성능인증제품

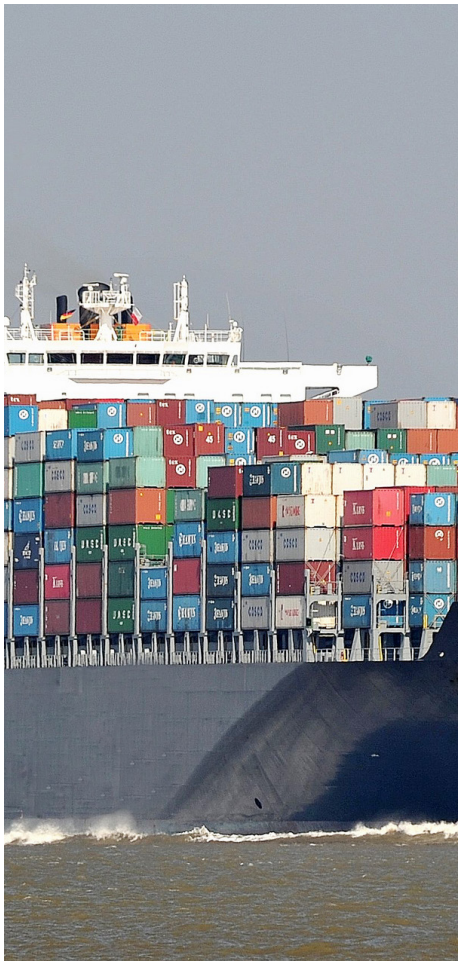
녹색인증
Green Certification

www.technobio.co.kr

Eco-friendly fuel additive

POWER-Z

Power-Z facilitates complete combustion by re-forming particles in fuel into super-fine ones.



POWER-Z®

Introduction of Power-Z

EXPECTED EFFECTS

Prevention of air pollution

- Reduction of PM(Particulate matter) exhaust(approx. 50%)
- Reduction of NOx exhaust(approx. 20~30%)

Stabilization of vessel engine

- Cleaning effect of storage tank
- Cleansing effect of explosion section of engine
- Removing effect of soot inside boiler tube etc.

Saving of fuel cost

- Vessel of 40 ton/day : saving of $50,000 worth of fuel cost per year
- Small vessel : saving fuel cost of approx. 5%
- Large vessel : saving fuel cost of approx. 3%

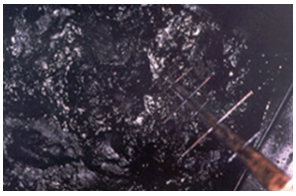
Stabilization of vessel operation and saving of its operation costs

- Carbon removing effect (after use of 600 hours)
- Transforming sludge into fuel through its dispersion

3 Unique technologies

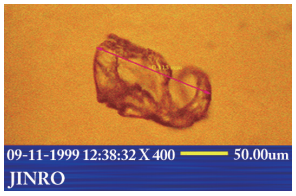
DISPERSANT EFFECT

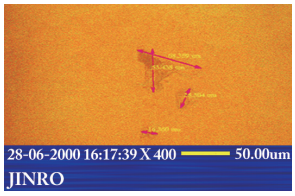
Transform the sludge inside bunker tank containing low quality of oil into fuel.
(stabilization of vessel's engine and decrease of fuel consumption rate)



ULTRA-ATOMIZATION OF FUEL

Homogenize and maximize its vaporization rate by ultra-atomizing fuel during its injection
(Enhancement of fuel efficiency)





COMPRISAL OF OXYGENATED SUBSTANCES

Lead to rapid combustion and explosion at low temperature through containing oxygenated substances.
(Reduction of the rate of NOx, PM)

Introduction of Power-Z

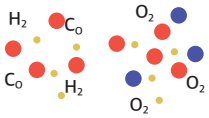
With POWER-Z

Cracking ····· **Fuel-injection** ···· **Ignition** ····· **Combustion** ····· **Exhaust**

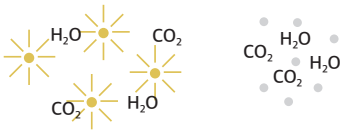
Particle of
long carbon chain
▶breaking down to fuel particles
of short carbon chains
- results in minifying the size of each fuel particle.
- results in increasing the number of fuel particles.

- results in increasing the whole oxygen surface dimension.

