Ben-Gurion University of the Negev
The Internal Combustion Engines Laboratory

אוניברסיטת בן-גוריון בנגב
המעבדה למנועי שריפה פנימית

Friday, December 29th, 2006

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Please find enclosed hereto a summary report on the contribution of the ALGAE-X 500 Magnetic Fuel Stabilizer for reducing air pollution by diesel engines.

Very respectfully,

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STUDY OF THE CONTRIBUTION OF THE ALGAE-X 500 MAGNETIC FUEL STABILIZER ON THE REDUCTION OF AIR POLLUTION FROM DIESEL ENGINES

The tests that we have conducted to study the rate of reduction of air polluters emitted from diesel engines fitted with Magnetic Fuel Stabilizers of the ALGAE-X 500 type are described hereunder together with their results. We have conducted two series of tests:

Series of Tests with Chassis Dynamometer

1. The test's objective: Testing the rate of reduction of air polluters emitted from a Volvo truck used in garbage disposal, made available for the test by the Transport Department of the Tel-Aviv Municipality.
2. The subject stabilizer was installed on the 5th of November, 2006 between the fuel tank and the primary fuel filter adjacent thereto.
3. The truck was loaded with the assistance of a chassis dynamometer at a "DAN" workshop and the emission rates were measured in three different working regimes. The tests were conducted under the supervision of the signatory.
4. The composition of the exhaust gases was measured at each working regime, once before the stabilizer was fitted (on November 5th, 2006) and again after having fitted it (on December 3rd, 2006). The vehicle traveled between said dates with the fuel stabilizer (the number of kms. shows in the table).
5. During the period of time between both measurements the truck worked as usual and the truck engine did not undergo any treatment (any kind of cleaning, injectors replacement, injection or valves adjustments, filters replacement, oil replacement, etc.).
6. The three different working regimes in which the tests were conducted are detailed in Table Nr. 1.
7. NOx, HC, CO were measured at each regime as well as parameters characterizing the solid particles, namely, the particles' distribution by size and their total mass.
8. The exhaust gases' composition was measured by means of a SUN produce DGA 1000 Gas Analyzer.
9. The parameters characterizing the solid particles were measured by means of a SENSORS produce PM-300 Pariculate Analyzer.
10. The results reflect single measurements and are not representative of a statistic sampling collection.

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Series of Tests with an Engine Dynamometer

1. The test's objective: Testing the rate of reduction of air polluters emitted from a Ford Transit's engine loaded in this test with a turbulence currents dynamometer.
2. The subject stabilizer was installed on December 27th, 2006, between the fuel tank and the primary fuel filter adjacent thereto. All the tests were conducted on the same day.
3. The engine was loaded with assistance of a turbulence currents dynamometer and the emission rates were measured in three different working regimes.
4. The exhaust gases' composition was measured at each regime in two different protocols: according to the first protocol, at each working regime, the engine was continuously fed by moving the gate valve once thru the engine's normal fuel piping and once thru the magnetic stabilizer. The results are displayed in Table Nr. 2. According to the second protocol, the engine was tested without the stabilizer at three operating regimes one after the other and then it was tested in the same manner and at the same regimes with the stabilizer. The results are displayed in Table Nr. 3.
5. The tests were conducted under the supervision of the signatory.
6. NOx, HC, CO were measured at each working regime as well as the smoke's turbidity and the fuel consumption.
7. The exhaust gases' composition was measured by means of a SUN produce DGA 1000 Gas Analyzer.
8. The smoke's turbidity was tested by means of a SUN produce DG 8000 Smoke Meter.
9. The fuel consumption was measured by weighing fuel at measured times.
10. The results reflect single measurements and are not representative of a statistic sampling collection.

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Results of the Series of Tests with a Chassis Dynamometer

1. The stabilizer helped in reducing CO emission by an average rate of 50.4%/ It should be pointed out that, as a rule, the rate of CO emission from diesel engines is very low compared with the emission rate of this component from petrol engines.
2. The HC rate of emission from diesel engines is also low compared with the emission rate of this component from petrol engines. The measured rates were between 2 and 16ppm, therefore they have no practical significance. However, it should be pointed out that except for the medium load test (apparently a measuring error), the average reduction rate is 36.5%.
3. The stabilizer helped in reducing NOx emission by a rate of 12.8%.
4. The stabilizer helped in lowering the level of the particles' emission by a rate of 3.5%.

