Smart MVR Distiller

Doowon's Philosophy: “To make human life happy with clean water supply and to restore the environment to revive the earth.”

DOOWON TEG Co., Ltd.

www.doowonteg.com

SMVR system

SMVR (Smart Mechanical Vapor Recompression):
A high-efficiency system that converts evaporated water vapor into high-temperature energy with a turbo steam compressor and reuses it as heating energy.

Desalination

Equipment that produces drinking water from as seawater, river and groundwater

Wastewater treatment

It purifies and reuses domestic sewage and industrial wastewater.

ENERGY

High energy efficiency

A high-efficiency system that creates high-temperature steam and uses it as evaporation energy.
*average power consumption
: 50kwh/ton

COMPACT

Space intensive module

Small size, about the size of a 20ft container.

* Daily water production :
(25, 50, 75, 100 ton)

ECO FRIENDLY

Nature friendly

Eco-friendly system that does not use chemicals and filters.

Ⅰ. Production of drinking water

If we make seawater into drinking water, humanity's water problem will be solved. It is an eco-friendly, high-efficiency system that can turn seawater, river water, and groundwater into high-quality drinking water.

- **Eco-friendly facility without using chemicals or filters.**
- **Able to consistently produce high-quality water (less than 100 ppm)**
- **Concentrated water can produce sterilized expensive edible salt by drying.**

Ⅰ-Ⅱ. Salt Production and amount by Model

Model	Daily salt production (ton)	Monthly (25 days)		Yearly (300 days)	
		Salt production (ton)	Amount of salt (USD)	Salt production (ton)	Amount of salt (USD)
DSM 25	0.75	18,75	28,125	22.5	337,500
DSM 50	1.5	37.5	56,250	450	675,000
DSM 75	2.25	56.25	84,375	675	1,012,500
DSM 100	3	75	112,500	900	1,350,000

< Remarks >

- Salt price: 1.5 USD Dollar/kg. (based on sea salt)
- The price of roasted salt is 15~20 USD Dollar/kg .
- Salt produced in SMVR is salt sterilized at 100℃, close to roasted salt, so it can be sold at a higher price than sea salt, so the profit is judged to be very high.
- As of 25 days of operation per month.
- Concentrated water (10%) salt crystallization period: 10 to 20 days (varies depending on the season. For sea salt, it takes an average of 40 days)

* DSM is the model name of the SMVR system

Ⅰ-Ⅱ-Ⅰ. Salt Production and amount by Model

Model	Daily salt production (ton)	Monthly (25 days)		Yearly (300 days)	
		Salt production (ton)	Amount of salt (USD)	Salt production (ton)	Amount of salt (USD)
DSM 25	0.75	18.75	375,000	225	4,500,000
DSM 50	1.5	37.5	750,000	450	9,000,000
DSM 75	2.25	56.25	1,125,000	675	13,500,000
DSM 100	3	75	1,500,000	900	18,000,000

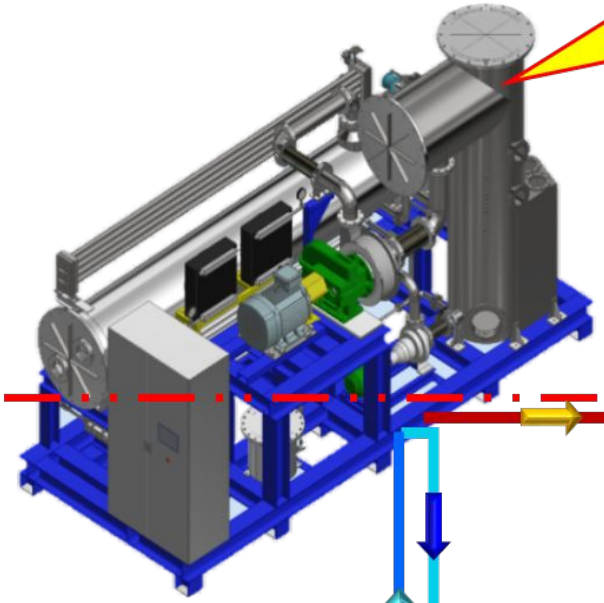
< Remarks >

- The price of roasted salt is 20 USD Dollar/kg .
- Salt produced in SMVR is salt sterilized at 100℃, close to roasted salt, so it can be sold at a higher price than sea salt, so the profit is judged to be very high.
- As of 25 days of operation per month.
- Concentrated water (10%) salt crystallization period: 10 to 20 days (varies depending on the season. For sea salt, it takes an average of 40 days)

SMVR - Distiller

◈ Scope of Doowon TEG ◈
- Only SMVR – Distiller Equipment
- Installation Supervision & Final Testing
- Training

100ton/day



Salt production Farm
(Vinyl or Glass house)

In the case of seawater, dried abandoned concentrated water can produce sterilized high-grade salt.

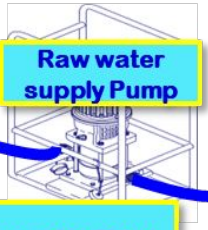
Concentrated water : Salt

Drinking Water

By Customer

(100ton/day)

Sea Water



Raw water supply Pump

Raw water Filter

Raw Water Storage Tank
(100 ton)

Pure Water Storage Tank
(100 ~150ton)

Drinking Water Supply Pump

▣ Let's create a smart city by always flowing clean water in the city's river.

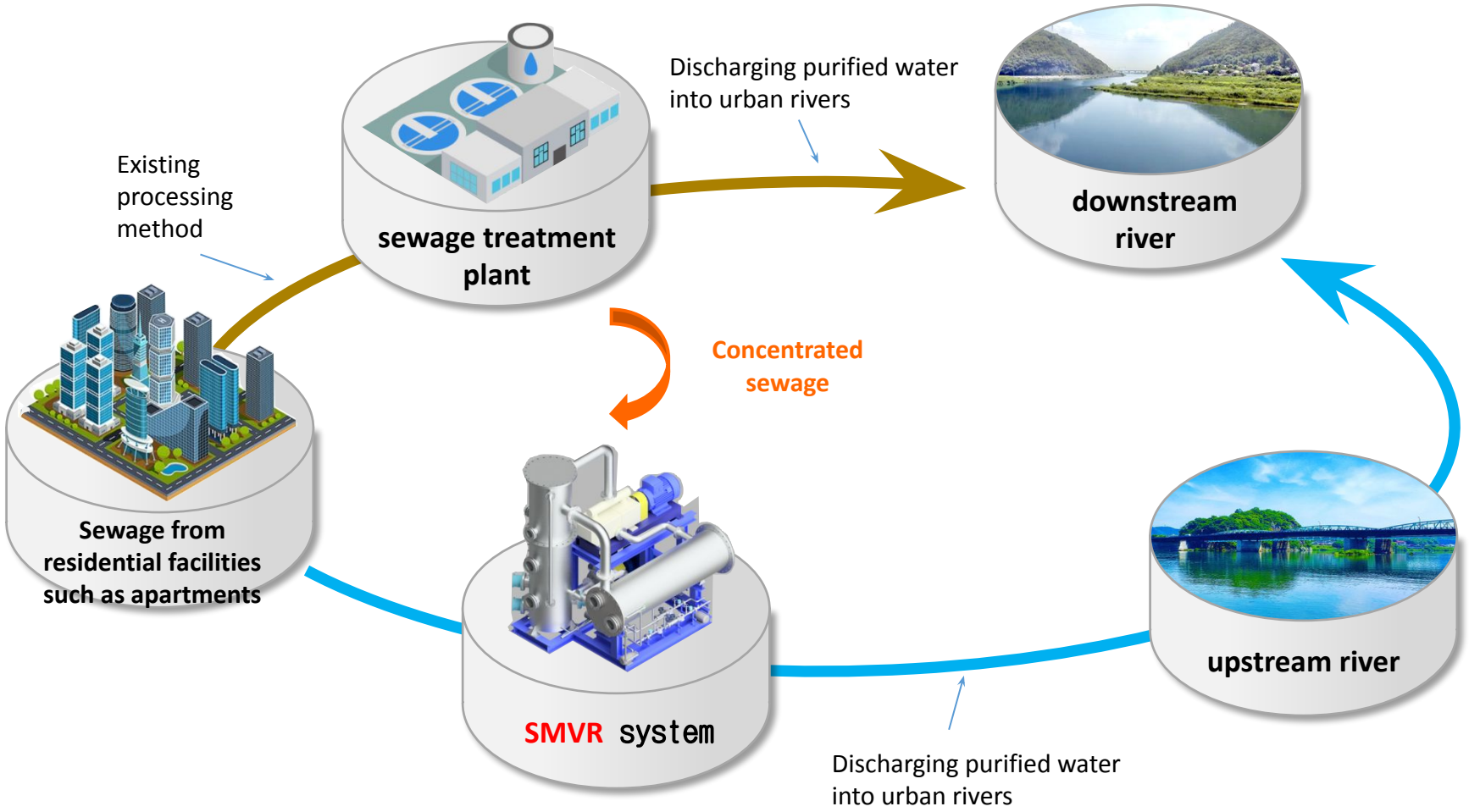
▸ In the world, 'water reuse technology' is attracting attention as water scarcity has emerged as a serious problem due to urbanization, industrialization, and climate change. Water reuse technology refers to a technology that purifies domestic sewage and industrial wastewater and reuses it as industrial water or river water.

