AOS®

OIL WATER SEPARATOR & NON-POINT SOURCES

AOS® SEPARATOR
AOS® -park

Road collecting well non-point pollutants treatment equipment
drain for bridge non-point pollutants treatment equipment
artificial wetland non-point pollutants treatment facility
surface water penetration wetland non-point pollutants treatment facility

Through the long-term development for the purpose of advancing the technology and localization in the water environment industry fie ld of the country, our company is producing and providing sludge re mover, the basic equipment in the water environment industry, and l ow-price environmental products for oil/water separation facilities an d associated facilities.

AOS type oil/water separation facilities produced by our company, in particular, can be selectively applied to from small scale discharge facilities including gas stations, repair shops, auto junkyards, rail wa y vehicle bases as well as parking districts of bays, moorings of airp orts, waster water disposal plants of the nuclear power stations, whe re various oil discharge is expected to take place to large scale ones, thereby creating pleasant water environment.

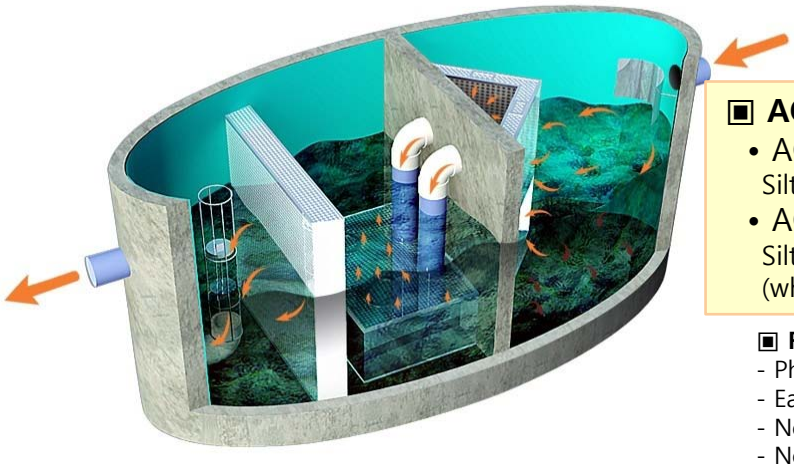
Also, we are producing special concrete structure for water dispos al with high strength and high elasticity in elliptical and cylindrical sh apes, which have little resistance against water flow.

We seek your further advice and encouragement. Thank you

March 2014

Hae Dong A&C Co., Ltd.
C E O Kim, Soo Hae

AOS separator's non-point pollutants treatment facility



AOS Separator

▣ AOS separator consists of:

- AOS Oil water separator
  Silt chamber→ Oil water separator→Discharge
- AOS Oil water separator
  Silt chamber→ Oil water separator→ filter (when necessary) -> discharge

▣ Features

- Physical treatment facility without power
- Easy to maintain and control
- No consumable (oil absorption) is needed;
- No maintenance and control cost is needed during operation.
- Semi-permanent life

▣ Use

- Separate oil and water at waste treatment plant;
- first rainfall treatment of roads and bridges;
- Oil refinery, airport, junkyard, harbor, car wash, maintenance shop and other places that are likely to leak oil and so on.
- Rain and sewage duct non-point pollutants treatment facility
- Large-scaled restaurant, institutional food service, sewage treatment plant's animal and vegetable oil

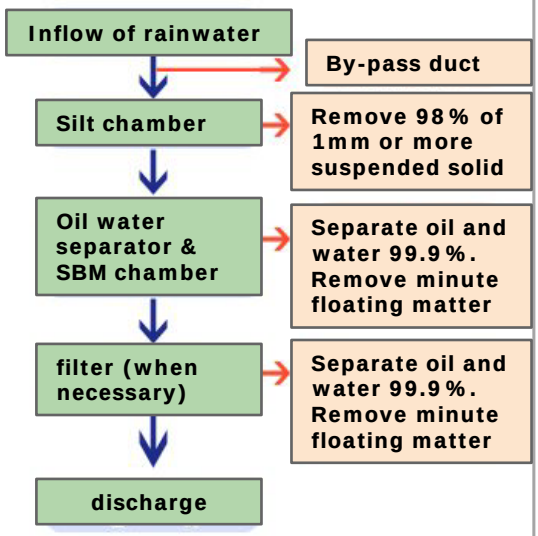
▣ Source technology new product certification

