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Dr. Colin Hill
Chief Scientist
Biofriendly Corporation
158 Sawpit Lane
Bradbury, CA 91010

January 24, 2003

(626)-303-6000
(562)598-3110

Re: Additive compatibility testing

Final Report

Dear Dr. Hill:

Testing has been completed on Biofriendly fuel catalyst with diesel fuel. A DF#2 fuel was purchased from a local gas station as specified. The no-harm tests shown in the attached report were performed on the neat diesel and on the diesel additized according to our instructions with 25mL of additive to 10gallons of diesel. The additive was received during your visit with us on November 13, 2002. The additive was stored in dark and cool conditions prior to blending, and the additized fuel is being stored in an opaque container. Each of the tests has been performed to the specified ASTM or special test procedure as described, with no modifications or deviations. Precisions have not been established for this testing, but ASTM precisions may be referred to. Sample aliquots were taken in accordance with the specified test methods. No significant differences were observed between the two samples in the specification testing, the elastomer testing, or the filter testing. Based on these results, no harm would be expected to fuel systems from use of this additive at the given add rate.

Descriptions are included for the non-ASTM tests requested on the program.

Filter Media Compatibility

The fuel filter media compatibility test was performed as follows:

Fleetguard filters F105d and F1212 were measured for pressure drop per the test apparatus outlined in CES 10,508, Section 4.4.3, at 20, 60, and 100 gallons per hour using a #2 diesel fuel at 100 degrees F. One F105d filter was filled with the additized reference fuel. One of the F1212 filters was filled with the additized reference fuel, but also had added 1% water, shaken vigorously for 30 seconds. The filters were covered with foil to minimize fuel loss and aged for three (3) weeks at 160 degrees F. Each week consisted of five days at 160 degrees F followed by being cooled and remaining at room temperature for 2 days. After three weeks of aging the filters were drained of the test fluid and measured for pressure drop at 20, 60, and 100 gallons per hour using the procedure outlined at the start of the test.

Pass/Fail criteria: The pressure drop at each flow condition shall not increase by more than 0.2 inches of Hg. A reference filter using the reference fuel was tested under identical conditions to ensure that the fuel does not contribute to the pressure drop increase. The filter media was then removed from each of the filters and the media inspected for any unusual appearance or signs of a sticky or gel type residue. The plastic material used to bond the filter media to the metal end plates should not be soft or tacky. A description of the condition of the filter media and plastic material is attached.

(OKBKAAX3)page 1 of 4



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Elastomer Compatibility test

Three elastomers, a nitrile-type elastomer, Buna-N, to evaluate effects on nitrile hose type materials, along with a fluorinated elastomer, Viton, and a silicone elastomer to evaluate effects on gasket-type materials were used. The test conditions included exposure of each set of elastomers to reference diesel in one container and to additized reference diesel in a separate container, both maintained at 160°F, for 3 weeks, followed by evaluation of the parameters listed below. The change in physical properties of the elastomers tested in reference fuel with additive should not differ from those properties in the reference fuel by more than the following values:

Hardness	- 3 points Shore A
Tensile	- 25%
Elongation	- 25%
Volume Swell	+ 25%
Surface Cracks	None

These analyses pertain only to the sample(s) received by Southwest Research Institute and represent only a sampling of each lot. This report shall not be reproduced except in full without the express written permission of Southwest Research Institute.

If there are any questions concerning these analyses, or if you have further instructions please contact me at (210)522-2071

Sincerely,



Karen B. Kohl
Manager, Fuels Laboratory
Petroleum Products Research Dept.
Automotive Products and Emissions Research Div.
Southwest Research Institute

Attachments: Filter test data, 2 pages

SUMMARY OF TEST DATA
COMPATIBILITY AND NO-HARM TESTS

Test Parameter	Test Method	#2 Diesel	Additized #2 Diesel
Density, Specific Gravity	ASTM D 1298	0.8610	0.8611
Distillation, °F 10% vol 50% vol 90% vol Final Boiling Point Residue Loss	ASTM D 86	413.0 519.6 604.9 651.1 0.8 0.9	412.5 519.0 606.6 652.9 1.0 1.6
Flash Point, °F	ASTM D 93	151	141
Pour Point, °C	ASTM D 97	-24	-21
Cloud Point, °C	ASTM D 2500	-14	-16
Cetane Index	ASTM D 976	44.8	45.1
Sulfur, mass%	ASTM D 2622	0.0390	0.0399
Ramsbottom carbon, wt% on 10% bottoms	ASTM D 524	0.09	0.09
Water and sediment, vol%	ASTM D 1796	<0.02	<0.02
Viscosity, cSt, at 40°C	ASTM D 445	2.822	2.814
Ash, mass%	ASTM D 482	<0.001	<0.001
Color	ASTM D 1500	L1.0	L1.0
FIA Aromatics, vol% Olefins, vol% Saturates, vol%	ASTM D 1319	33.8 1.2 65.0	33.4 1.6 65.0
Heat of Combustion, Btu/lb	ASTM D 240	19439.2	19395.5
Cetane number	ASTM D 613	45.9	46.4
Copper Corrosion	ASTM D 130	1A	1A
Rust Resistance	ASTM D 665A	A-pass	A-pass
Lubricity, mm scar	ASTM D 5001	0.500	0.500
Water tolerance Change in water layer Interface rating Separation rating	ASTM D 1094	-2 3 3	-2 3 3
Filter compatibility		Filters purchased	Filters purchased

