



Enzymatic fuel additive **Combustion assists**
Developed by Biotechnology in Japan



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Petro EXL brings various benefits especially on **COST REDUCTION** and **POLLUTION CONTROL** by improvements of combustion environment, removing sludge & carbon and reducing soot.

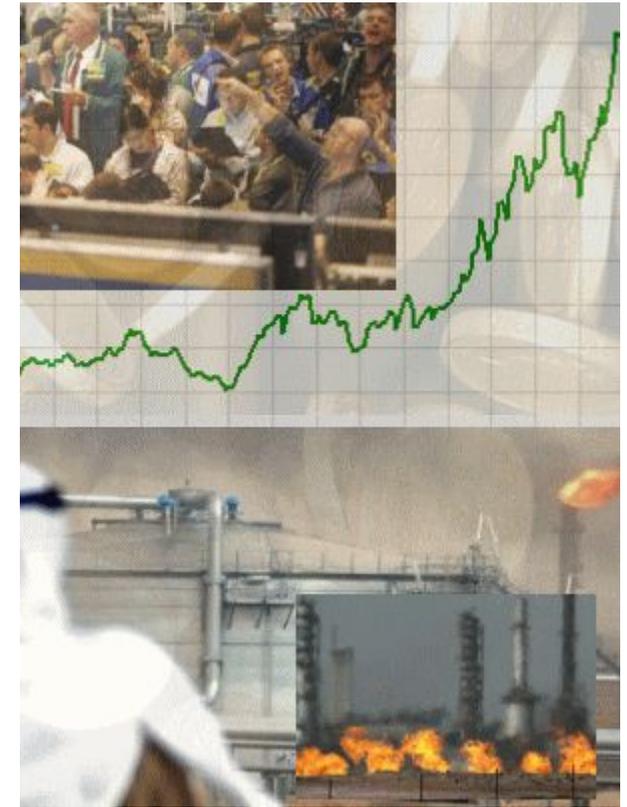


Petro EXL



Reduce Pollution

- Reduce Air pollution factors like SO_x, NO_x, CO, etc
- Reduce Black smoke and Harmful corpuscles in Exhaust
- Does not create collateral air contamination (Does not like metallic base fuel additives)



Reduce Cost

- Improve Fuel efficiency
- Reduce Periodical engine overhaul cost
- Reduce Engine maintenance cost

Easy handling

- Does not require agitation, just adding to your fuel
- Requires only 1/10000 of the petroleum amount
- Does not choose kind of petroleum (gasoline, kerosene, light & heavy oil, etc).

The active materials of Petro EXL

Petro EXL was developed by Biochemical technology in Japan, Ferment microbe in especially composed kerosene based culture solution.

The active materials of Petro EXL are produced by symbiotically cultured 2 different characters of microbes in our especially composed kerosene based culture solution.

1) Group of enzymes (Sludge dispersion effect)

Disperse the sludge preventing the sludge particle forming to grow the size

- Dispersing sludge gradually
- Reducing Soot and Carbon slag
- Controlling corrosion of parts and equipments
- Preventing black smoke
- Reducing harmful factors SOx, NOx, CO and etc.
- Cleaning (Oil tank)

2) Esters (Combustion accelerating effect)

After culturing, we specially process intramolecular-esterrification. Those Esters are stable, but when combust petroleum, Esters will be dissolved and produce peroxide material, which accelerate combustion.

- Accelerating combustion
- Accelerating complete combustion

3) 4-Acetylcyclohexane (Removing sludge, carbon and soot effect)

