FINAL REPORT

Evaluation of Additives in Liquid Fuels

PROTOCOL
ASTM E1259

ORDER Number
371000995

PREPARED FOR:

FuelLift Manufacturing Group

PRODUCT TESTED:
FuelLIFT Diesel Catalyst

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Certificate of Analysis

Client: FuelLift Manufacturing Group

Contact: Chris Schwartz
Project: ASTM E1259

Product : FuelLIFT Diesel Catalyst
EMSL NO: 371000995

Sample received: 2/1/2010
Start date: 2/16/2010
Report date: 3/5/2010
Challenge Bacteria: *Pseudomonas aeruginosa* ATCC No. 33988
Challenge Fungi: *Hormoconis resinae* ATCC No. 20495
Challenge Yeast: *Candida (Yarrowia) tropicalis* ATCC No. 18138

Experimental Summary: The testing procedure was designed after discussions between EMSL Analytical, the testing company, and the client, FuelLift Manufacturing Group. The protocol followed was ASTM E1259, Standard Practice for Evaluation of Antimicrobials in Liquid Fuels Boiling Below 390ºC. All testing was conducted in our Westmont Microbiology Laboratory.

Procedure:

In order to determine the effect the fuel catalyst has on microbial growth, three test organisms; *Pseudomonas aeruginosa, Hormoconis resinae,* and *Candida tropicalis,* were used to set up small scale, 1 liter, microcosms. Microcosms were first inoculated with bottom water (Bushnell-Haas broth) and the previously stated organisms. Each bottle was overlaid with a 10:1 ratio of diesel to bottom water. Three sample types were examined: 1) the test sample, an inoculated liter of diesel fuel plus the additive; 2) a positive control, an inoculated liter of diesel fuel without additive; and 3) a negative control, an un-inoculated liter of diesel fuel plus the catalyst. All samples were tested in replicate and an initial count of the microorganisms was obtained by standard plate counts on Tryptic Soy agar (TSA) for bacteria, and Malt Extract agar (MEA) for yeast and fungus. Agar plates were incubated for 3-5 days then examined using a light box. Samples were collected again 48 h later to observe the effect of the fuel additive on microbial growth in the diesel fuel.

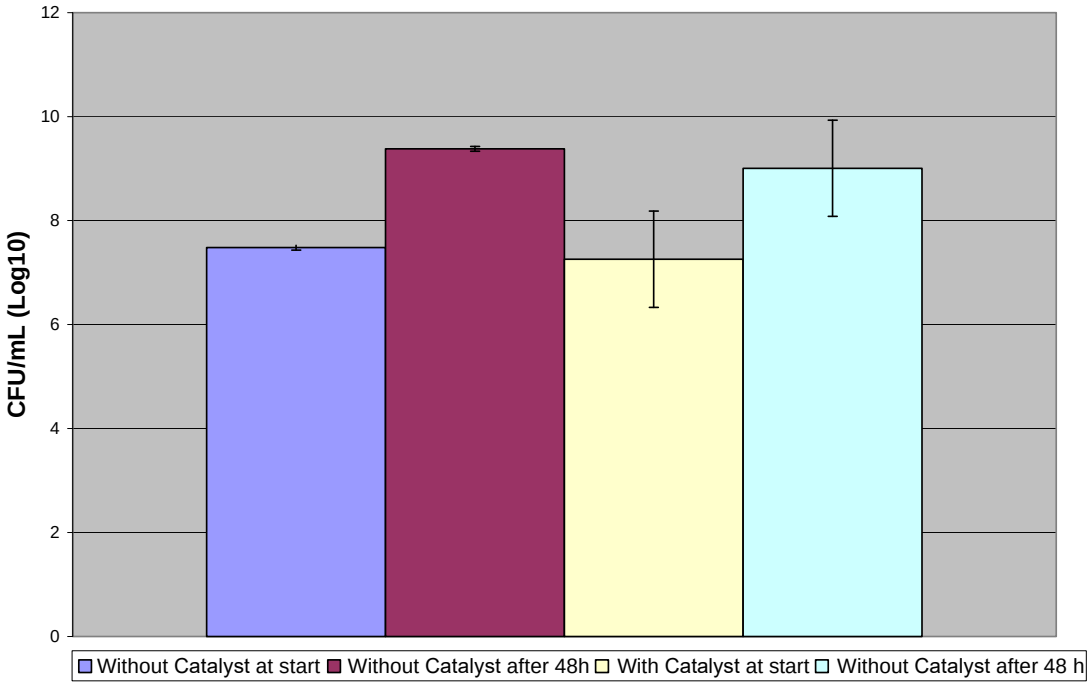
Experimental Results:

Table 1. Microcosm results at start and after 48 hr incubation.