- low ignition point
- rapid combustion, low-temperature explosion
- reduction of supplied air volume by 20-30% (decrease of NOx)



Drastic increase of O_2 volume and buring oxidation
- reduces fuel consumption by curbing the volume of fuel flow through drastic reduction of excessive air volume. (also results in decreasing effect of NOx emission)
- decreases unburned carbon through complete combustion.
- increases heat calory through generating big volume of O_2 gas.



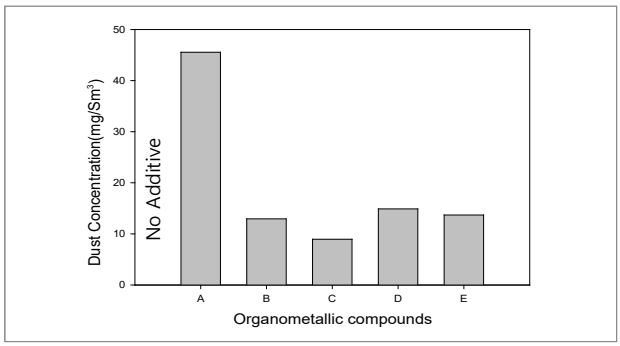
- reduces harmful exhaust gas. (PM, NOx, CO)
- removes Soot and Hydrocarbon through converting them into soft and smooth particle state

Precondition for development of oil soluble organic-calcium additive

- Reduction performance of PM (dust) should be superior to the existing fuel additives.
- Eco-friendly material should be used. Among domestically distributed ingredients of additive, Fe, Ba and Mn etc. are classified as air pollution substances according to the Article 2 of the Clean Air Conservation Act. The products of our competitors are produced by using these air pollution substances, though.

■ Reduction Effect of fine dust(PM)

- Optimum amount of addition : approx. 30ppm of heavy oil quantity is recommended to be added on a organometal basis.
- Out of the target samples of fuel accelerator, one of excellent performance indicated the reduction rate of about over 50%.
- The compound of Fe and Ba belongs to air pollution substances.



A : No additive
B : Iron(III) compound
C : Calcium compound
D : Manganese(II) compound
E : Barium compound

Source : Final Report issued by Korea Institute of Energy Research in March , 2009
as part of Korean Ministry of Environment's Core Environment Technology Project

Outline and application of TCS System

■ Outline

For the purpose of optimization of vessel operation, data are to be collected and verified through application of diverse greenship technologies (SCR, Silicon, Paint, Optimum trim, Slow steaming etc.) to vessel.
Based on these data, the Greenship technology certification system is built up on the foundation of international suitability evaluation system. The formalities for international greenship technology verification and technical standards are both to be developed through this verification system, and these standards are aimed at setting up as international standards through international marine organizations.

■ Application

The aim of TCS System is to realize eco-friendly vessel operation through building the greenship TCS system. This is the system for leading each of the equipments to the optimized operation condition, pertinent to the minutely collected, saved and measured data of over 366 kinds related to individual energy flow and navigation related data from TCS system-(Testing, Certification, Standard System) equipped vessels.

Performance test results of the fuel accelerator conducted by Hanjin Shipping Co., Ltd.

Specification of MV Hanjin Europe

Hull specification

DELIVERY DATE	2012.05.04	LOA	366 M
CONTAINER CAPACITY	13102	HEIGHT	54.764
DEAD WEIGHT	140973	DRAFT	15.5553 M
BUILDER	HHI	SERVICE SPEED	23.7
GROSS TONNAGE	141754	FO CONSP_MT/DAY	236.4

Engine specification

	MAIN ENGINE	GENERATOR ENGINE
MAKER	HYUNDAI-WARTSILA	HYUNDAI-HIMSEN
TYPE	12RT-FLEX96C	8H32/40 (2SETS)
		6H32/40 (2SETS)
BHP/RPM	68,640 KW/102 rpm	4,000 kw (8H32/40)
		2,950 kw (6H32/40)

Performance test results of the fuel accelerator conducted by Hanjin Shipping Co., Ltd.

