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Summary of the Test of FPC-1[®] by The University of Perugia, Perugia, Italy

This paper summarizes the results of tests with FPC-1[®] conducted by the University of Perugia, Perugia, Italy. The study discusses the results of steady-state engine tests (constant load and rpm) in a four cylinder diesel engine mounted in a test cell at the University of Perugia, Institute of Energy. The intent was to determine the effect of the FPC[®] catalyst upon fuel economy, power output, and exhaust emissions.

Fuel Economy

The results of the fuel economy tests are tabled below:

Table 1. Change in Fuel Consumption and Power Output after FPC-1[®] Fuel Treatment

<u>Engine Load</u>	<u>Fuel Consumption Chg</u>	<u>Power Output Chg</u>
None	-5.7%	*****
Low Load	-3.7%	+5.1%
High Load	-3.5%	+4.2%

Two types of tests were conducted. The first determined the change in fuel consumed for the same time of work, and the second determined the change for the same electrical power output.

The data shows engine efficiency improved as the engine operated longer on FPC-1[®] treated fuel. This is known as the engine pre-conditioning period which has been observed in dozens of tests with FPC Catalyst.

Further, the author of the study also points out that these steady-state tests create conditions that minimize the potential for improvement, and that "**engines operated under variable loads and engine speed should experience even greater improvements**". This statement agrees with the opinions of other combustion experts, and with prior experience with FPC[®] catalyst field trials.

Exhaust Emissions

Exhaust emissions were also positively affected by the addition of FPC-1[®] to the diesel fuel powering the test engine. Gaseous emissions measured included sulfur dioxide (SO₂), carbon monoxide (CO), carbon dioxide (CO₂), and oxygen (O₂). Particulate or solid emissions were measured as smoke using a smokemeter (opacity).

The results of the emissions tests are found on Table 2 below:

Table 2. Change over Baseline in Exhaust Emissions after FPC-1[®] Fuel Treatment

<u>Emittant</u>	<u>Chg at Low Load</u>	<u>Chg at High Load</u>
SO ₂	-21.0%	***.**
CO	-19.5%	-24.0%
CO ₂	- 5.3%	- 1.4%
O ₂	1.7%	0.4%
smoke (opacity)	-40.0%	-25.0%

All emissions were positively affected by the addition of FPC-1[®] to the diesel fuel. However, of greatest interest is the effect upon sulfur dioxide (SO₂) emissions and the products of incomplete combustion (CO and smoke).

SO₂ is a precursor to sulfuric acid, which is detrimental to both the engine and the environment. With reductions in SO₂, the engine operator can expect acid accumulation in the motor oil to be slowed dramatically. Oil life will be extended, and engine wear due to acid corrosion minimized. This could be a critical issue to fleet operators who purchase diesel fuels high in sulfur content.

In addition, reduced SO₂ escaping into the atmosphere will reduce the impact of acidic rain and vapors upon pedestrians and the environment. In congested areas, such as large cities with heavy traffic, this effect equates to reduced irritation to sinuses and lungs, and reduced burning of the eyes, from inhalation of or exposure to the exhaust fumes. Reduced SO₂ emissions would impact the formation of acid rain, which both damages the environment and destroys the stone and brick of buildings and other structures.

CO and smoke are products of incomplete combustion, and as such represent energy losses to the engine. They are also harmful to the human body and the environment. These data agree with the considerable data already available that also documents FPC[®] catalyst's ability to greatly decrease these harmful and energy robbing exhaust emissions.

By combusting the fuel more rapidly and more completely, the energy available from the fuel is used inside the engine to produce power. Engine efficiency is improved, and the fuel dollar is conserved. Further, with more of the fuel burned before the exhaust valve opens, fewer of these harmful compounds reach the atmosphere, and your lungs and eyes.

Conclusions

- 1) FPC-1[®] fuel treatment reduced fuel consumption an average 3.60% under loaded conditions, and 5.7% with no load.
- 2) FPC-1[®] fuel treatment increased power output an average 4.65% under loaded conditions.

3) All exhaust emissions were positively affected. Of particular importance are the 21.5% reduction in SO₂, the 21.75% average reduction in CO, and the 32.5% average reduction in smoke. The reduction in the products of incomplete combustion (CO and smoke) verifies the catalyst is conserving more of the fuels energy for use inside the combustion chamber.

4) A definite engine pre-conditioning period was observed. Engine performance improved the longer the engine operated on FPC-1[®] treated fuel. No leveling off of the improvement trend was observed in the data, and therefore, improvements would have been greater with longer testing time.

5) The improvements observed in this test run under ideal engine conditions represent minimums, and will be greater when FPC[®] catalyst is used in engines operating under more variable, transient conditions.

Note: All FPC products, including FPC-1[®], FPC-1.5[®] and FPC-2[®], contain the same active ingredient.

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