▸ Purify domestic sewage used in homes and buildings and use it as maintenance water for rivers.

▸ Then, the size of the city's sewage treatment plant can be significantly reduced.

Ⅱ - Ⅰ . SMVR applied sewage treatment system

By purifying domestic sewage from apartments, buildings, etc., using it as maintenance water for urban rivers, and sending only the concentrated sewage to the terminal treatment plant, the maintenance water of the river is secured and the size of the terminal treatment plant is minimized.



▣ We build an eco-friendly city with always clean water flowing.

- It has the effect of lowering the temperature of the city.
- It has the effect of reducing fine dust in the city.
- By reducing the inflow of sewage, the size of the sewage treatment plant can be minimized.
- The use of the reduced site can bring economic benefits.
- It is economical by reducing the number of management personnel.
- It is eco-friendly by reducing the use of chemicals.

Ⅲ. Purify the Industrial wastewater.

▣ Industrial wastewater from factories is purified and recycled as industrial water.

▸The amount of industrial water usage is increasing. Hereby the amount of industrial wastewater also increases, resulting in many complex environmental problems such as groundwater contamination and treatment cost increase.

▸With using SMVR, purify the industrial sewage from factories and recycled as industrial water. It will solve environmental problems and the shortage of industrial water.

▸ SMVR can achieve "ZLD(zero Liquid Discharge" and "MLD(Minimum Liquid Discharge)" system.

Purification efficiency according to concentration of raw water (wastewater)

* Based on 100 tons of inflow waste water per day

Wastewater Concentration (%)	Concentrated Water (ton)	Distilled Purified Water (ton)	Purification Efficiency
0.5	5	95	95%
1	10	90	90%
2	20	80	80%
3	30	70	70%
4	40	60	60%
5	50	50	50%

Capacity

▶ Various small SMVR sizes for niche markets in the world's desalination market
– A standard production model for fresh water facilities

Model	Producing Ability (ton/day)	Standard (m)			Weight (ton)	Delivery (month) on FCA	Remarks
		L	W	H			
DSM 25	25	5.8	2.2	3.4	14	4~6	*Produced in one piece of product with using a frame *All model specification are the same 20ft standard container size -split production in two frame
DSM 50	50	5.8	2.2	3.4	17		
DSM 75	75	6	3.15	3.4	21		
DSM 100	100	6	3.5	3.4	24		

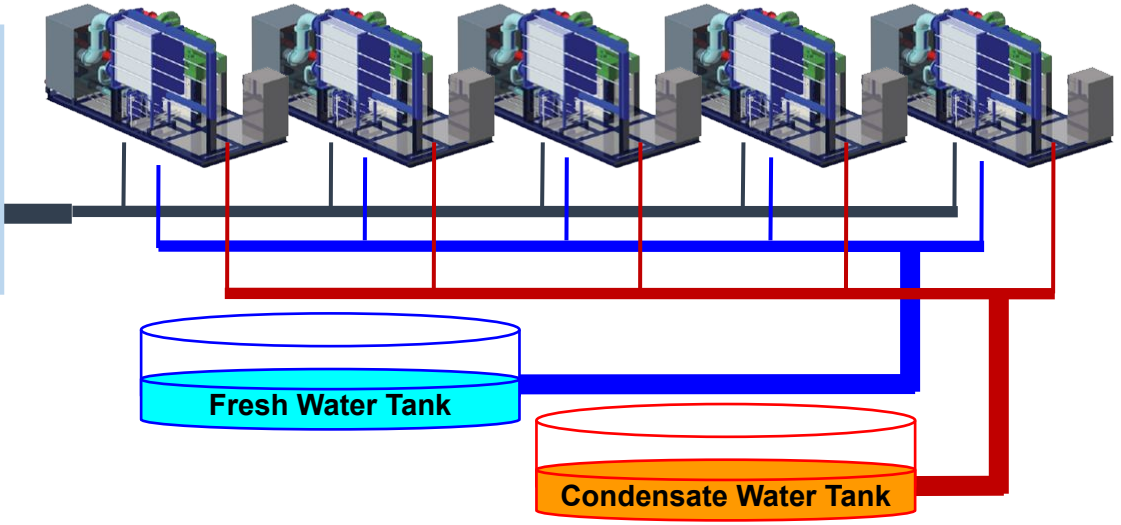
Capacity (Connecting Multiple)

▸ SMVR-Desalination for Large Capacity

Model	Producing Ability (ton/day)	Standard (m)			Weight (ton x quantity)	Delivery (month) on FCA	Components and Installation
		L	W	H			
DSM 300	300	6	3.4 x 3	2.9	17 x 3	6 ~ 8	Connect 3 to 10 'SMVR 100'
DSM 500	500	6	3.4 x 5	2.9	17 x 5		
DSM 1000	1,000	6	3.4 x 10	2.9	17 x 10		

[Multi Stage Model : DSM 500] ➡ [DSM 100] [DSM 100] [DSM 100] [DSM 100] [DSM 100]

Supple Raw Water
(Sea water / Salt Water)



Raw Water Pipe
Fresh Water Pipe
Condensate Water Pipe

Production cost analysis

- Electric Energy Required for Water Production: **50 kwh/ton**
- Water Production Cost: 50 kwh/ton x 0.07 USD/kwh = **4 $/ton** (Base on. 1kwh=0.08$ USD)

Standard

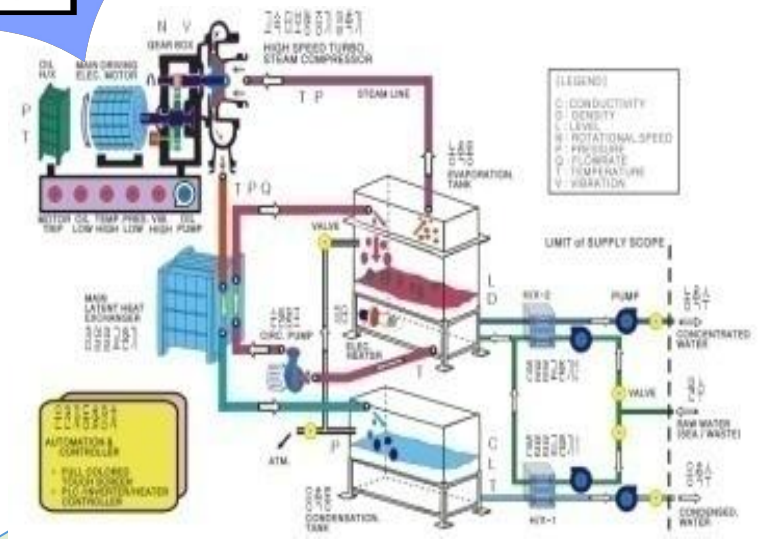
- water production per day :**100ton**
- Daily water consumption per person : **0.3ton**

Estimated number of people who can be supplied water

- 100 tons of water production per day is enough for 333 people.

100 tons of water
: 100,000 bottles / 1 liter
: 200,000 bottles / 500ml.