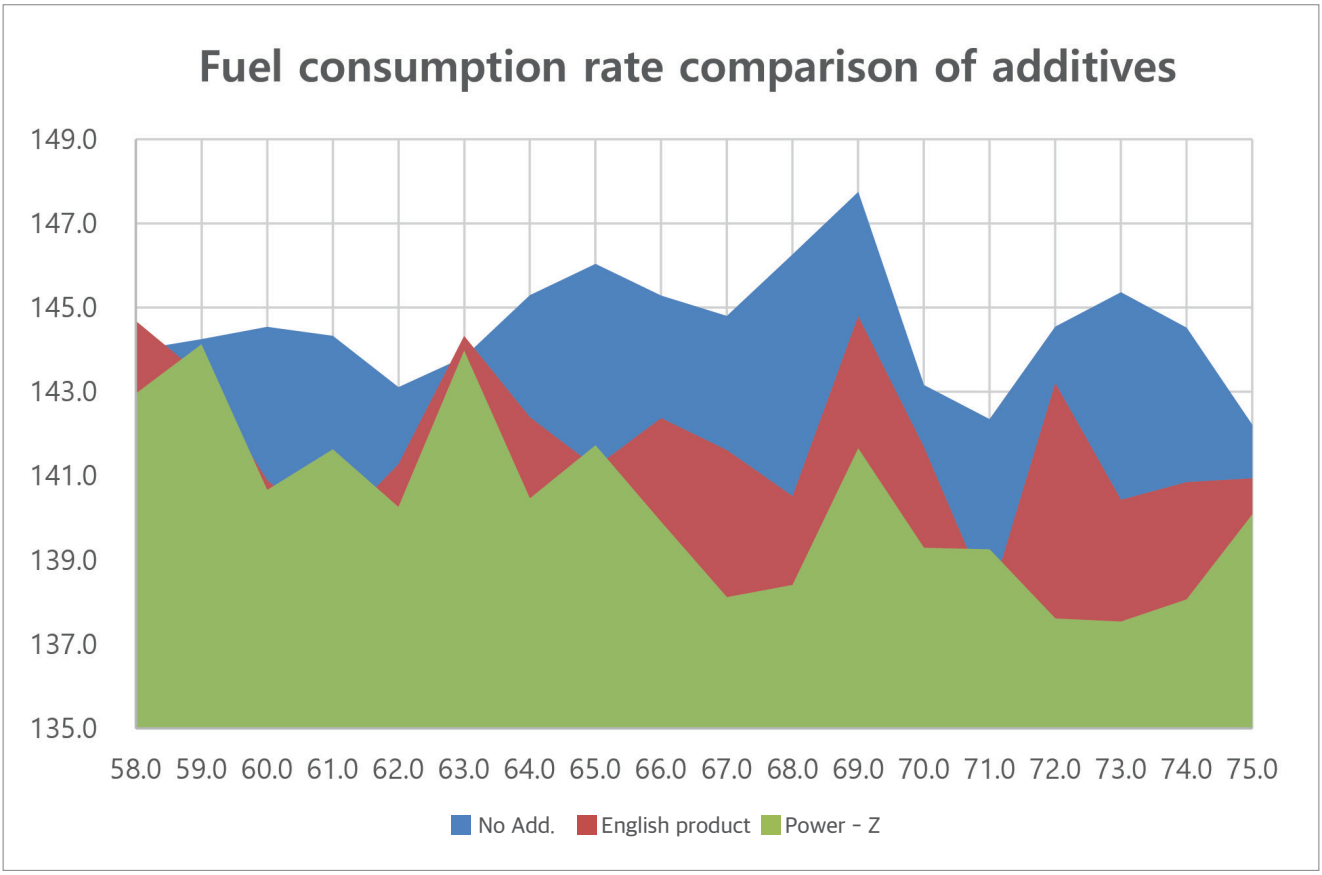
Results of performance test

1. TCS system - equipped vessel
2. Utilization of Noon Report due to the Mass flow meter failure
3. Production of comparison data between english company's product and Power-Z

PERIOD	ADDITIVES	Fuel reduction rate
2012.05.12 ~ 2013.12.31	NO additives	0%
2014.01.01 ~ 2014.10.09	English product	1.5%
2014.10.20 ~ 2016.01.18	Power-Z	2.5%