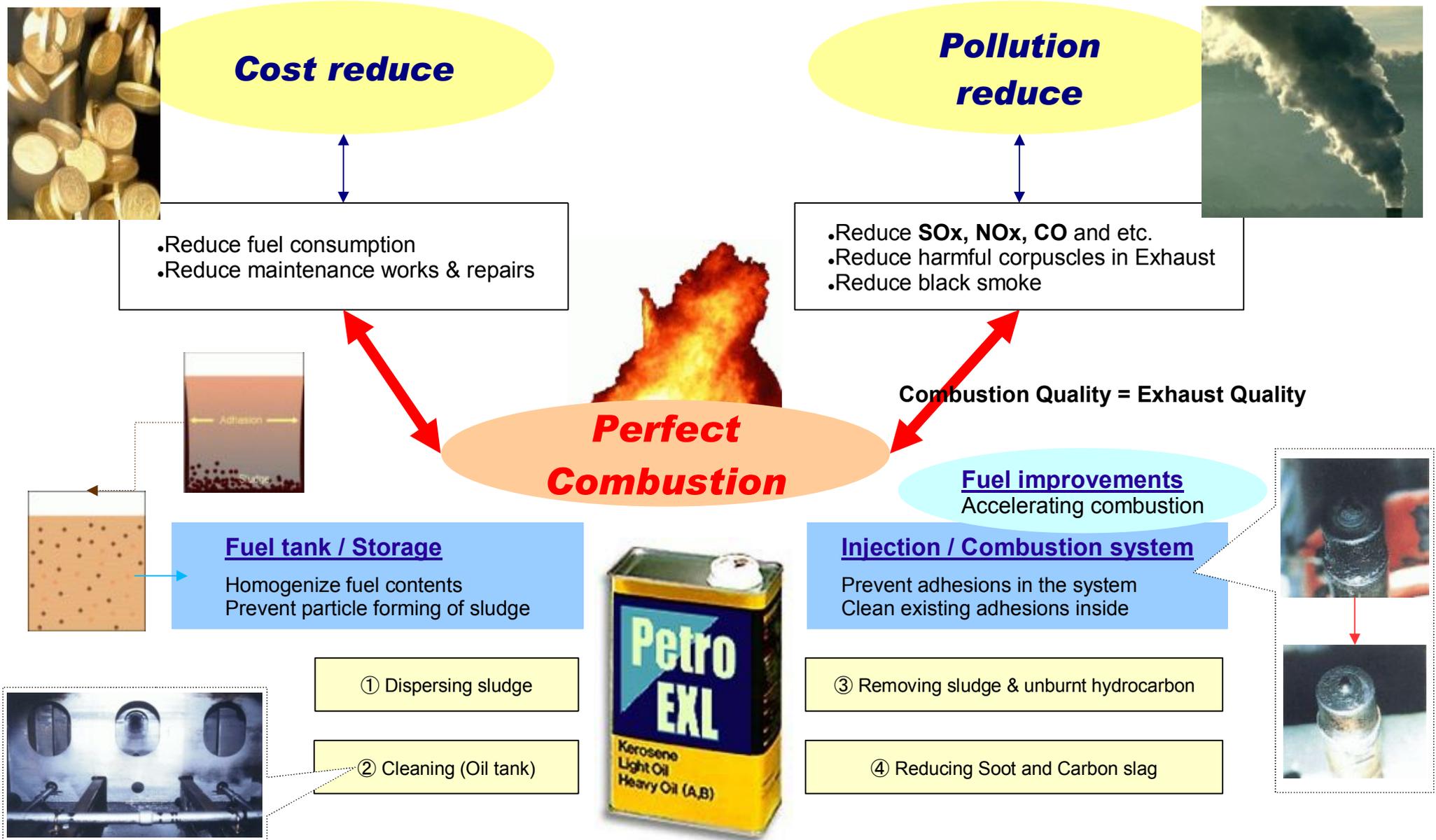
This material is a newly found material through our technology of culturing, which removes sludge & unburnt hydrocarbon and reducing soot as the main purpose of the product.

- Improving fuel efficiency and saving fuel
- Improving anti-knocking
- Prevent producing hard slug at high temp. area



Mechanism

Petro EXL is **Biological fuel additive combustion accelerant** designed to aim **Perfect Combustion**, which can be expected reducing Cost and Pollution.



Synergy effects

Synergy effects of the product can be listed by the test results with diesel engines from research institutes as follows.