Microorganism	Without Catalyst (CFU/mL)		With Catalyst (CFU/mL)	
	At Start	After 48 h	At Start	After 48 h
P. aeruginosa	3.02E+07	2.40E+09	1.81E+07	1.01E+09
C. tropicalis	1.28E+06	7.80E+05	8.30E+05	9.00E+05
H. resinae	8.00E+04	5.00E+04	1.13E+05	6.50E+04

Un-inoculated microcosms consisting of catalyst and fuel did not show any growth at start or after 48 hr (<10 CFU/mL).
CFU = colony forming unit

P. aeruginosa **Levels In Microcosms With and Without Catalyst**



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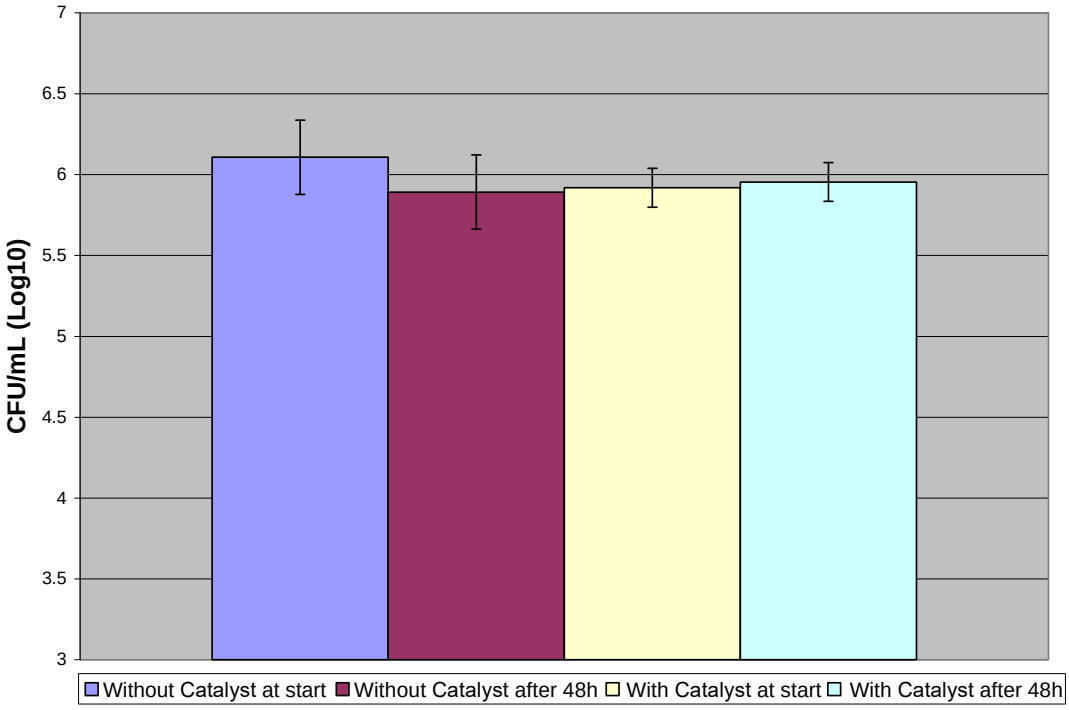
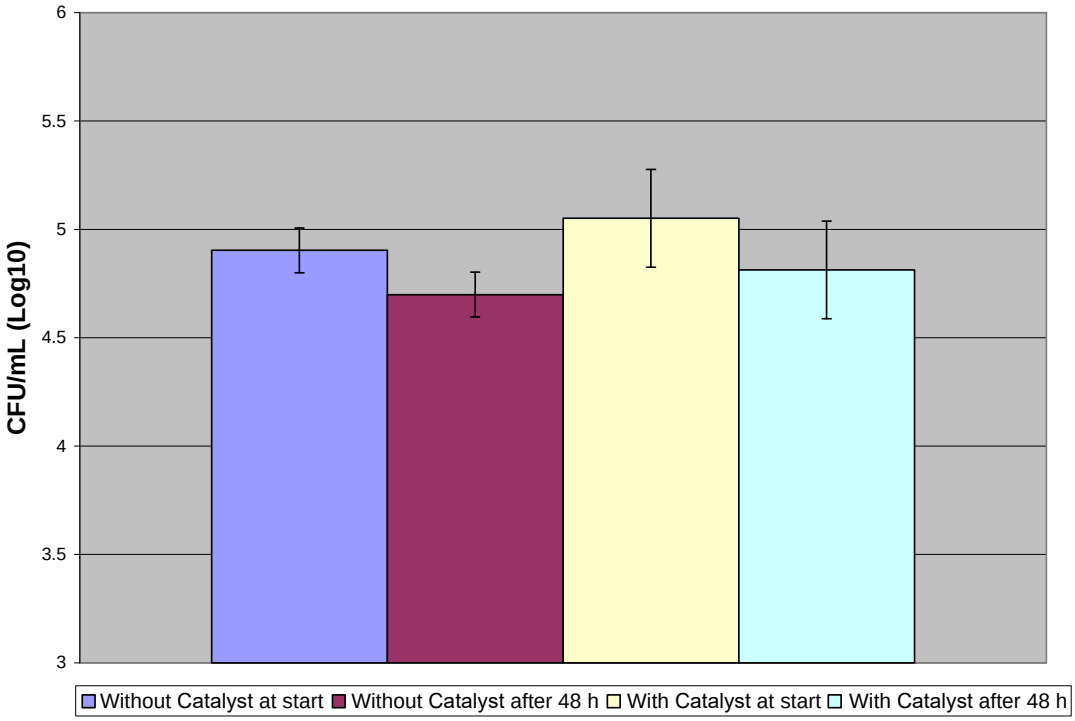
C. tropicalis Levels in Microcosms With and Without Catalyst