Test Parameter	Pass/Fail	#2 Diesel	Additized #2 Diesel
Elastomer compatibility ASTM D 471 modified 160F for 3 weeks	Allowable differences between additized and reference diesel		
Nitrile Elastomer	Batch NBR BC-4		
Hardness change, Shore A	3 pass	-19	-20
Tensile strength, % change	-25% pass	-18.39	-21.64
Elongation, % change	-25% pass	-18	-23
Volume Swell, % change	+25% pass	21.09	21.48
Surface cracks	none pass	none	none
Viton Elastomer	Batch FKM BC-4		
Hardness change, Shore A	3 pass	-5	-4
Tensile strength, % change	-25% pass	-8.17	-7.00
Elongation, % change	-25% pass	2	0
Volume Swell, % change	+25% pass	2.29	2.5
Surface cracks	none pass	none	none
Silicone Elastomer	Batch SIL BC-4		
Hardness change, Shore A	3 pass	-20	-21
Tensile strength, % change	-25% pass	-23.19	-21.82
Elongation, % change	-25% pass	-45	-45
Volume Swell, % change	+25% pass	70.90	71.57
Surface cracks	none pass	none	none

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RESISTANCE TO FLOW (PER CUMMINS ENGINEERING STANDARD 10508) MODIFIED

STAND I.D.: #4

WORK ORDER: 375229

TEST DATE: DECEMBER 23, 2002

SPONSOR: BIOFRIENDLY

TEST FLUID: LSRD 4 DIESEL FUEL

FILTER BRAND: FLEETGUARD

TEMPERATURE: 38.0 DEG.C.(100.0 DEG. F.)

FILTER I.D.: SEE BELOW

TEST FLOW RANGE: 20.0-100.0 GPH

TEST FLOW (GPH)	DIFFERENTIAL PRESSURE READINGS (in. of Hg.)			
	F105D (#1)		F1212 (#2)	
	0-HR.	EOT	0-HR.	EOT
20.0	0.01	0.06	0.00	0.08
60.0	0.04	0.10	0.03	0.13
100.0	0.08	0.14	0.07	0.15

TEST FLOW (GPH)	DIFFERENTIAL PRESSURE READINGS (in. of Hg.)			
	F105D (#3)		F1212 (#4)	
	0-HR.	EOT	0-HR.	EOT
20.0	0.01	0.08	0.02	0.07
60.0	0.04	0.11	0.05	0.11
100.0	0.08	0.16	0.09	0.13

REQUIREMENT: NOT TO EXCEED 0.2 INCHES OF Hg.

TECHNICIAN: DD, GG, LJ

DATE COMPLETED: JANUARY 18, 2003

APPROVED BY: *AMR Nelson 1/18/03*



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FUEL FILTER MEDIA COMPATIBILITY

TEST DATE: DECEMBER 23, 2002

WORK ORDER: 375229

OVEN AGE TEMPERATURE: 71.0 DEG. C.(160.0 DEG. F.)

SPONSOR: BIOFRIENDLY

AGE DURATION: 10 DAYS

FILTER BRAND: FLEETGUARD

AMBIENT TEMPERATURE: 22.0 DEG. C.(72..0 DEG. F.)

FILTER I.D.: SEE BELOW

AMBIENT DURATION: 6 DAYS

FILTER I.D.	TEST CONDITION	OBSERVATION
F105D (#1)	LSRD 4 DIESEL FUEL	NORMAL APPEARANCE. ADHESIVE NOT SOFT OR TACKY.
F1212 (#2)	LSRD 4 DIESEL FUEL PLUS 1% BY VOLUME WATER	NORMAL APPEARANCE. ADHESIVE NOT SOFT OR TACKY.
F105D (#3)	LSRD 4 DIESEL FUEL PLUS ADDITIVE	NORMAL APPEARANCE. ADHESIVE NOT SOFT OR TACKY.
F1212 (#4)	LSRD 4 DIESEL FUEL PLUS 1% BY VOLUME WATER, PLUS ADDITIVE	NORMAL APPEARANCE. ADHESIVE NOT SOFT OR TACKY.

TECHNICIAN: DD,GG,LJ

DATE COMPLETED: JANUARY 18, 2003

APPROVED BY: MR Nelson 1/20/03



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