Proof tests at Research institutes

Ministry of Land, Infrastructure, Transport and Tourism

Ship Research Institute ②⑥⑦⑧

National Research Institute for Pollution and Resources

Lubricant Institute ③

National Fuel Institute in Italy

Stazion Sperimentale

per I Combustibili

Dr. Salvi (lab) ②

L' AQUILA University in Italy

Engineering Lab

Machine Engineering Lab ②⑥

Middlesex Polytechnic in UK

Consultancy Services Organization

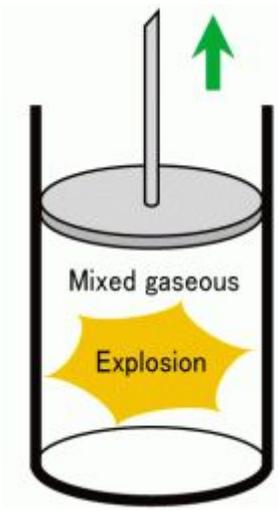
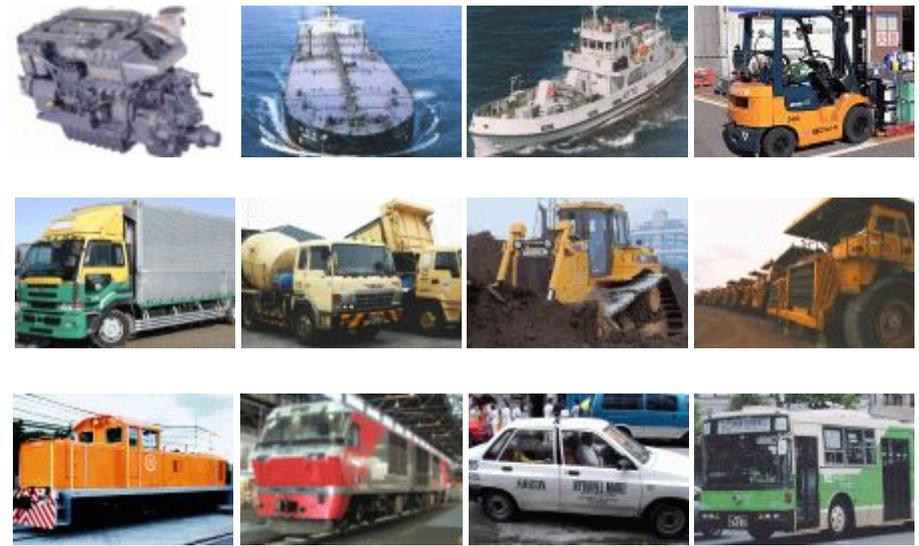
Energy Engineering Lab

Dr. S. H. Ahmad ①②③④⑤⑥

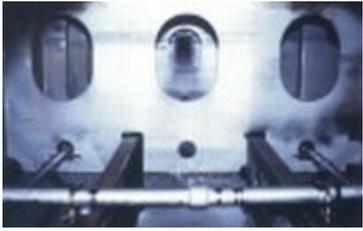
... etc.