RPM	Dealing method	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	Average
Add	No Add.	144	144.2	144.5	144.3	143.1	143.8	145.3	146	146	144.8	146.3	147.7	143.2	142.3	144.5	145.4	144.5	142.2	144.5
	English product	144.7	143.4	140.9	139.7	141.3	144.3	142.4	141.2	142.4	141.6	140.5	144.8	141.7	138	143.2	140.4	140.8	140.9	142.3
	Power-z	143	144.1	140.7	141.6	140.3	144	140.5	141.7	139.9	138.1	138.4	141.6	139.3	139.3	137.6	137.5	138.1	140.1	140.8
Reduction rate	English product	0.49	-0.55	-2.49	-3.19	-1.26	0.35	-2.00	-3.29	-2.00	-2.21	-3.96	-1.96	-1.05	-3.02	-0.90	-3.44	-2.56	-0.91	-1.5
	Power-z	-0.69	-0.07	-2.63	-1.87	-1.96	0.14	-3.30	-2.95	-3.72	-4.63	-5.40	-4.13	-2.72	-2.11	-4.78	-5.43	-4.43	-1.48	-2.5

Performance test results of the fuel accelerator conducted by Hanjin Shipping Co., Ltd.



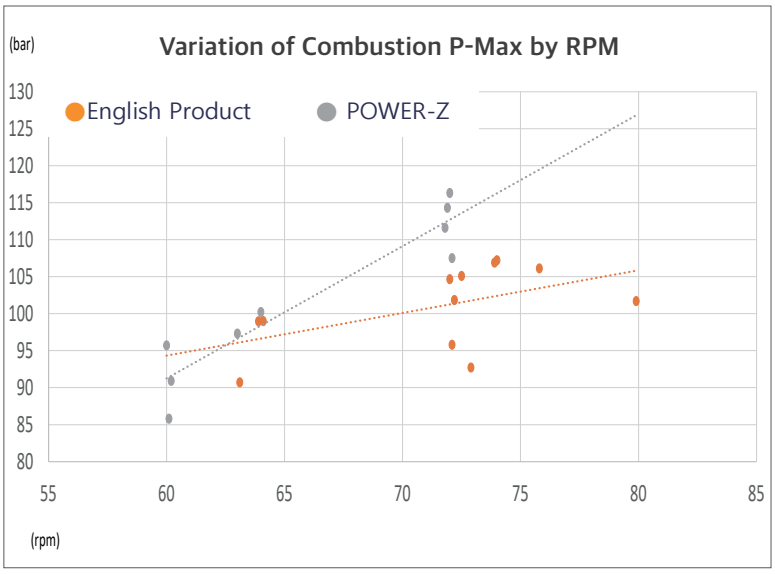
Measured results of fuel consumption rate by RPM

represented that Power-Z proved fuel reduction effect of 2.5% close to about 1.67 times more than English additive and also showed about 5 - 7% increase of output per RPM in comparison with the English product at the same RPM.

RPM	60	60.1	60.2	63	63.1	63.9	64	64.1	71.8	71.9	72	72.1	72.2	72.5	72.9	73.9	74	75.8	79.9
English product					90.7	99.0		99.0			104.7	95.8	101.8	105.1	92.7	106.9	107.2	106.1	101.7
POWER-Z	95.7	85.8	90.9	97.3			100.2		111.6	114.3	116.3	107.5							

Performance test results of the fuel accelerator conducted by Hanjin Shipping Co., Ltd.

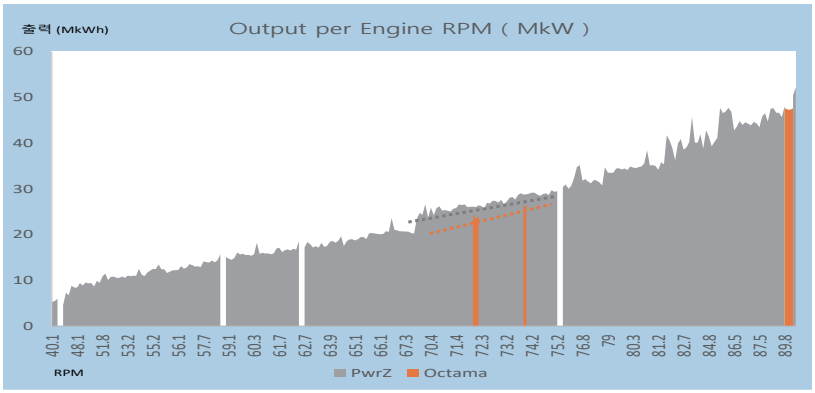
Measured results of maximum pressure (P-Max) by RPM



The measuring result of P-Max of Power-Z showed that its P-Max was by about 10 bar higher than the English company's additive.

If this P-Max value is converted to fuel consumption amount, maximum 4g of fuel per KWh is saved, consequently approximately 2.3% of fuel saving rate can be expected theoretically.