- NEP –2005 –002 (EEC) : AOS separator

▣ Patent registration

- Patent 10-1130251
- Patent 10-1130569
- Patent 10-1130579
- Patent 10-1128388
- Patent 10-1207391

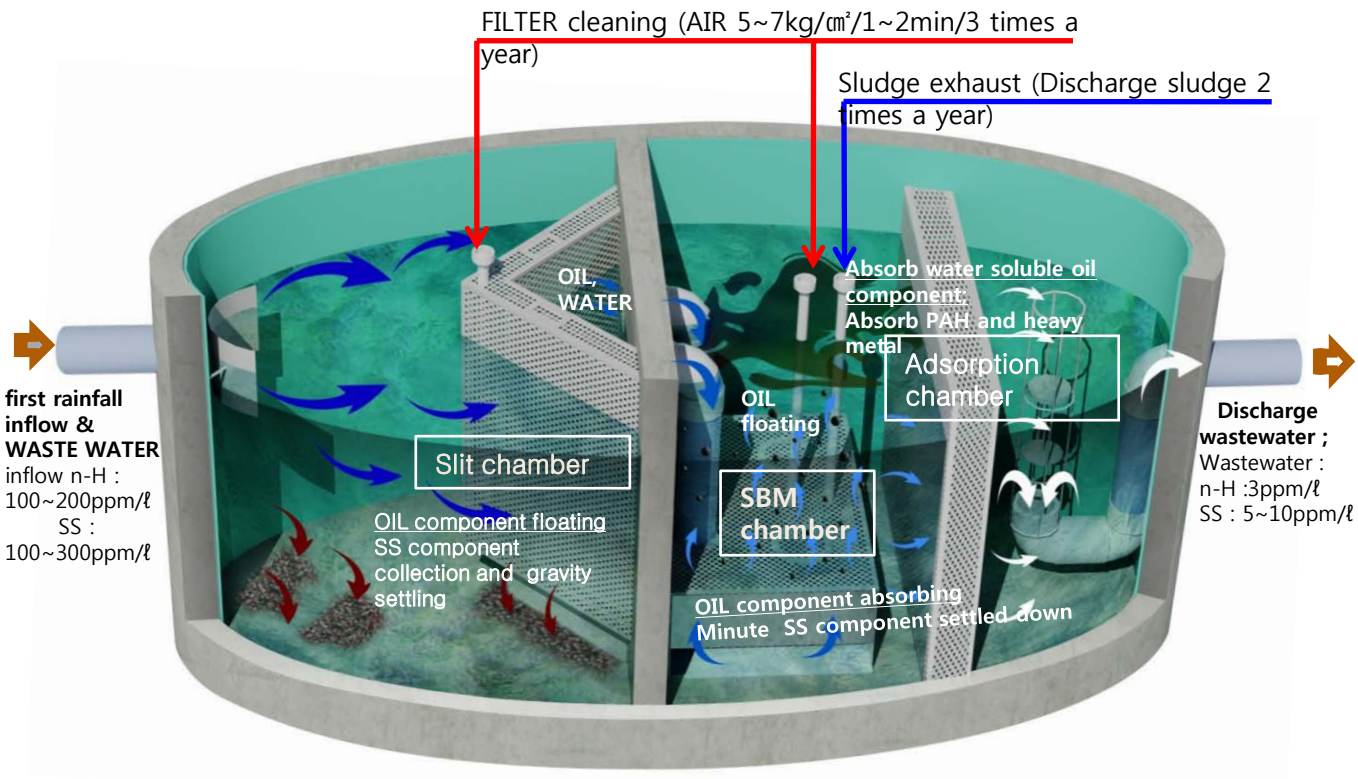
▣ AOS® SEPARATOR 처리 과정도

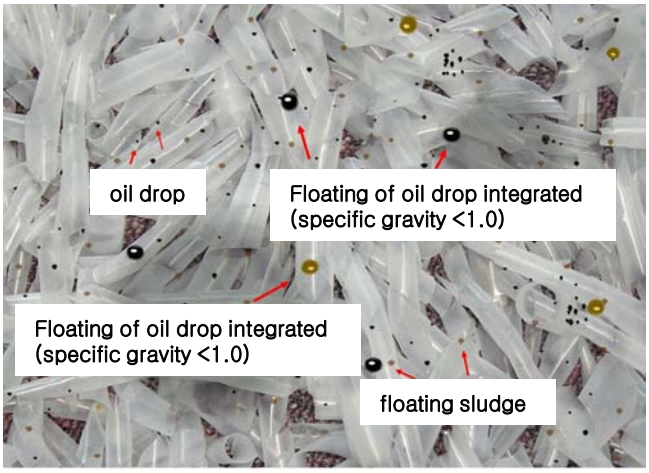


Specification depending upon treatment capacity

구 분		장(Length)	폭(Width)	고(height)	내경	m³
S-1	10 m³/hr	3,400	2,100	2,100	3000x1700x1600	8.2
S-2	20 m³/hr	4,000	2,300	2,150	3600x1900x1650	11.3
S-3	30 m³/hr	4,300	2,400	2,300	3900x2000x1700	13.3
S-5	50 m³/hr	4,600	2,700	2,400	4200x2300x1900	18.4
S-7	70 m³/hr	5,000	2,700	2,600	4600x2300x2100	22.2
M-1	100 m³/hr	5,400	2,800	2,600	4900x2300x2100	23.7
M-1.5	150 m³/hr	5,700	2,900	2,700	5200x2400x2200	27.5
M-2	200 m³/hr	6,000	3,000	2,800	5500x2500x2300	31.6
M-3	300 m³/hr	6,400	3,300	3,000	5900x2800x2500	41.3
M-5	500 m³/hr	7,000	3,500	3,150	6500x3000x2650	51.7
M-7	700 m³/hr	8,000	3,900	3,600	7400x3300x3000	73.3
L-1	1000 m³/hr	8,800	4,200	3,800	8200x3600x3200	94.5
L-1.3	1300 m³/hr	9,700	4,400	4,000	9100x3800x3400	117.6
L-2	2000 m³/hr	10,400	5,100	4,200	9800x4500x3600	158.8
L-3.5	3500 m³/hr	11,900	6,100	4,600	11100x5300x3800	223.6