DIESEL Engine

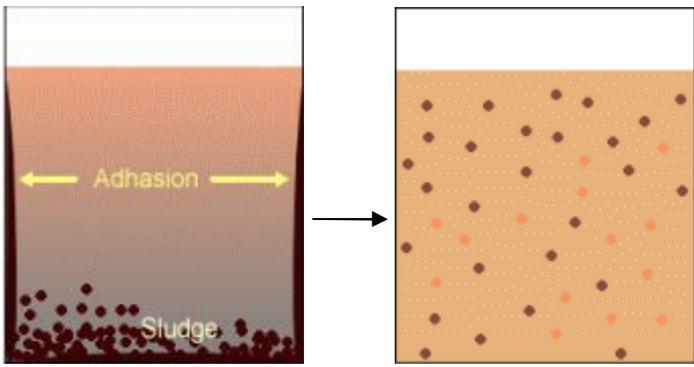


Internal Combustion



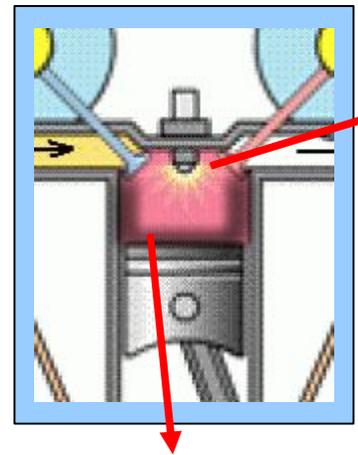
Storage / Refuel system Fuel tank

- Homogenizing fuel contents
- Preventing particle forming of sludge
- Cleaning adhesion on inside of tank

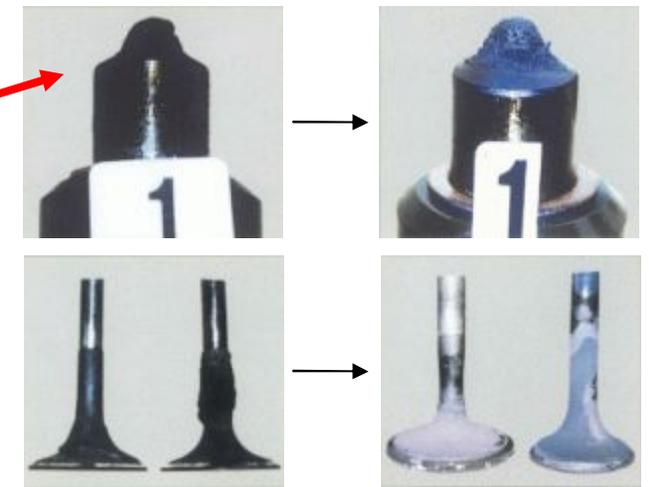


Injection / Combustion system Inside of Engine

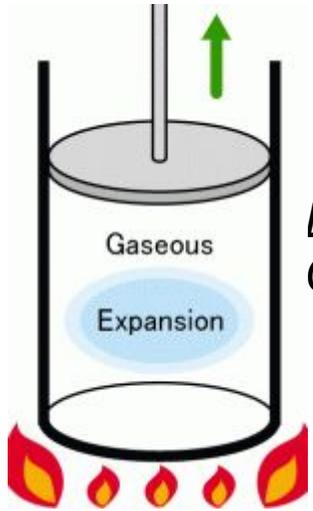
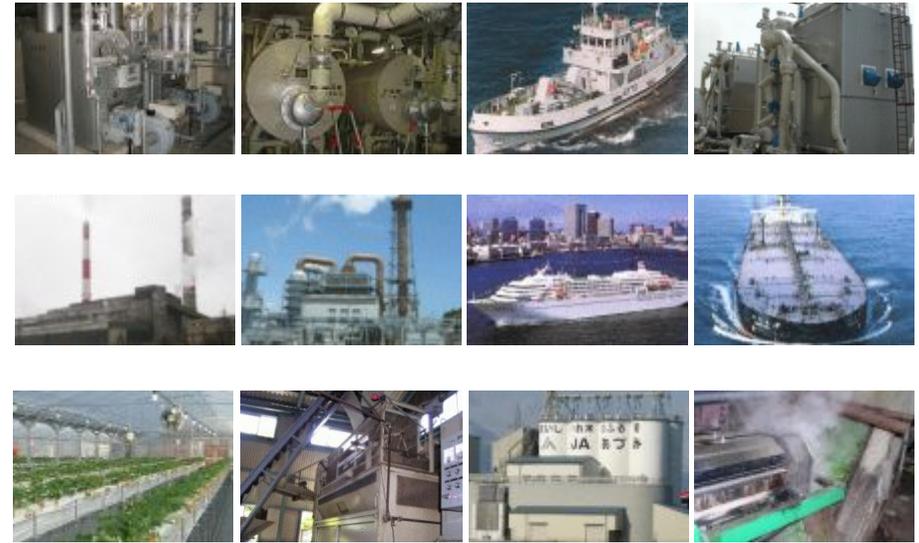
- Preventing Unburnt-carbon adhesion
- Cleaning Unburnt-carbon adhesion inside of the system, connecting pipe, Injection parts and combustion area