SMVR System Automation Controller



10 inch Full Color
Touch Screen
on Windows 7

High Performance Control System :

A high-performance controller (LS_GM6_PLC) that transmits and receives signals such as temperature, pressure, level meter, flow meter, and inverter at 4-20mA.

Programming that enables remote operation through RS232, RS485 communication and efficiently controls multiple SMVR systems

Visible & Easy Operation on Human-Machine-Interface System with Full Colored Touch Screen helps your reliable and easy operation :

It shows user input parameters, status maps, trends of key parameters, alarms, causes of errors, and operational data.

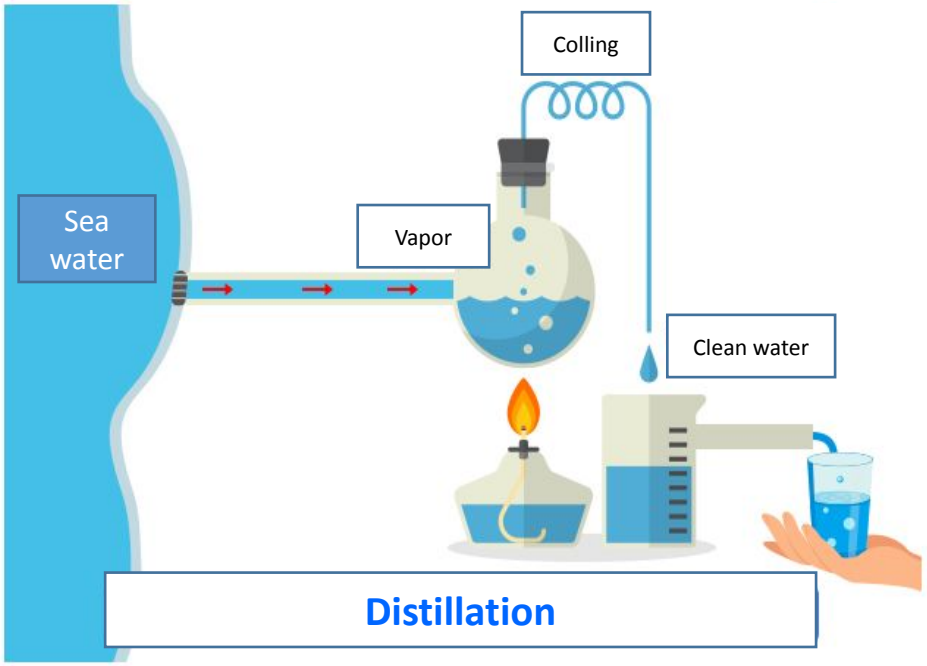
If something goes wrong with your equipment, you can see when, where, and why the problem started.

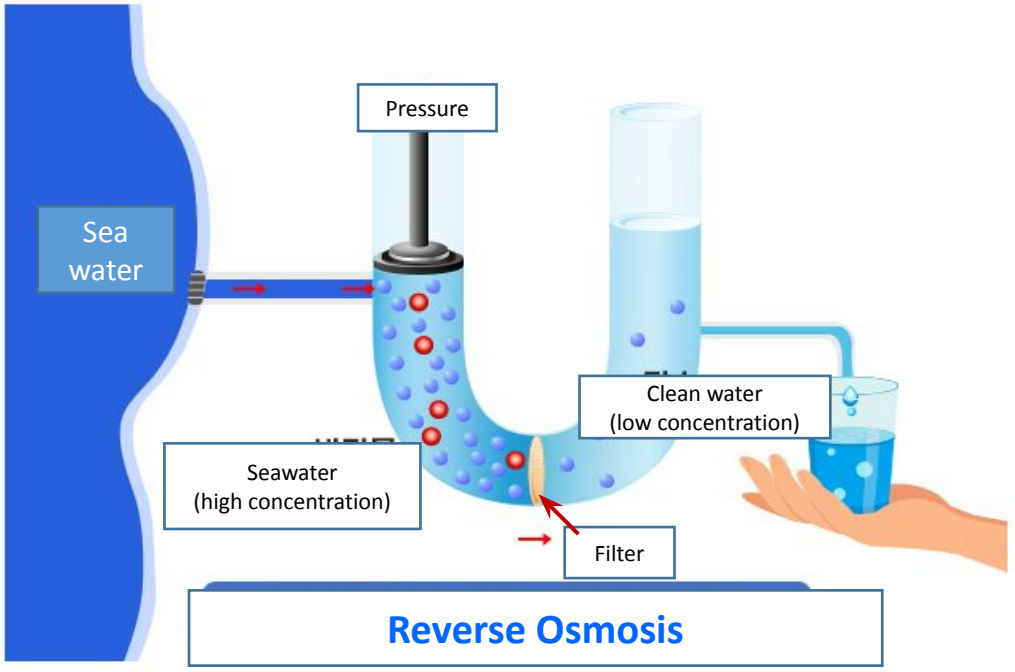
It is possible to operate the system only with basic training, so it is possible even if you are not a professional operator.

Seawater desalination principle

Less than 2% of fresh water for consumption and drinking on Earth.

- **The UN predicts that by 2030, the water shortage will become severe and 15% of the world's population will have to desaltize the seawater to drink.**





< Distillation >

- It boils to form steam and cools.
- The quality of the water is good because the salt removal is 100%.
- Disadvantages of high energy consumption.

  ⇒ The SMVR system solves this shortcoming.

< Reverse Osmosis>

- A strong pressure is applied to force it through the membrane.
- It is difficult to completely remove the salt, so the quality of the water deteriorates.

Technology & Quality Competitiveness

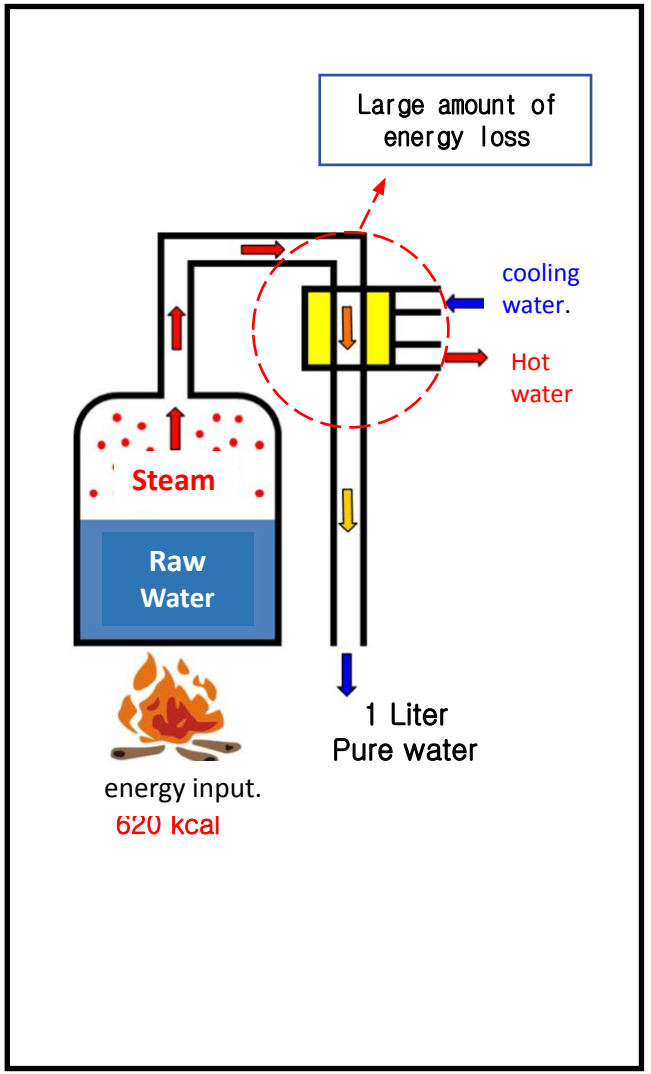
Comparative analysis of domestic and overseas competitors

Evaluation Criteria	SMVR	RO	Others
Environmental pollution caused by the discharged water	No effect (eco – friendly)	Effect on the environment	
Chemical input	Needless	Absolutely needed	
Additional Steriliizing	Needless	Absolutely needed	
Pre-treatment facility	Needless	Absolutely needed	
Post-treatment facility	Needless	Absolutely needed	
Quality of Water	Superlative degree water	Good water	Korea Standard :
	(TDS<100ppm)	(100<TDS<500ppm)	TDS<500 PPM
Maintenance item	Low pressure pump seal parts	High pressure pump and parts	
		Filters	
System Components & Maintenance	Very easy and simple	Very complicated and hard	
	Technician not needed	Specialized manpower needed	
Brine filtering	100% desalination	Cat not desalinate 100%	
Filtering efficiency	Constant and high efficiency	Love and erratic	
Periodical part replacing	None (semi permanent)	Periodic Filter replacement	General items such as pump and motor excluded
Water production cost per ton (USD)	4 USD (50kwh/ton)	1.5 USD (2.6kwh/ton)	
Initial investment cost	High (@ 1.2 Mil USD)	Low (@ 0.7 Mil USD)	
Contaminated sea water desalination	Possible	Impossible	
Level of technology and quality	Very High	Low	
Availability in Ships and Offshore plants	Most suitable (Compact size)	Suitable (Currently used)	

The amount of energy required for evaporation.