Power-Z indicates the engine power increase of about 5 - 7 % comparing with English company's product at same RPM



Synthetic opinion about test results on MV Hanjin Europe:

The comparative test result of Power-Z and the English Company's product showed the outcome of similar tendency with the results detailed in the report on performance test conducted by Jeju Thermoelectric Power Plant.

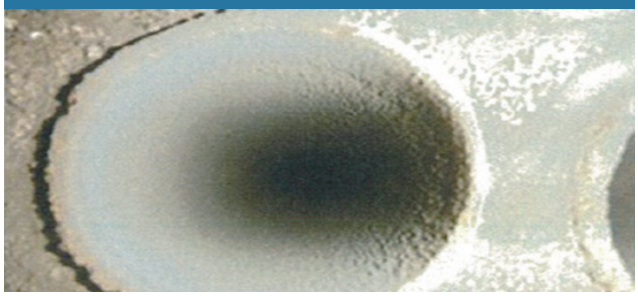
Performance test results of the fuel accelerator conducted by Hanjin Shipping Co., Ltd.

Soot Removal effect

Economizer condition comparison before and after using fuel additive by Hanjin Scarlet vessel

Photographed on Nov. 4, 2014
after operation of 340 hours at initial state after economizer cleaning (before using Power-Z)

Photographed on Nov. 19, 2014
after operation of 344 hours after economizer cleaning (after using Power-Z)



Data Source : materials on Hanjin Scarlet vessel

History of effect verification of Fuel additive

Kind of additive	Test duration	Test vessel	LOAD	Fuel consumption rate
English product	2008.06.24 ~ 2009.04.28	HANJIN WASHINGTON	average 25~60%	average -1.4%
English product	2009.12.16 ~ 2010.07.22	OTHER 7 VESSELS	average 25~60%	average -1.45%
Japanese product	2011.12.03 ~ 2013.01.10	HJES	average 25~60%	average -1.4%
No additives	2012.5.12 ~ 2013.12.31	HANJIN EUROPE	average 20~50%	0%
English product	2014.01.01 ~ 2014.10.09	HANJIN EUROPE	average 20~50%	average -1.5%
POWER-Z	2014.10.20 ~ 2016.01.18	HANJIN EUROPE	average 20~50%	**average -2.5%**

Performance test results of the fuel accelerator conducted by Jeju Thermoelectric Power Plant

1. Facilities for testing : Jeju Themoelectric Power Plant (40MW 2 stroke B&W 12K80-MC-S)
   Diesel Engine Generator / Dusan Co., Ltd. / 2009.6.9
2. Performance Test : conducted by an environment measuring agent authorised by KEPCO
   (Korea Electic Power Corporation)(exhaust gas NOx and PM measured)
3. Used additive : Comparative test between both A and B
   - Additive A : Technobio's product (Power-Z) (domestic product)
   - Additive B : English product
4. Period of additive test : March 14, 2014 - June 3, 2016
5. Evaluation result

Evaluation item	Evaluation method	Test vessel	LOAD	Evaluation result	
				Technobio's product	English product
PM(Dust)	Criteria for air pollution process test (mg/m^3)	40% decrease	75, 50, 30 %	-58.8%	-39.9%
NOx	Criteria for air pollution process test (ppm)	15% decrease	75, 50, 30 %	-27.34%	-17.85%
Fuel consumption rate	ISO:3046	2% save	75, 50, 30 %	-2.157%	-1.147%

6. Other achievements : • Application and registration of 2 domestic patents
   • Application and registration of 3 international patents

Summary of Test results

• Comparison of converted fuel consumption rates
  before and after adding addtive A (Technobio's product)

(g/kwh)

TEST ITEM	100% NR	75% NR	50% NR	30% NR
Before putting additive	188.422	186.395	207.430	239.623
After putting additive A	186.913	185.103	202.833	231.087
Difference	-1.509	-1.292	-4.597	-8.536
Reduction rate	-0.801%	-0.693%	-2.216%	-3.562%

Performance test results of the fuel accelerator conducted by Jeju Thermoelectric Power Plant

• Comparison of converted fuel consumption rates
before and after additing addtive B (English product)

(g/kwh)

TEST ITEM	100% NR	75% NR	50% NR	50% NR
Before putting additive	188.422	186.395	207.430	239.623
After putting additive B	188.172	186.482	204.921	234.165
Difference	-0.250	+0.087	-2.509	-5.458
Reduction rate	-0.133%	0.047%	-1.210%	-2.278%