Unburnt-carbon adhesion



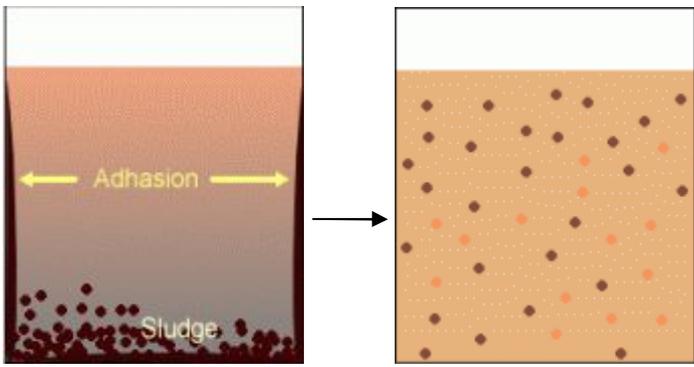
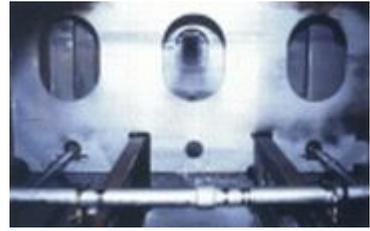
BOILER / incinerator



External
Combustion

Storage / Refuel system Fuel tank

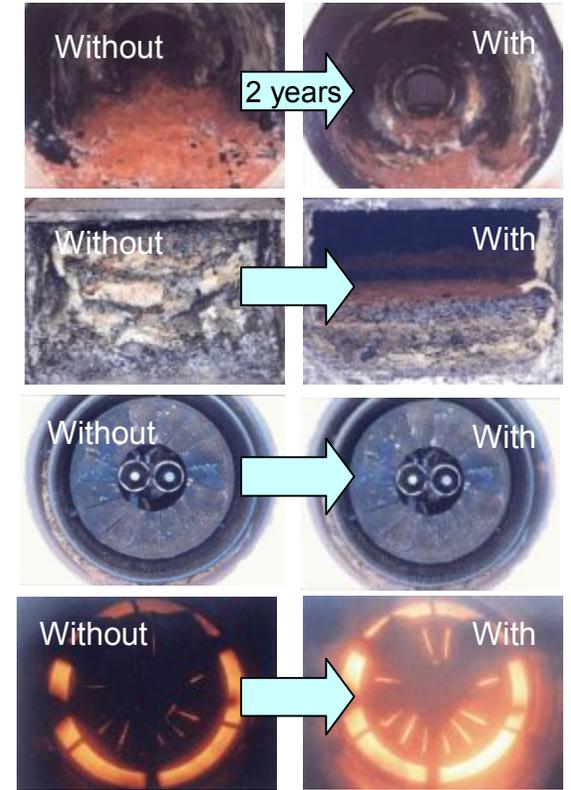
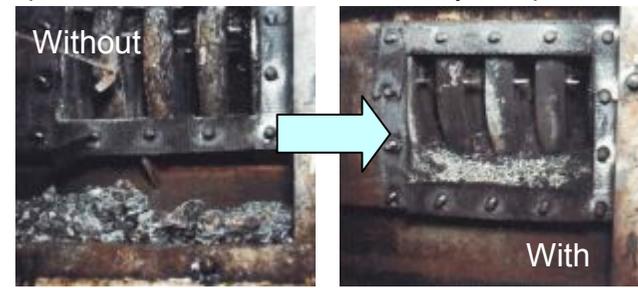
- Homogenizing fuel contents
- Preventing particle forming of sludge
- Cleaning adhesion on inside of tank



Combustion Chamber Boiler / incinerator

- Preventing Unburnt-carbon adhesion
- Cleaning Unburnt-carbon adhesion inside of the system, connecting pipe, fuel parts and combustion area
- Petro EXL has remarkably reduced contamination on Diffuser and deposit of Furnace bottom as you see on the pictures.