- Calorie required to raise 1 kg(Liter) of water by 1℃ is **1 kcal.**
- The amount of heat required to make 1 kg(Liter) of water 20 ℃ into water at 100 ℃ is **80 kcal.**
- The amount of heat required to convert 1 kg(Liter) of water at 100 ℃ to steam at 100 ℃ is **539 kcal.**
- **That is, the amount of heat required to evaporate 1 kg(Liter) of water 20 ℃ is 620 kcal.**

(SMVR is a system that minimizes energy use by producing 620 kcal by itself.)

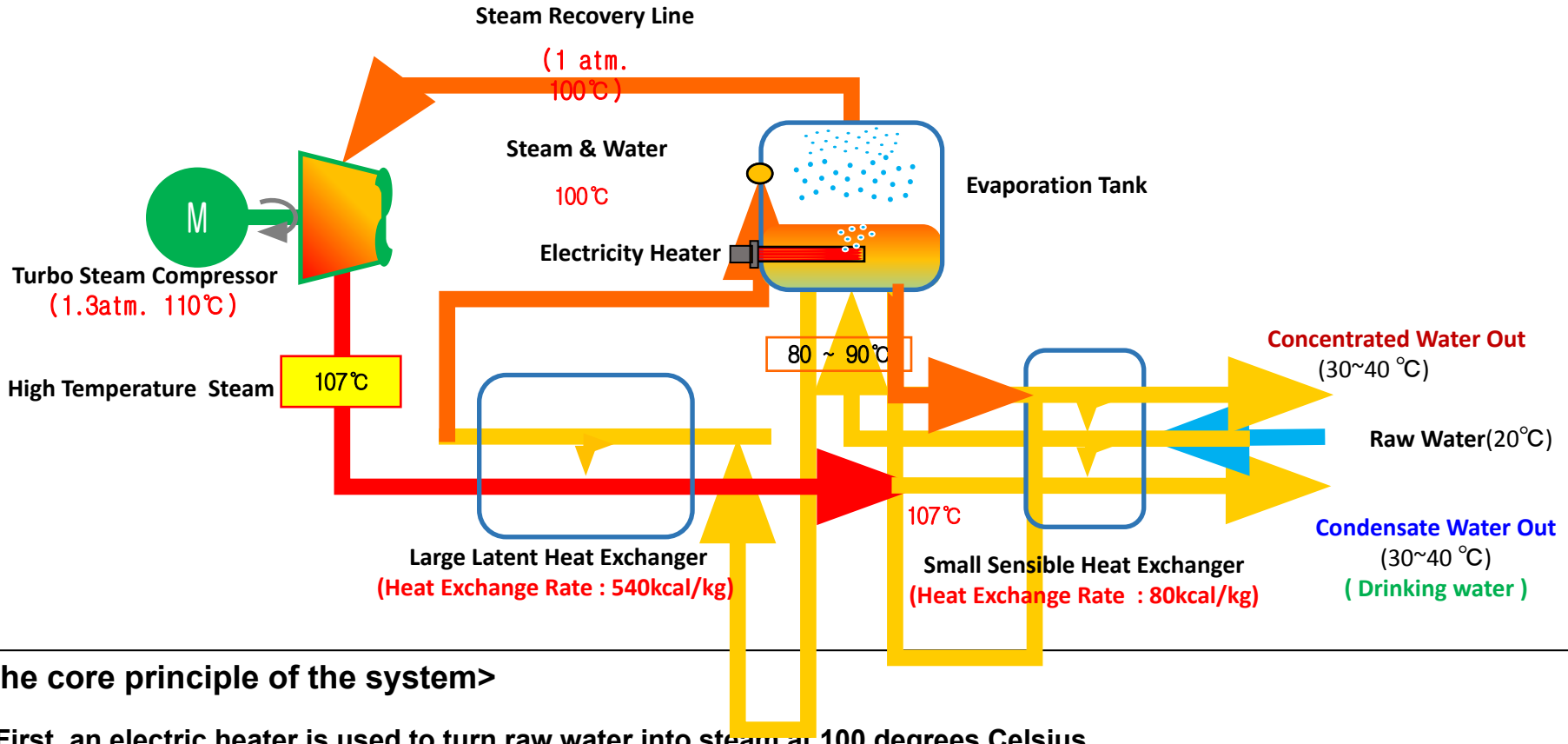


Simple heating step 1 recovery method

* 1KW=860Kcal/h
* Water : 1L=1kg, 1㎥=1ton, C=1 Kcal/kg℃)

Overview and Characteristic of Smart MVR

Principle



<The core principle of the system>

1) First, an electric heater is used to turn raw water into steam at 100 degrees Celsius.

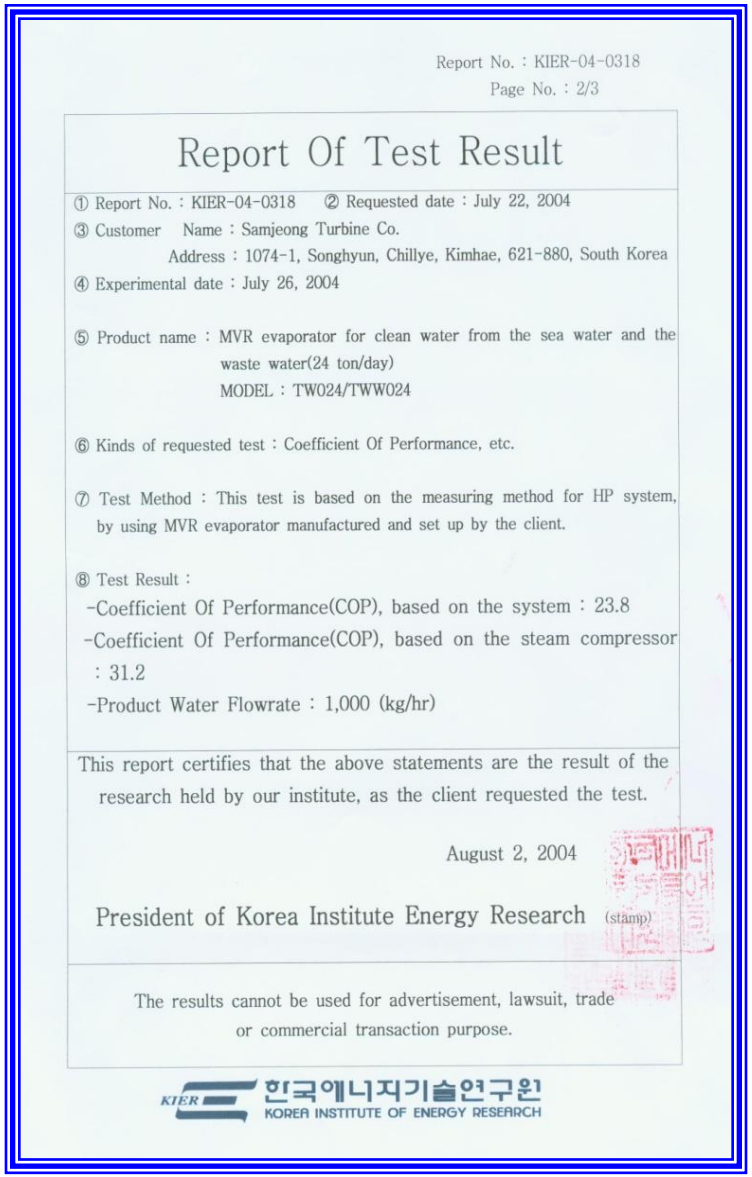
2) This 100 degree steam is made into 110 degree high temperature steam with "turbo steam compressor".