Load	100+75+50% NR average	75+50+30% NR average	50+30% NR average
Reduction rate of Additive A (Technobio's product)	-1.237%	-2.157%	-2.889%
Reduction rate of Additive B (English product)	-0.432%	-1.147%	-1.744%

Additive A&B : Comparison table of air pollutants decrease rate

1.Comparison of NOx measured values(at SCR inlet)

(PPM)@13%O_2

Load	Before using Additive (Mar. 14, 2014)	During using additive-A (Apr. 23, 2014)		During using additive-B (June. 3, 2014)	
		ppm <g/kwh>	Reduction Rate(%)	ppm <g/kwh>	Reduction Rate(%)
50% NR	1387.4 <16.6>	1068.0 <12.6>	-23.02	1158.2 <14.3>	-16.52
75% NR	1620.4 <21.5>	1092.0 <11.7>	-32.61	1340.3 <14.9>	-17.29
100% NR	1714.6 <22.4>	1262.2 <14.3>	26.39	1376.2 <15.4>	-19.74
Decreased rate (Average)			-27.34		-17.85

2.Comparison of PM measured values(at E·P inlet)

mg/m^3

Load	Before using Additive (Mar. 14, 2014)	During using additive-A (Apr. 23, 2014)		During using additive-B (June. 3, 2014)	
		mg/m^3	Reduction Rate(%)	mg/m^3	Reduction Rate(%)
50% NR	64.1	27.3	-57.4	39.2	-38.8
75% NR	100.8	40.9	-59.4	60.5	-40.0
100% NR	108.6	43.8	-59.7	64.2	-40.9
Decreased rate (Average)			-58.8		-39.9

• Additive-A : Technobio Co.,Ltd. / • Additive-B : English company's product

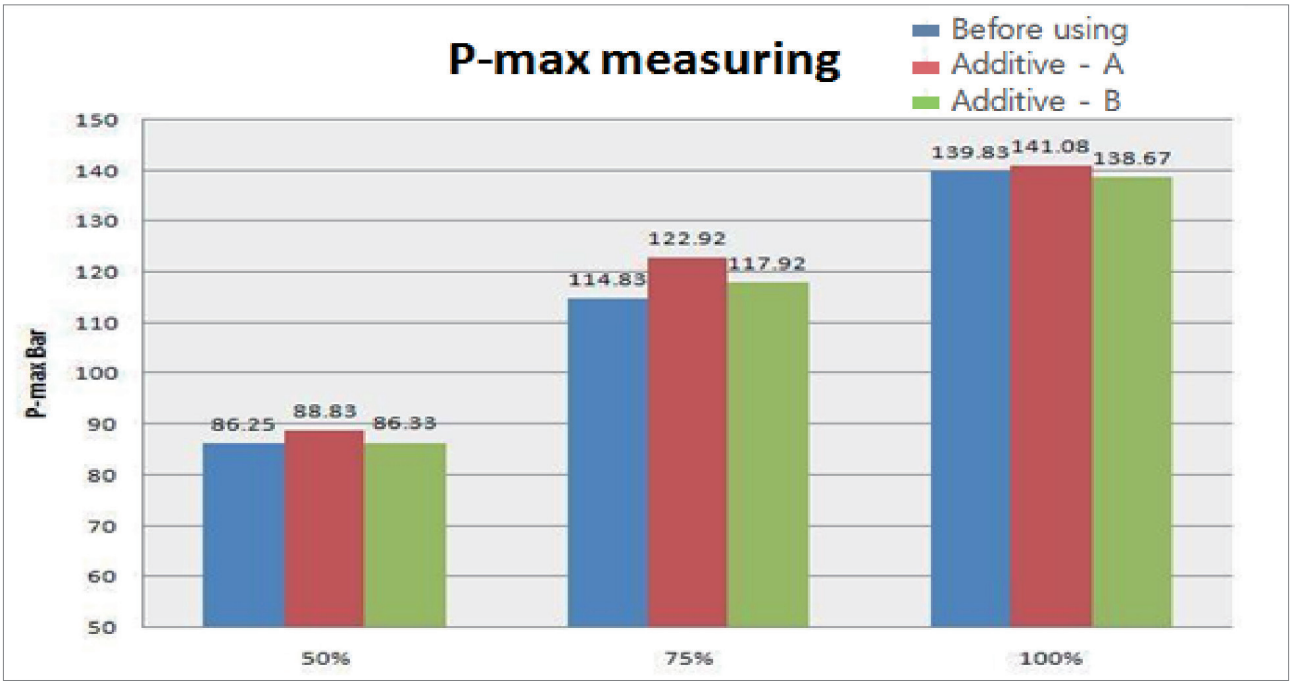
Performance test results of the fuel accelerator conducted by Jeju Thermoelectric Power Plant