L-5	5000 m³/hr	14,500	7,100	5,000	13700x6300x4200	362.5

AOS SEPARATOR Treatment System (10 ~500 ㎥/hr)





<Pollutant treatment of U.H.M.W FILTER >

<Shape of Adsorb-it FILTER >

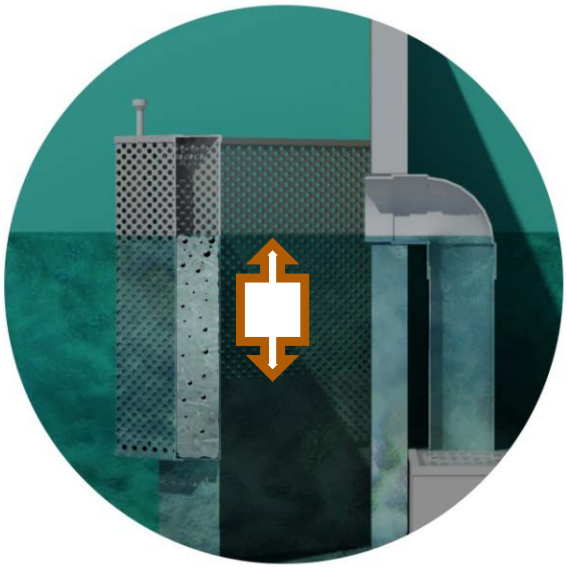
Not only AOS separator's slit chamber but also built-in ultra-high molecular polyethylene made filter of SBM chamber can remove TSS and n-H material 90 to 98% ore more by using physical properties (surface tension between particles by electro-kinetics, electrostatic effect and van der waals force), gravity and buoyancy, and keeps by air supply of movable air compressor 1 to 2 times a year, and run disposal plant economically owing to semi-permanent life.

Built-in geo-textile fabric filter of adsorb-it chamber of AOS SEPARATOR has oil water separator of waste and rain treatment to remove temporary emulsion oil component by pump rotation and swirl at the inflow and to absorb heavy metal and PAH ingredient and to assure of stable treatment efficiency. Reuse of 10 times or more and less than 1% of incineration residue at waste disposal are environmentally friendly.