3) This 110 degree high temperature steam is used as an energy source to heat raw water into steam through a latent and sensible heat exchanger, and comes out as low temperature drinking water.

(From this point on, the electric heater is not used and continues to produce steam)

sMVR 성능 및 소비 전력 테스트 결과

Record/conversion items	self-evaluation	Accredited agency evaluation
Cumulative test time (Hr)	1,444	8.53
Average raw water temperature (℃) Average steam temperature	20 100	21.3 99.8
Average freshwater flow(Liter/hr)	1,000	1,007.8
Average compressor power.(kW)	23	21.0
Total fresh water quantity(Liter)	1,444,700	8.597
Accumulated total power(kWh)	43,584	244
Compressor-based performance coefficient (COP)	**31.3**	**31.2**
SMVR system-based grade coefficient (COP)	**23.9**	**23.8**
Power consumption. (Watt.h/Liter)	**30.2**	**30.1**
Energy saving rate. (%)	**95.8**	**95.8**



Report No. : KIER-04-0318
Page No. : 2/3

Report Of Test Result

① Report No. : KIER-04-0318 ② Requested date : July 22, 2004
③ Customer Name : Samjeong Turbine Co.
Address : 1074-1, Songhyun, Chillye, Kimhae, 621-880, South Korea
④ Experimental date : July 26, 2004

⑤ Product name : MVR evaporator for clean water from the sea water and the waste water(24 ton/day)
MODEL : TW024/TWW024

⑥ Kinds of requested test : Coefficient Of Performance, etc.

⑦ Test Method : This test is based on the measuring method for HP system, by using MVR evaporator manufactured and set up by the client.

⑧ Test Result :
-Coefficient Of Performance(COP), based on the system : 23.8
-Coefficient Of Performance(COP), based on the steam compressor : 31.2
-Product Water Flowrate : 1,000 (kg/hr)

This report certifies that the above statements are the result of the research held by our institute, as the client requested the test.

August 2, 2004

President of Korea Institute Energy Research (stamp)

The results cannot be used for advertisement, lawsuit, trade or commercial transaction purpose.

KIER 한국에너지기술연구원 KOREA INSTITUTE OF ENERGY RESEARCH

Technology & Quality Competitiveness

▣ Comparison of Evaporation System

Items	SMVR	TVR	MED	MSF	Others
▸ Relative Efficiency	25	5	2	1	Relative efficiency when heat recovery is compared on a MSF basis.
▸ Relative Size	Very Low	Low	Medium	Large	Based on the Same Capacity
▸ Required Energy	Electric	Fuel + Electric + Steam	Fuel or Electric + Steam	Electric + Steam	TVR, MED, MSF desalination plants require a lot of energy
▸ Capacity	Low	Medium	Large	Large	-
▸ Technology Level	Very High	High	Medium	Low	SMVR need high technology
▸ Required Conditions	Electric Heater + Turbo Steam Compressor	High Pressure Steam System + Chemical Processing System	TVC (High Pressure Steam System) + High-Capacity Electrical System +Chemical Processing System	Steam Turbine or Heat Recovery Boiler + High-Capacity Electrical System +Chemical Processing System	TVR, MED and MSF facilities are very complicated structure and water purification method, so they can not be operated without professional manpower.

Seawater Test Analysis

Before

KOTITI 시험연구원 인류의 안전을 추구하고 미래기술을 선도하는 글로벌 비즈니스 파트너 Global Business Partner for Human Safety and Future Technology

KOTITI Testing & Research Institute

129, Dunchon-daero 541beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, SEOUL KOREA
ZIP CODE 13216
TEL : 82-2-3451-7452, FAX : 82-2-3451-7464

CERTIFICATE OF ANALYSIS

1. Description of Sample

SAMPLE	Tap Water	SAMPLE NO.	82193002101828-002
COMPANY / CLIENT	DoowonTEG	COLLECTION DATE	21, October, 2019
SAMPLING SITE	Oryu-ri, Gampo-eup, Gyeongju-si, Gyeongsangbuk-do, Republic of Korea [SEA Water]		

2. Analytical Result

	ITEM	CRITERIA	RESULT		ITEM	CRITERIA	RESULT
1	Total Colony Counts	≤ 100 CFU/mL	15	31	1,2-Dibromo-3-chloropropan	≤ 0.003 ㎎/L	ND
2	Total Coliforms	ND/100mL	Detected	32	1,4-Dioxane	≤ 0.05 ㎎/L	ND
3	Fecal Coliforms	ND/100mL	Detected	33	Free residual chlorine	≤ 4.0 ㎎/L	ND
4	Lead(Pb)	≤ 0.01 ㎎/L	NA	34	Total Trihalomethane	≤ 0.1 ㎎/L	ND
5	Fluoride(F)	≤ 1.5 ㎎/L	1.04	35	Chloroform	≤ 0.08 ㎎/L	ND
6	Arsenic(As)	≤ 0.01 ㎎/L	NA	36	Bromodichloro methane	≤ 0.03 ㎎/L	ND
7	Selenium(Se)	≤ 0.01 ㎎/L	NA	37	Dibromochloro methane	≤ 0.1 ㎎/L	ND
8	Mercury(Hg)	≤ 0.001 ㎎/L	ND	38	Chloral hydrate	≤ 0.03 ㎎/L	ND
9	Cyanide(CN)	≤ 0.01 ㎎/L	NA	39	Dibromoacetonitrile	≤ 0.1 ㎎/L	ND
10	Chrominum(Cr)	≤ 0.05 ㎎/L	NA	40	Dichloroacetonitrile	≤ 0.09 ㎎/L	ND
11	Ammonium Nitrogen(NH_4-N)	≤ 0.5 ㎎/L	NA	41	Trichloroacetonitrile	≤ 0.004 ㎎/L	ND
12	Nitrate Nitrogen(NO_3-N)	≤ 10 ㎎/L	ND	42	Haloacetic acid	≤ 0.1 ㎎/L	ND
13	Cadmium(Cd)	≤ 0.005 ㎎/L	NA	43	Formaldehyde	≤ 0.5 ㎎/L	ND
14	Boron(B)	≤ 1.0 ㎎/L	NA	44	Total Hardness	≤ 300 ㎎/L	5,871
15	Bromate	≤ 0.01 ㎎/L	NA	45	Consumption of $KMnO_4$	≤ 10 ㎎/L	2.4
16	Phenols	≤ 0.005 ㎎/L	NA	46	Odor	Odorless	PASS
17	Diazinon	≤ 0.02 ㎎/L	ND	47	Taste	Tasteless	FAIL
18	Parathion	≤ 0.06 ㎎/L	ND	48	Cooper(Cu)	≤ 1 ㎎/L	NA
19	Fenitrothion	≤ 0.04 ㎎/L	ND	49	Color	≤ 5 Unit	ND
20	Carbaryl	≤ 0.07 ㎎/L	ND	50	Alkyl Benzene Sulfonate	≤ 0.5 ㎎/L	NA
21	1.1.1-Trichloroethane	≤ 0.1 ㎎/L	ND	51	pH	5.8 ~ 8.5	8.2
22	Tetrachloroethylene	≤ 0.01 ㎎/L	ND	52	Zinc(Zn)	≤ 3 ㎎/L	NA
23	Trichloroethylene	≤ 0.03 ㎎/L	ND	53	Chloride(Cl⁻)	≤ 250 ㎎/L	18,573.4
24	Dichloromethane	≤ 0.02 ㎎/L	ND	54	Total Solids	≤ 500 ㎎/L	53,210
25	Benzene	≤ 0.01 ㎎/L	ND	55	Iron(Fe)	≤ 0.3 ㎎/L	NA
26	Toluene	≤ 0.7 ㎎/L	0.044	56	Manganese(Mn)	≤ 0.05 ㎎/L	NA
27	Ethylebenzene	≤ 0.3 ㎎/L	0.005	57	Turbidity	≤ 0.5 NTU	0.69
28	Xylene	≤ 0.5 ㎎/L	ND	58	Sulfate ion	≤ 200 ㎎/L	2,702
29	1.1-Dichloroethylene	≤ 0.03 ㎎/L	ND	59	Aluminium(Al)	≤ 0.2 ㎎/L	NA
30	Carbon Tetrachloride	≤ 0.002 ㎎/L	ND				