H. resinae Levels in Microcosms With and Without Catalyst



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Conclusions/Observations:

The FuelLIFT catalyst did not have any effect, either positive or negative, on the microbial growth in the diesel fuel microcosms tested.

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test report: ASTM D975.

Summary of FuelLIFT Catalyst Results in Compliance with OEM Standards

Results from ASTM D975 Testing Conducted and Completed at Southwest Research Institute (SwRI)

		Detroit Diesel Standards			Cummins Diesel Fuel Property Requirements			Caterpillar Specifications For Distillate Diesel Fuel		
ASTM Number	Description	Minimum	Maximum	FuelLIFT Meets Requirements	Minimum	Maximum	FuelLIFT Meets Requirements	Minimum	Maximum	FuelLIFT Meets Requirements
D287	Density	34	38	✓				30	45	✓
D1298	Gravity	0.81	0.86	✓						
D93	Flash Point	52		✓				Legal Limit		✓
D445	Viscosity	1.9	4.1	✓	1.3	4.1	✓	1.4		✓
D2622	Sulfur Content		500 ppm	✓		5,000 ppm	✓		1%	✓
D2500	Cloud Point	None	None	✓	C6		✓	None		✓
D4359	Filter Plug Point	None	None	✓						
D613	Cetane	45		✓	42		✓	40		✓
D 86	Distillation:									
	IBP typical	320		✓						
	10%	430		✓		540	✓		540	✓
	50%	510		✓						
	90%		625	✓		680	✓		680	✓
	95%		671	✓						
	Rec Vol	98		✓						
D2709	Water		0.02	✓		0.01	✓			
D5452	Sediment		10	✓						
D482	Ash		0.01	✓		0.02	✓		0.02%	✓
D524	Carbon Residue		0.35	✓		0.35	✓		0.35	✓
D130	Copper Corrosion		3a	✓		3a	✓		3	✓
D2274	Storage Stability		15	✓						
D6468	Temp. Stability	70		✓				80%		✓
D4868	Heat Content	128,500	131,500	✓						
D6078	Lubricity	3,100		✓	3,100		✓			
D6079	Lubricity		460	✓						
D 4052	Density				0.816	0.876	✓			
D 1319	Aromatics								35%	✓
D 97	Pour Point								6° C	✓
D1796	Water & Sediment								0.1	✓
D1744	Water								0.1	*
D473	Sediment								0.05	*

Note:

** Water and Sediment were not tested separately. ASTM D1796 tests for both Water and Sediment combined. Results revealed that Water and Sediment amounts decreased with FuelLIFT catalyst.*