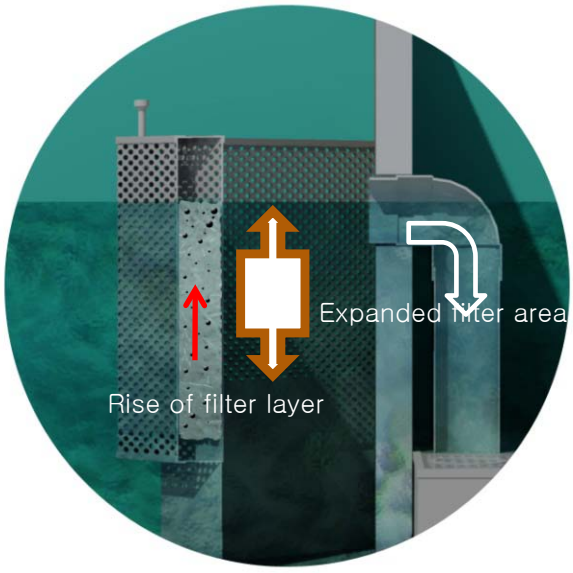
Excellent treatment

Built-in filter of treatment facility moves up and down depending upon change of water level to meet characteristics of irregular rainfall to have normal treatment ability and efficiency even at inflow of much quantity of rainwater after torrential rainfall and to treat irregular rainwater without additional facility.

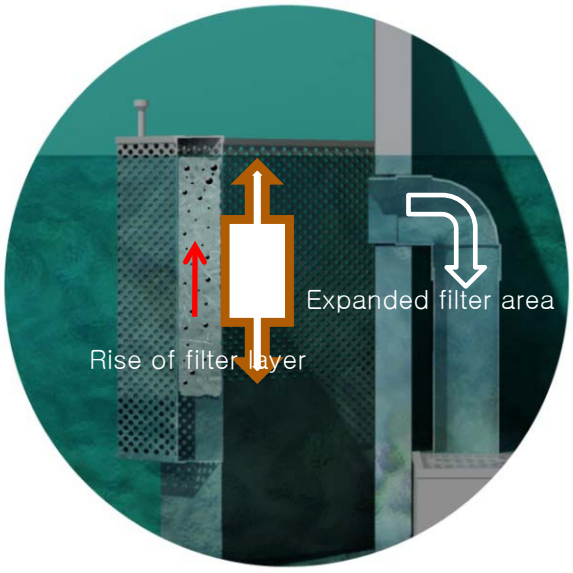
▣ Changes of surface area of filter layer of slit chamber depending upon changes of rain inflow



Normal time



First rainfall



Torrential rainfall

Built-in filter layer of slit chamber of AOS separator moves in accordance with water surface layer depending upon rainfall to treat rain having pollutants.

Built-in ultra-high molecular polyethylene made filter of the chamber has been designed to float under water surface and to move top of filter layer according to rise and fall of rainwater at bottom of slit chamber that rainwater passes through.

The system shows stable treatment efficiency despite more inflow of rainwater at first rainfall and/or torrential rain to differ from existing filter type of non-point pollutant prevention facility.