1. The test results contained in this report are limited to results on the sample(s) that is provided by client and are not necessarily indicative or representative of the qualities of the lot from which the sample(s) was taken or of all products.
2. Further use of the results of this report is prohibited unless allowed under a separate agreement set forth in an official document that is established between the client identified on this letter and the KOTITI Testing & Research Institute.
3. ND : Not-detected, ≤ : Not more than, NA : Not-available

KOTITI Testing & Research Institute

08, November, 2019
Sincerely yours Deputy Taek kyun, Choi
Signature T.K.Choi

Issue Number : 2547686667

KOTITI Testing & Research Institute

KOTITI

Global Business Partner

After

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CERTIFICATE OF ANALYSIS

1. Description of Sample

SAMPLE	Tap Water	SAMPLE NO.	82193002101806-001
COMPANY / CLIENT	DoowonTEG	COLLECTION DATE	17, October, 2019
SAMPLING SITE	Oryu-ri, Gampo-eup, Gyeongju-si, Gyeongsangbuk-do, Republic of Korea [MVR Distilled water]		

2. Analytical Result

	ITEM	CRITERIA	RESULT		ITEM	CRITERIA	RESULT
1	Total Colony Counts	≤ 100 CFU/mL	0	31	1,2-Dibromo-3-chloropropan	≤ 0.003 ㎎/L	ND
2	Total Coliforms	ND/100mL	ND	32	1,4-Dioxane	≤ 0.05 ㎎/L	ND
3	Fecal Coliforms	ND/100mL	ND	33	Free residual chlorine	≤ 4.0 ㎎/L	ND
4	Lead(Pb)	≤ 0.01 ㎎/L	ND	34	Total Trihalomethane	≤ 0.1 ㎎/L	ND
5	Fluoride(F)	≤ 1.5 ㎎/L	ND	35	Chloroform	≤ 0.08 ㎎/L	ND
6	Arsenic(As)	≤ 0.01 ㎎/L	ND	36	Bromodichloro methane	≤ 0.03 ㎎/L	ND
7	Selenium(Se)	≤ 0.01 ㎎/L	ND	37	Dibromochloro methane	≤ 0.1 ㎎/L	ND
8	Mercury(Hg)	≤ 0.001 ㎎/L	ND	38	Chloral hydrate	≤ 0.03 ㎎/L	ND
9	Cyanide(CN)	≤ 0.01 ㎎/L	ND	39	Dibromoacetonitrile	≤ 0.1 ㎎/L	ND
10	Chrominum(Cr)	≤ 0.05 ㎎/L	ND	40	Dichloroacetonitrile	≤ 0.09 ㎎/L	ND
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12	Nitrate Nitrogen(NO_3-N)	≤ 10 ㎎/L	ND	42	Haloacetic acid	≤ 0.1 ㎎/L	ND
13	Cadmium(Cd)	≤ 0.005 ㎎/L	ND	43	Formaldehyde	≤ 0.5 ㎎/L	ND
14	Boron(B)	≤ 1.0 ㎎/L	0.02	44	Total Hardness	≤ 300 ㎎/L	6
15	Bromate	≤ 0.01 ㎎/L	ND	45	Consumption of $KMnO_4$	≤ 10 ㎎/L	0.5
16	Phenols	≤ 0.005 ㎎/L	ND	46	Odor	Odorless	PASS
17	Diazinon	≤ 0.02 ㎎/L	ND	47	Taste	Tasteless	PASS
18	Parathion	≤ 0.06 ㎎/L	ND	48	Cooper(Cu)	≤ 1 ㎎/L	ND
19	Fenitrothion	≤ 0.04 ㎎/L	ND	49	Color	≤ 5 Unit	ND
20	Carbaryl	≤ 0.07 ㎎/L	ND	50	Alkyl Benzene Sulfonate	≤ 0.5 ㎎/L	ND
21	1.1.1-Trichloroethane	≤ 0.1 ㎎/L	ND	51	pH	5.8 ~ 8.5	6.0
22	Tetrachloroethylene	≤ 0.01 ㎎/L	ND	52	Zinc(Zn)	≤ 3 ㎎/L	ND
23	Trichloroethylene	≤ 0.03 ㎎/L	ND	53	Chloride(Cl⁻)	≤ 250 ㎎/L	0.9
24	Dichloromethane	≤ 0.02 ㎎/L	ND	54	Total Solids	≤ 500 ㎎/L	12
25	Benzene	≤ 0.01 ㎎/L	ND	55	Iron(Fe)	≤ 0.3 ㎎/L	ND
26	Toluene	≤ 0.7 ㎎/L	0.034	56	Manganese(Mn)	≤ 0.05 ㎎/L	ND
27	Ethylebenzene	≤ 0.3 ㎎/L	ND	57	Turbidity	≤ 0.5 NTU	0.11
28	Xylene	≤ 0.5 ㎎/L	ND	58	Sulfate ion	≤ 200 ㎎/L	ND
29	1.1-Dichloroethylene	≤ 0.03 ㎎/L	ND	59	Aluminium(Al)	≤ 0.2 ㎎/L	ND
30	Carbon Tetrachloride	≤ 0.002 ㎎/L	ND				

1. The test results contained in this report are limited to results on the sample(s) that is provided by client and are not necessarily indicative or representative of the qualities of the lot from which the sample(s) was taken or of all products.
2. Further use of the results of this report is prohibited unless allowed under a separate agreement set forth in an official document that is established between the client identified on this letter and the KOTITI Testing & Research Institute.
3. ND : Not-detected, ≤ : Not more than, NA : Not-available

KOTITI Testing & Research Institute

08, November, 2019
Sincerely yours Deputy Taek kyun, Choi
Signature T.K.Choi

Issue Number : 4261120861

KOTITI Testing & Research Institute

KOTITI

Global Business Partner

Test Analysis (Plating wastewater)

Test Results

(Proved water efficiency with authorized institution test]

No.	Item	Measure	Restrictions on malicious wastewater for a specific area in Korea				Request Accredited Institutional Examination of SMVR Test Result Very good (First Grade)		
			Clean Area	"A" Area	"B" Area	Special Area	Influx	Efflux	Ratio (%)
1	BOD	mg/ℓ	40	80	120	30	79.4	9.1	88.5
2	COD_{Mn}	mg/ℓ	50	90	130	40	484	28.3	94.2
3	SS	mg/ℓ	40	80	120	30	186	2.0	98.9
4	T-N	mg/ℓ	30	60	60	60	504	6.01	98.8
5	T-P	mg/ℓ	4	8	8	8	0.85	0.05	94.1
6	CN^-	mg/ℓ	0.2	1	1	1	ND	ND	-
7	Cr	mg/ℓ	0.5	2	2	2	1.42	0.02	98.6
8	Fe	mg/ℓ	2	10	10	10	62.2	0.14	99.8
9	Zn	mg/ℓ	1	5	5	5	183	0.11	99.9
10	Cu	mg/ℓ	1	3	3	3	0.07	0.03	57.1
11	pH	-	5.8~8.6	5.8~8.6	5.8~8.6	5.8~8.6	5.7	6.8	-
12	Conductivity	㎲/㎝	Reference				24,700	57	99.8
13	Na	mg/ℓ	Reference				5,180	1.77	100.0
14	Ni	mg/ℓ	Reference				1.41	0.02	98.6
15	TDS	mg/ℓ	Reference				16,300	48.0	99.7