Results of the Series of Tests with an Engine Dynamometer

1. The stabilizer helped in reducing CO emission by an average rate of 11.1% according to the first protocol and by an average rate of 25.5% according to the second one. As a rule, the rate of CO emission from diesel engines is very low compared with the emission rate of this component from petrol engines.
2. The stabilizer helped in reducing HC emission by an average rate of 5.1% according to the first protocol and by an average rate of 16.2% according to the second one. As a rule, the rate of HC emission from diesel engines is very low compared with the emission rate of this component from petrol engines.
3. The stabilizer helped in reducing NOx emission by an average rate of 13.9% according to the first protocol and by an average rate of 3.3% according to the second one.
4. The stabilizer helped in lowering the smoke emission level by a rate of 15.1% according to the first protocol and by an average rate of 23.4% according to the second one.
5. The stabilizer helped in reducing the fuel consumption by an average rate of 5.5% (9% according to the first protocol and by a rate of 2.0% according to the second one).

Conclusion:

From the results obtained from the series of tests described above it can be concluded that the ALGAE-X 500 fuel stabilizer has a contribution in lowering air pollution emitted from diesel engines, including lowering the level of the NOx emitted and the smoke emission rate. From the above results the contribution in the other tested components may also be noted.

Very respectfully,

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Table Nr. 1: Summary of Chassis Dynamometer Results – Truck (Volvo) data and rates of polluters measured at the engine's different operating regimes.

		RPM kW	Neutral 650 0	v=36-39 800 25-26	v=47-49 1350 46-45
		Vehicle Nr.		17-904-15	
Before installation Nov. 5, 2006	vol. %	CO	0.039	0.023	0.023
	vol. ppm	HC	16	2	5
	vol. ppm	NOx	123	449	389
After installation	vol. %	CO	0.036	0.006	0.007
	vol. ppm	HC	11	6	3
	vol. ppm	NOx	110	434	293

Table Nr. 2: Summary of engine dynamometer results according to the first protocol, i.e., at each working regime the (Ford Transit) engine was fed continuously by moving a gate valve once thru the engine's normal fuel piping and once thru the magnetic stabilizer. W/O – without the instrument.

	Point by Point					
	Idle W/O	Idle	1200 W/O	1200	1800 W/O	1800
Torque [N*m]	0	0	95.5	93	122.5	121
CO [%]	0.04	0.02	0.03	0.04	0.05	0.02
HC [ppm]	18	15	22	37	2	0
NOx [ppm]	140	140	500	450	610	610
Smoke [%]	5.8	5	46	26	23	20
O2 [%]	18	18.3	10.2	9.5	8.5	8.7
CO2 [%]	1.75	1.69	7.21	7.21	8.39	8.36
Fuel [g/min]	6	6	52	50	94	92

Table Nr. 3: Summary of engine dynamometer results according to the second protocol, i.e., the (Ford Transit) engine was tested without stabilizer at three operating regimes one after the other and then it was tested at the same regimes with the stabilizer.

	Map after Map					
	Idle W/O	Idle	1200 W/O	1200	1800 W/O	1800
Torque [N*m]	0	0	100	99	127	127
CO [%]	0.02	0.02	0.03	0.02	0.04	0.04
HC [ppm]	11	11	14	11	16	17
NOx [ppm]	120	110	460	410	620	480
Smoke [%]	3	3.5	18	10	23	19
O2 [%]	18.7	18.7	10.3	10.3	7.7	7.6
CO2 [%]	1.58	1.55	7.27	7.24	9.08	9.12
Fuel [g/min]	8	6	50	50	96	94

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Table Nr. 4: Results of the particles' measurements obtained from the chassis dynamometer tests.

Truck 1	No. of Particles per liter of diluted air									
bins	0.3-0.39u	0.4-0.49u	0.5-0.64u	0.65-0.79u	0.8-0.99u	1.0-1.5u	1.6-1.99u	>2u	m3/lit	mg/m3
T1-idle	189,406	52,369	35,855	14,493	9,350	5,143	468	1,870	2.86E-14	57.23
T2-idle	149,622	61,083	32,993	12,078	8,954	5,362	256	1,720	2.64E-14	52.75
T3-36km/h	672,027	101,080	57,233	16,830	11,843	5,610	4,363	2,493	5.37E-14	107.41
T4-39km/h	587,600	114,816	62,786	17,645	10,276	5,380	4,620	2,560	5.37E-14	107.39
T5-47km/h	901,900	139,650	49,582	13,600	7,387	6,233	3,400	567	4.29E-14	85.84
T6-49km/h	830,458	123,117	51,419	12,584	7,843	6,483	3,310	483	4.08E-14	81.57

Attachment: Declaration

Rishon, December 3, 2006

DECLARATION

I, the undersigned, hereby confirm by my handwritten signature that the tested truck license number 17 904 15, was refueled during the subject period (from October 05 thru December 03) with regular fuel only.

I hereby declare that to the best of my knowledge no treatment what so ever was given to the truck's engine during the above mentioned period of time (no cleaning what so ever, injection or valves adjustment, filters replacement, oil replacement and so forth), except for the above addition.

Name and duty of the signatory:

Aharon Raby, Transportation Manager

Tel Aviv – Jaffa Municipality

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