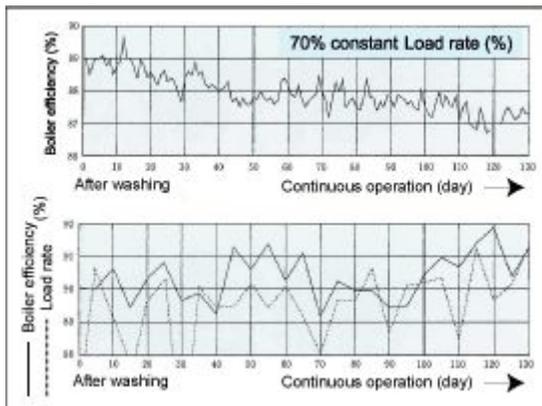
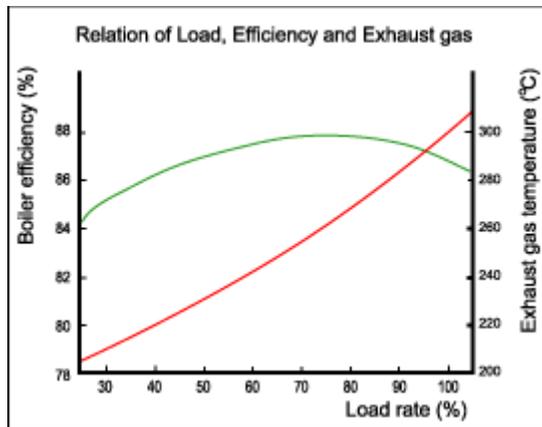
Deposit of Furnace bottom after 100 days of operation



Combustion Efficiency

Relation of Load, Efficiency and Exhaust gas Boiler / incinerator

- Generally, the peak of Boiler efficiency points with certain Load rate.
- The low Load rate causes incomplete combustion and leads low Boiler efficiency.
- The high Load rate causes high Exhaust gas temperature and also leads lower Boiler efficiency.



Even if the boiler is operated at constant Load rate, Boiler efficiency will gradually drop down with time being.

When 0.01 % of Petro EXL was added to the fuel, Boiler efficiency kept in good figure.

Air ratio and Fuel consumption Boiler / incinerator

Everyone knows reducing Air ratio is one of the ways to reduce fuel consumption, therefore generally, Air ratio is set at a minimum ratio without creating too much incomplete combustion.

Accelerating combustion effect of Petro EXL was proved by Air ratio test at Japanese client.

Without Petro EXL, Air ratio was set at 1.5 and still confirming incomplete combustion. (Below chart)

	CO2%	O2%	CO%	Air rate
1	11.2	5.4	1.6	1.27
2	11.4	5.3	0.8	1.29
3	10.4	6.8	0.8	1.40
4	9.5	7.8	0.5	1.53
5	9.3	8.0	0.2	1.56
6	9.2	8.1	0.2	1.57
7	9.2	8.2	0.4	1.58
8	9.0	8.4	0.6	1.59

Gas composition test in Furnace without Petro EXL

With Petro EXL, Air ratio could reduce to 1.1 - 1.2 without incomplete combustion.

The client was succeeded to reduce 19% of fuel consumption.