Before

Concentration of pigment in seawater : 35,000 ppm

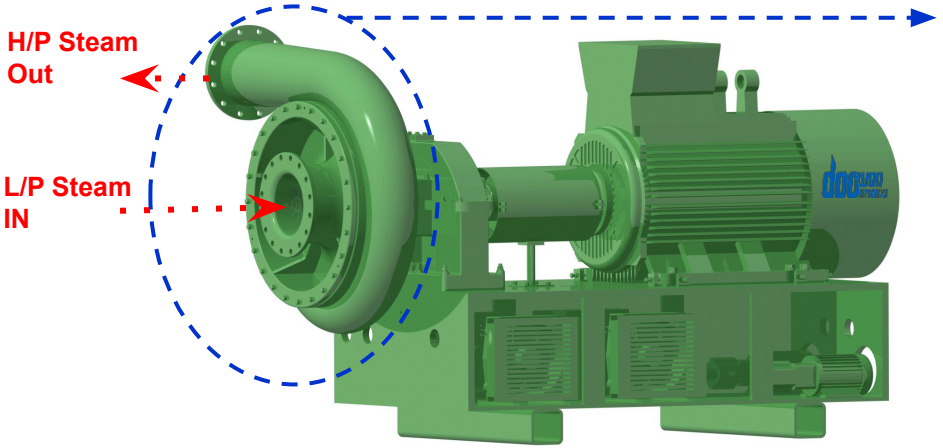
After

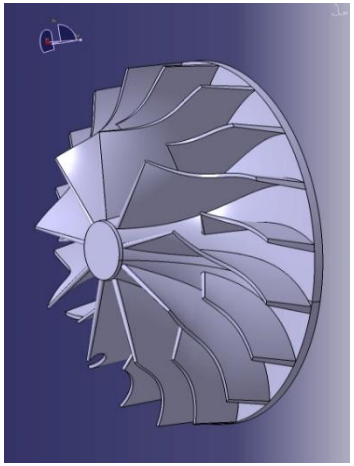
No coliform
No Bacterial
No Salinity
Concentration after purification : 100 ppm.

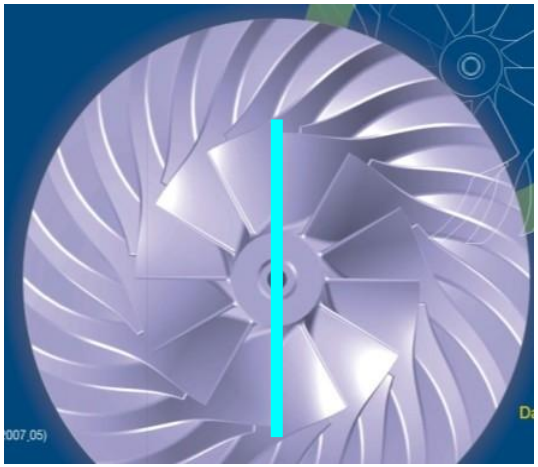
Component and Core Technology

▣ Aerodynamic Design of Turbo Steam Compressor(Core Technology of Doowon)

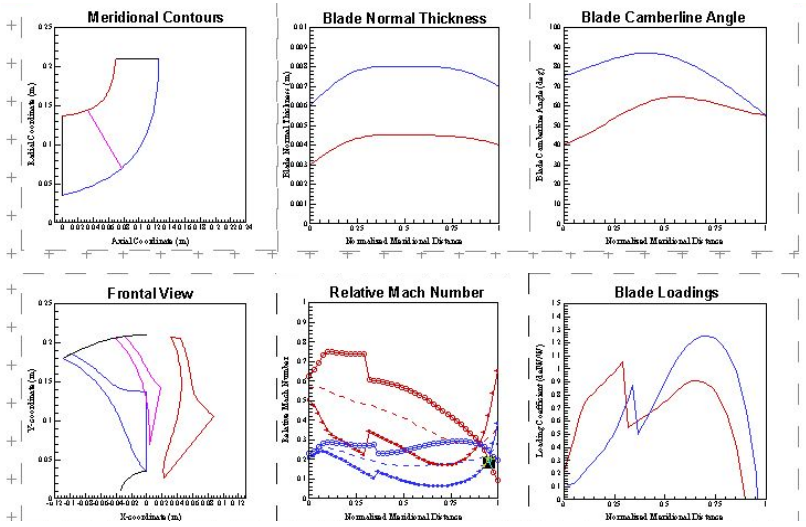
Design Rot. Speed= Max. 22,500 (rpm)