Measurement of P-Max

Load	Before using Additive	Additive - A	Additive - B
30% NR	-	-	-
50% NR	86.25	88.83	86.33
75% NR	114.83	122.92	117.92
100% NR	139.83	141.08	138.67

▸ Comparison of P-Max measured values
Additive-A : Technobio Co.,Ltd. / Additive-B : English company's product

Measurement of P-Max

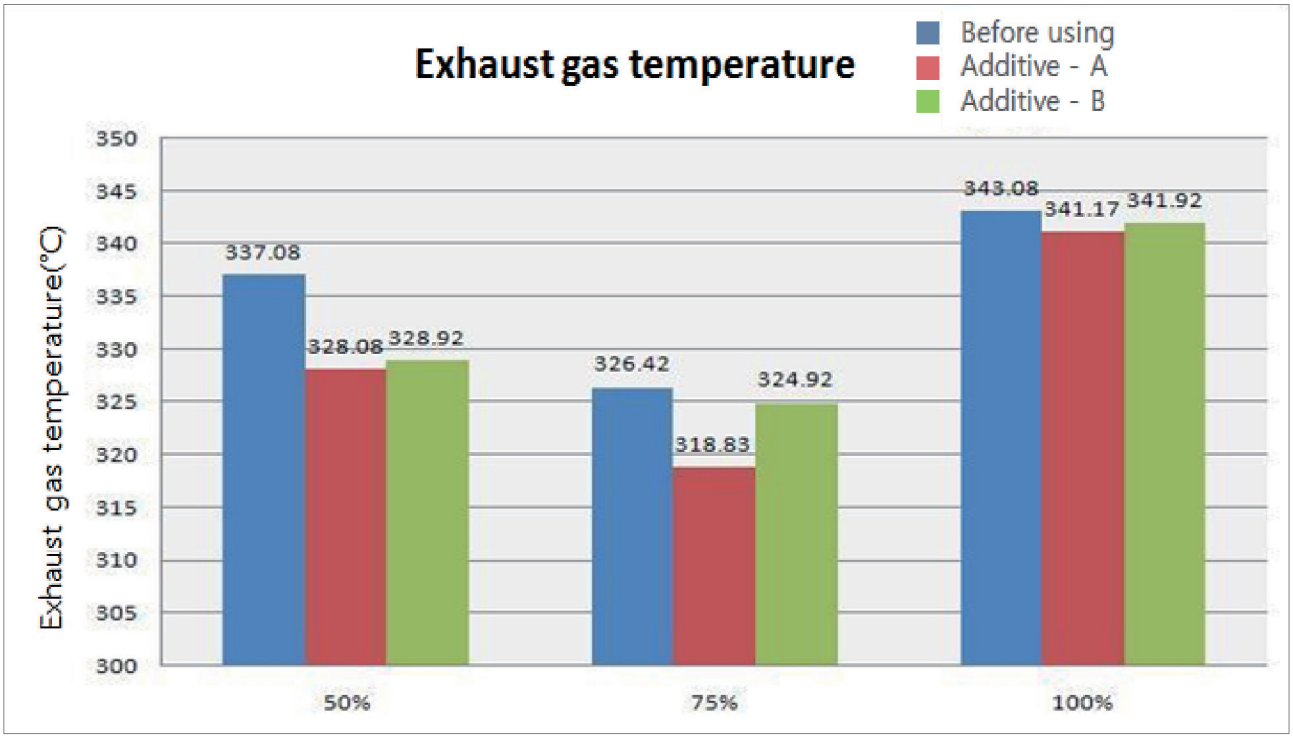


▸ As a result of measuring P-Max values of additive A and B, P-Max value of additive A proved higher than that of additive B.