Exhaust quality

Exhaust gas / smoke control

Diesel engine / Boiler / incinerator

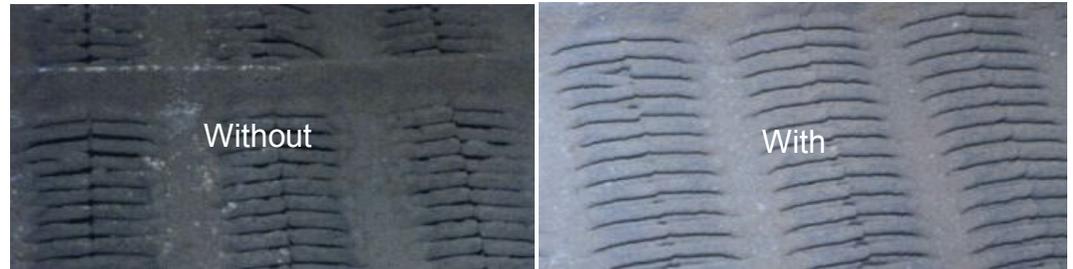
- The black smoke and corpuscles in the smoke can be reduced by Petro EXL. The effect will appear in quite early stage. It was also confirmed at the field test as the below pictures.
- At the laboratory test (long period continuous driving with Heavy oil), black smoke and corpuscles in smoke were significantly reduced then maintain.
- The improvements of smoke control has been confirmed as **improvements of combustion** on all tests of applications, Internal combustion and External combustion, such as vessel, automobile, boiler, incinerator and etc.



Internal cleaning

Diesel engine / Boiler / incinerator

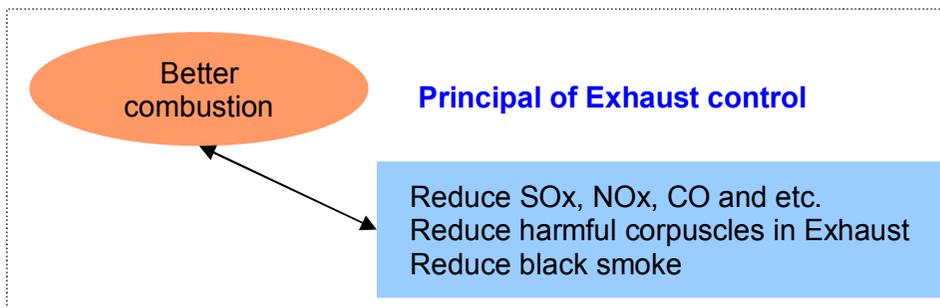
- The improvements on exhaust gas / smoke will be preventing stain damage and corrosion on Exhaust system, and it would be effective on maintenance of Exhaust system equipments (e.g., Exhaust gas economizer, Turbocharger and etc.)
- The below pictures are Exhaust gas economizer of vessel before cleaning.



Improvements of Exhaust gas composition

Diesel engine / Boiler / incinerator

- One of the way to prove improvements of combustion is analyzing the composition of Exhaust gas, which was done on all other applications, bus, truck, vessel, boat, boiler, incinerator, thermal generation and etc.
- Test results shows Petro EXL reduce harmful materials of CO, SOx, NOx in Exhaust.
- One of the main purpose of adopting Petro EXL is Exhaust gas and smoke control, indeed.



VESSEL



Test Results

It is hard to fix the fuel test condition for vessels due to the load factors, such as weather, waves, tidal current, wind direction, wind force, draft, vessel speed, etc., therefore the following data is from long period of research on regular ferries:

Fuel saving rates

Ferry B (Seto Inland Sea)	Heavy oil B	5.9%
Ferry T (Tokyo Bay)	Heavy oil B	4%
Ferry S (Tachibana Bay)	Heavy oil C	3%
Ferry G (Seto Inland Sea)	Heavy oil C	3%



Maintenance reports ^L

(Comparison of 2 Deep sea fishing vessel with Petro EXL and without)

	Vessel with Petro EXL	Vessel without Petro EXL
Fuel valve nozzle	Replacement every 4 voyages	Replacement every 1 voyage
Lubricating oil	Annual replacement	Semiannual replacement
Piston combustion chamber	No contamination	Difficult to remove contamination
	No carbon adhesion	Difficult to remove solid carbon from the cooling room
Exhaust valve	Usable for 1 year	Semiannual replacement required
Intake valve	Usable for 2 years on normal condition	Annual overhaul



Deep sea fishing vessels



Vessel boiler



Vessel diesel engine

Petro EXL has been adopted by various major shipping & ferry transport companies mainly in Japan, also some clients in Asia.