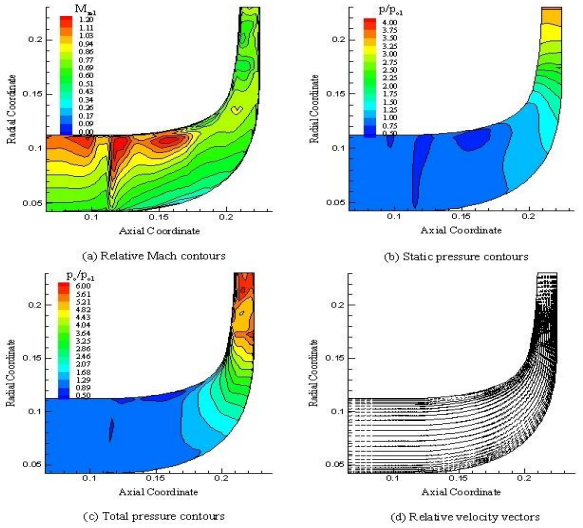




Aerodynamic Analysis & Design

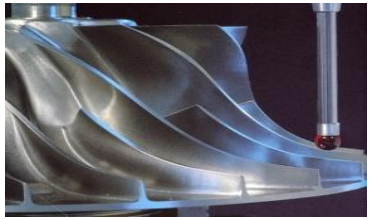


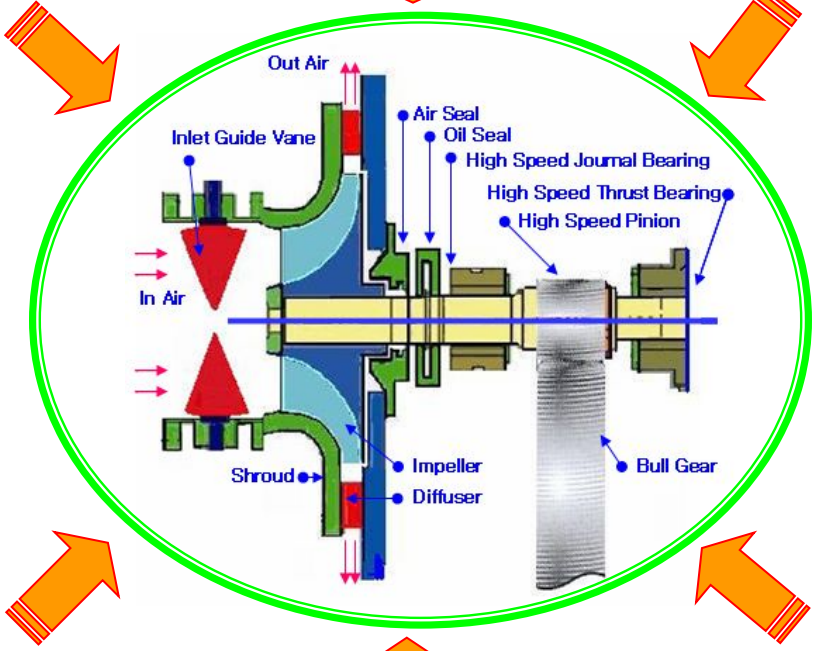
Q3D ⟷ F3D

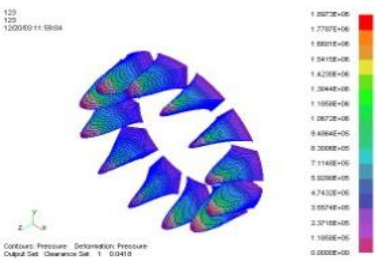


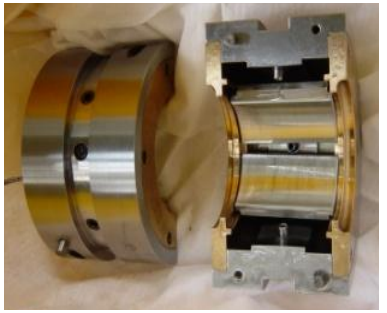
Attach 5

Essential Items of Turbo Compressor



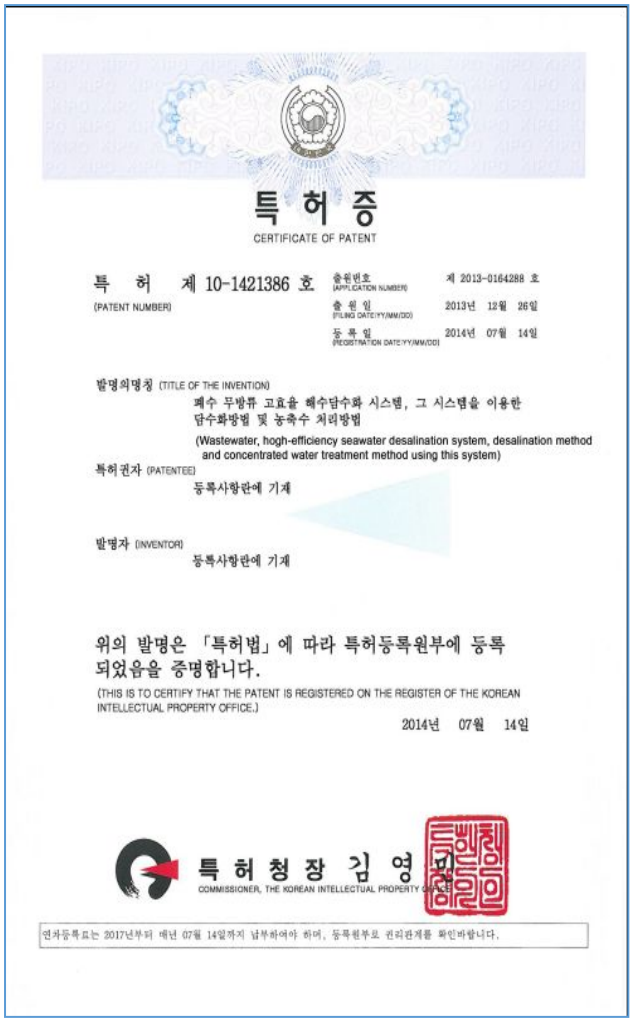






Model	water production		Producing 1 ton average power consumption (kWh/ton)					Motor capacity (kw)
	ton/hour	ton/day		During normal operation Power Consumption (kWh)	contract Power Consumption (kWh)	(kw)	Power Consumption (kWh/day)	
DSM 25	1.042	25	50	52	63	106	1,250	55
DSM 50	2.083	50	50	104	125	212	2,500	110
DSM 75	3.125	75	50	156	188	319	3,750	160
DSM 100	4.167	100	50	208	250	425	5,000	200

Patent Holdings



특 허 증
CERTIFICATE OF PATENT

특 허 제 10-1421386 호 (PATENT NUMBER)

출원번호 (APPLICATION NUMBER) 제 2013-0164288 호
출 원 일 (FILING DATE:YY/MM/DD) 2013년 12월 26일
등 록 일 (REGISTRATION DATE:YY/MM/DD) 2014년 07월 14일

발명의명칭 (TITLE OF THE INVENTION)
폐수 무방류 고효율 해수담수화 시스템, 그 시스템을 이용한 담수화방법 및 농축수 처리방법
(Wastewater, hogh-efficiency seawater desalination system, desalination method and concentrated water treatment method using this system)

특허권자 (PATENTEE)
등록사항란에 기재

발명자 (INVENTOR)
등록사항란에 기재

위의 발명은 「특허법」에 따라 특허등록원부에 등록되었음을 증명합니다.
(THIS IS TO CERTIFY THAT THE PATENT IS REGISTERED ON THE REGISTER OF THE KOREAN INTELLECTUAL PROPERTY OFFICE.)

2014년 07월 14일

특허청장 김 영 [illegible]
COMMISSIONER, THE KOREAN INTELLECTUAL PROPERTY OFFICE

연차등록료는 2017년부터 매년 07월 14일까지 납부하여야 하며, 등록원부로 권리관계를 확인바랍니다.

CERTIFICATE OF PATENT

Patent Number 10-0954301

Application Number 10-2009-0102798

Filing Date 2009. 10. 28.

Registration 2010. 04. 15.

Title of the Invention
APPARATUS FOR TREATMENT WASTEWATER

Patentee
Watergen Co., Ltd(195511-*******)
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Inventor
Jang Dong Hyun
(Jeonpo-dong) 75, Jinnam-ro 356beon-gil, Busanjin-gu, Busan, Republic of Korea

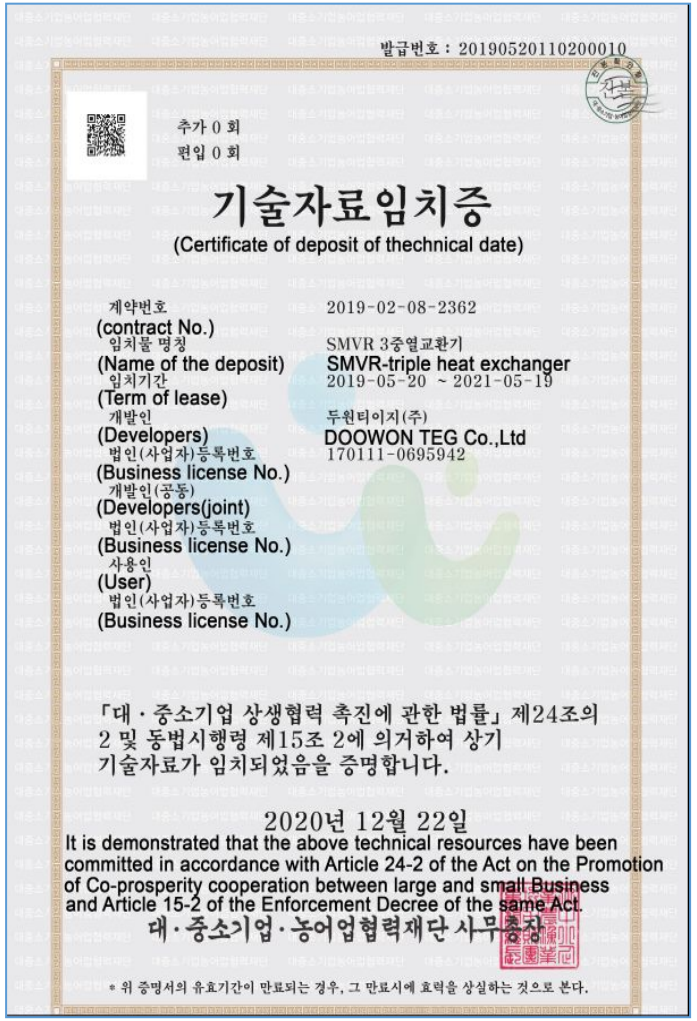
This is to certify that, in accordance with the Patent Act, a patent for the invention has been registered at the Korean Intellectual Property Office.

Check your current registration with QR code

2020. 12. 22.

특허청
Korean Intellectual Property Office

COMMISSIONER,
KOREAN INTELLECTUAL PROPERTY OFFICE
김 용래



발급번호 : 20190520110200010

추가 0 회
편입 0 회

기술자료임치증
(Certificate of deposit of thechnical date)

계약번호 (contract No.) 2019-02-08-2362
임치물 명칭 (Name of the deposit) SMVR 3중열교환기 SMVR-triple heat exchanger
임치기간 (Term of lease) 2019-05-20 ~ 2021-05-19
개발인 (Developers) 두원티이지(주) DOOWON TEG Co.,Ltd
법인(사업자)등록번호 (Business license No.) 170111-0695942
개발인(공동) (Developers(joint))
법인(사업자)등록번호 (Business license No.)
사용인 (User)
법인(사업자)등록번호 (Business license No.)

「대·중소기업 상생협력 촉진에 관한 법률」 제24조의 2 및 동법시행령 제15조 2에 의거하여 상기 기술자료가 임치되었음을 증명합니다.

2020년 12월 22일

It is demonstrated that the above technical resources have been committed in accordance with Article 24-2 of the Act on the Promotion of Co-prosperity cooperation between large and small Business and Article 15-2 of the Enforcement Decree of the same Act.

대·중소기업·농어업협력재단 사무총장

* 위 증명서의 유효기간이 만료되는 경우, 그 만료시에 효력을 상실하는 것으로 본다.

DOOWON T E G
Co., Ltd.

Thank you