Performance test results of the fuel accelerator conducted by Jeju Thermoelectric Power Plant

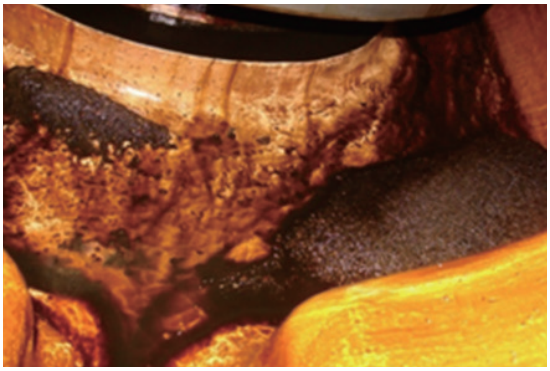
Exhaust gas temperature

Load	Before using Additive	Additive - A	Additive - B
50% NR	337.08	328.08	328.92
75% NR	326.42	318.83	324.92
100% NR	343.08	341.17	341.92



Performance test results of the fuel accelerator conducted by Jeju Thermoelectric Power Plant

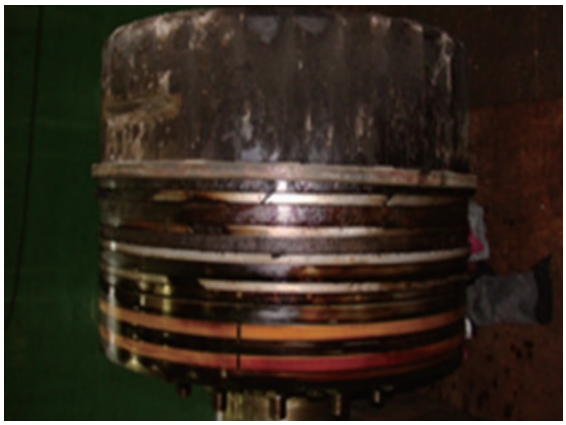
Comparison of Stuffing box condition of internal-combustion engine No. 2 (before & after using Power-Z)



Before using Power-Z
(Photographed : Mar. 12, 2014)

After using Power-Z
(Photographed : Apr. 9, 2014)

Comparison of piston state of internal-combustion engine No. 2 (before & after using Power-Z)



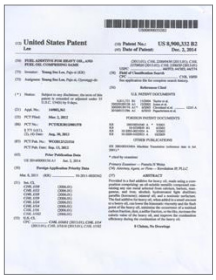
Before using Power-Z
(Photographed : Mar. 12, 2014)

After using Power-Z
(Photographed : Apr. 9, 2014)

OTHER ACHIEVEMENTS

Domestic / internatinal Patent registration / Awarded PRIZE

KOREA



U.S.A

CHINA

Confirmation of Green technology produst

Certificate of Quality

China certifioate for ecolabelling product type

Our Major Accounts

Shipping companies

KOREA LINE CORPORATION(KLC)
HANJIN SHIPPING Co., Ltd.
NDSM Co., Ltd.
WOORIM SHIPPING Co., Ltd.
DAEWOO LOGISTICS CORPORATION
SAMBU SHIPPING Co., Ltd.
KWANGWOON SHIPPING Co., Ltd.
DAESANG SHIPPING Co., Ltd.
SEO NAM SHIPPING CORPORATION
SHINKWANG SHIPPING Co.,Ltd.
SAEHAN MARINE SERVICE Co., Ltd.

KOREA SHIPPING CORPORATION(KSC)
KLCSM Co., Ltd.
SM LINE CORPORATION
WEIDONG FERRY Co., Ltd.
KHANAMARINE Ltd.
HANJIN HEAVY IND & CONS. Co.,Ltd
KEUKDONG FISHERIES Co.,Ltd
GOLDENLAKE Co., Ltd.
SEO HO SHIPPING Co., Ltd.
EASTERN TANKER Co., Ltd.
DORIKO LIMITED Co., Ltd.

Paper-manufacturing, chemical and textile companies

Hankuk Paper Co., Ltd.
Ssang Yong Paper Co., Ltd.
Ssang Yong C&B Co., Ltd.
Seha Corporation
Kolon Co., Ltd.
Hansol Chemical Co., Ltd.
Baeksan Co., Ltd.
Geosung Oilpaper Co., Ltd.

Hanil Textile Co., Ltd.
Saeyoung Textile Co., Ltd.
Daeduk Textile Industry Co., Ltd.
Woonam Industry Co., Ltd.
Tongin Industry Co., Ltd.
Binggrae Co., Ltd.
and many other companies

POWER-Z®
테크노바이오

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