A	N/A	N/A
PC-1	1.285	11.88	14.66	15.5	N/A	N/A	N/A	N/A	N/A	N/A
PC-2	1.276	11.77	14.34	15.17	N/A	N/A	N/A	N/A	N/A	N/A
PC-3	1.318	11.87	14.5	14.92	N/A	N/A	N/A	N/A	N/A	N/A
TC1-1	1.763	10.34	13.6	14.65	N/A	N/A	N/A	N/A	N/A	N/A
TC1-2	1.336	10.88	13.75	14.78	N/A	N/A	N/A	N/A	N/A	N/A
TC1-3	1.346	10.43	13.45	14.06	N/A	N/A	N/A	N/A	N/A	N/A

\*\*\* - test product contains inorganic carbon as bicarbonate: calculations accounting for initial carbon are provided on the next worksheet. Calculations on this worksheet are not applicable.

	Day 0	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 28
Blank Mean	1.21	0.12	0.12	0.12	N/A	N/A	N/A	N/A	N/A

Day 0 Product Mean	
PC	1.293
TC1	1.481667

Positive Control - Milligrams of Inorganic Carbon as CO<sub>2</sub> in Test Vessel @ Time t

Replicate	Day 0	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 28	
1	0	1.19	1.47	1.55	N/A	N/A	N/A	N/A	N/A	N/A
2	0	1.18	1.43	1.52	N/A	N/A	N/A	N/A	N/A	N/A
3	0	1.19	1.45	1.49	N/A	N/A	N/A	N/A	N/A	N/A

Test Chemical 1 - Milligrams of Inorganic Carbon as CO<sub>2</sub> in Test Vessel @ Time t

Replicate	Day 0	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 28	
1	0	1.03	1.36	1.47	N/A	N/A	N/A	N/A	N/A	N/A
2	0	1.09	1.38	1.48	N/A	N/A	N/A	N/A	N/A	N/A
3	0	1.04	1.35	1.41	N/A	N/A	N/A	N/A	N/A	N/A

Organic Carbon Content Per Reactor

Sample ID	TOC	Unit
PC	1.96	mg
TC1	1.98	mg



PC: Positive Control - Dextrose  
TC1: C-200

Positive Control - % Theoretical CO2 Production Realized

Replicate	Day 0	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 28	
1	0	54.59	68.45	73.06	N/A	N/A	N/A	N/A	N/A	N/A
2	0	54.03	66.81	71.38	N/A	N/A	N/A	N/A	N/A	N/A
3	0	54.54	67.63	70.10	N/A	N/A	N/A	N/A	N/A	N/A

Test Chemical 1 - % Theoretical CO2 Production Realized

Replicate	Day 0	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 28	
1	0	46.26	62.40	68.03	N/A	N/A	N/A	N/A	N/A	N/A
2	0	48.99	63.16	68.69	N/A	N/A	N/A	N/A	N/A	N/A
3	0	46.72	61.64	65.05	N/A	N/A	N/A	N/A	N/A	N/A

**Summary Statistics**

Average % Theoretical CO2 Production (>60% indicates passing conditions)

Mean	Day 0	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 28
PC	0.00	54.39	67.63	71.51	N/A	N/A	N/A	N/A	N/A
TC1	0.00	47.32	62.40	67.26	N/A	N/A	N/A	N/A	N/A

Standard Deviation Between Replicates at Each Sample Point

St. Dev.	Day 0	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 28
PC	N/A	0.310	0.816	1.484	N/A	N/A	N/A	N/A	N/A
TC1	N/A	1.461	0.758	1.938	N/A	N/A	N/A	N/A	N/A

95% Confidence Interval Values (+- Value Calculated) at n-1 Degrees of Freedom

95% CI	Day 0	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 28
PC	N/A	0.770	2.027	3.685	N/A	N/A	N/A	N/A	N/A
TC1	N/A	3.627	1.881	4.811	N/A	N/A	N/A	N/A	N/A

# Biodegradation Curves