VEHICLE



Test Results

TEST at Route transportation

The exhaust gas opacity is also satisfactory. Lubrication-oil test result showed a trend of decreasing deterioration. (Insoluble contents of N-Pentane and Benzene had reduced 50%)

Field data of fuel consumption	- 7.5 % (Ave.)
Smoke exhaust	- 36 % (Ave.)

Data analysis of route buses



Heavy vehicles and equipments

Petro EXL has been tested and adopted by transport and logistic companies in Japan, and some in Asia.

Logistic company

M Company, a major logistic company in Japan conducted further tests and confirmed the average of approx 8% decrease of fuel consumption. Due to the test result, M company has adopted Petro EXL.



Taxi & transportation



Trend of a lessening of deterioration In Philippines, Taxi drivers have reported reducing 10 - 15% of fuel consumptions and better car condition, and they are placing repeat orders. The market is kept growing.



TRAIN



Test Results

On the trial field tests with passenger trains (diesel locomotives) in Japan and overseas had shown remarkable improvements on Fuel Efficiency and Exhaust smoke rate.

On the further field tests were arranged by Japanese Railway Company with diesel locomotives, comparing one pair of diesel engines with Petro EXL and another pair without Petro EX. The result came out with 7 - 8 % of fuel saving with Petro EXL.



AGRICULTURE

Test Results

Petroleum is essential to Modern agriculture. Petro EXL provides easy control of low-temperature-drying, e.g. rice, mushrooms, leaf tobaccos and etc., especially preventing absorption of unburnt fuel smell, which is serious damage for agricultural products. Today, numbers of people have recommended and adopted Petro EXL, such as JA (Japan Agricultural Cooperative Association), Prefecture Economic Federations and individual Rice farmers.

Grain elevator

Wheat may be dried at a high temperature. However, Rice is dried in granary like under the sun; therefore the temperature control is very difficult. Petro EXL helps stabilizing drier operation, which improved temperature variation, fuel consumption and labor cost.



Greenhouse boilers

Heavy Oil A, for primary industry, is blended various type of oil, which commonly causes ignition problem especially in cold days. Petro EXL homogenizes oil contents and improves combustion efficiency and ignition problem.



Grain elevators

COAL

Test Results

There are large demands of Coal in the world, requires high temperature industries, such as Cement plant, Thermal power generation plant, Steel plant, Paper mills and etc., but today, there are social concerns on air contaminations by pollutants from Exhaust smoke of coal.

Petro EXL is adopted by Paper mills mixing with powdered coal to accelerate combustion, and confirmed reducing Coal ashes at our client down to 1/3.

Petro EXL is also used with briquette coals for accelerate combustion purpose but also controlling the generation of Carbon-Monoxide, which confirmed at our client down to 1/6.

By request of Chinese industries, we have developed and will release **Coal EXL** soon, designed more economically focused on coal application.



- 1) Adding 1/10000 of the petroleum amount^L directly into Fuel tank or Fuel storage tank^L "Gasoline, Kerosene, Light & Heavy Oil, etc."^L



Petroleum	Petro EXL
1 L	0.1 cc
40 L	4 cc
100 L	10 cc
500 L	50 cc
1,000 L	100 cc
10,000 L	1,000 cc

- 2) For coal application
 Adding 1 liter of Petro EXL into 10 tons of Powdered-coal
 Adding 2 - 3 drops of Petro EXL on Briquette Coals

Main component

Kerosene based plant enzyme derivative

Handling^L

Keep out of ignition sources such as fire, static electricity, sparks, etc.
 Prevent leakage

Storage

Seal the container for preventing leakage
 Store the product in dark and cool
 Keep out of direct sunlight^L
 Store the product under the provisions of Fire Defense Law, etc.^L

For details, refer to the Material safety instruction sheet issued by Manufacture

Example of applications

Vehicles
 Vessels
 Diesel Trains
 Vessels
 Boilers
 Agriculture
 Construction
 Heavy duty equipments
 Incinerator
 Thermal power generation
 Coal application



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 Eco products
 to the Globe

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