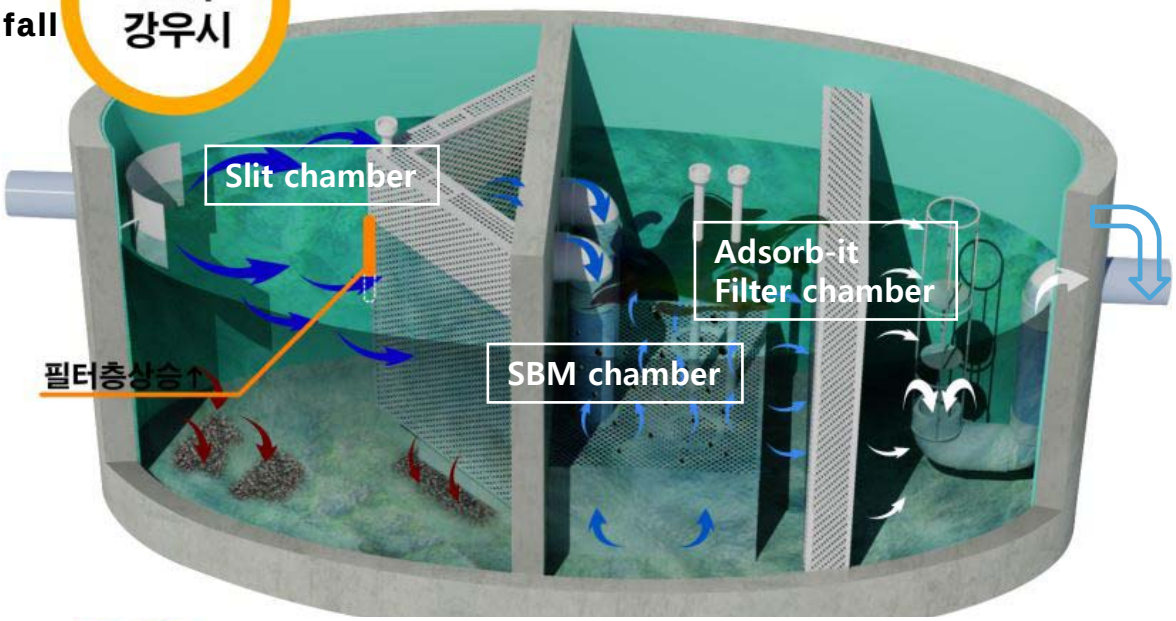
Control of Rainfall

Built-in filter layer of slit chamber of AOS separator moves depending upon rainfall in accordance with water surface layer to treat rain having pollutants.

Adsorb-it filter chamber makes change of its shape depending upon processing capacity and installation place to give limitation upon installation according to kinds of pollutants into treatment tank.

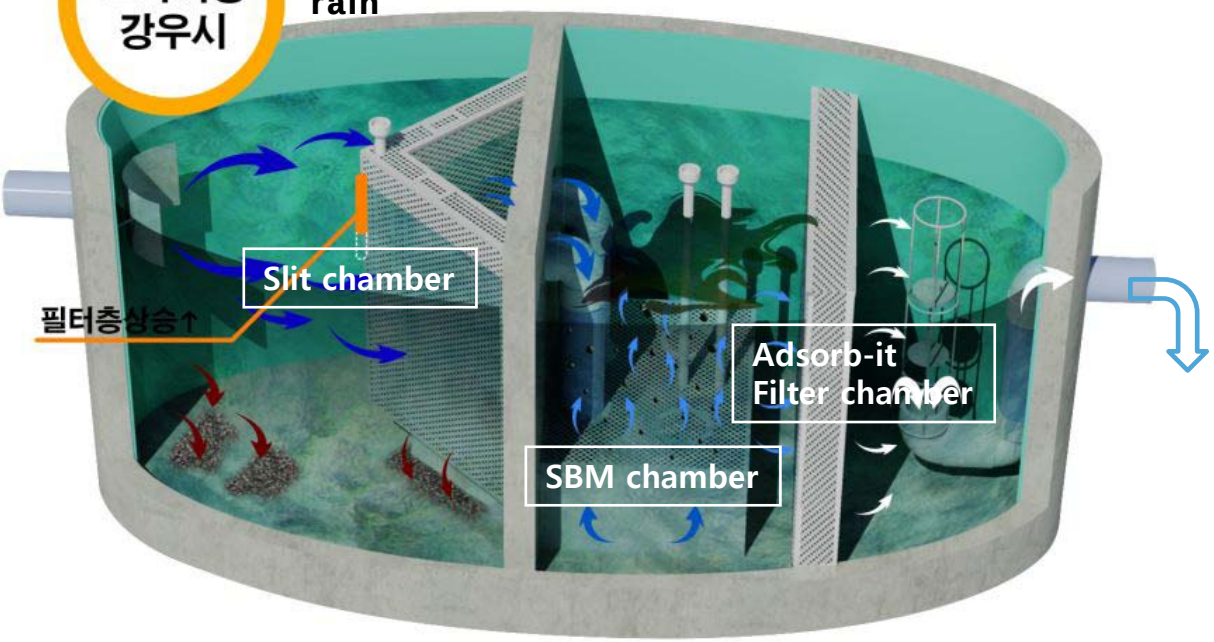
Initial rainfall

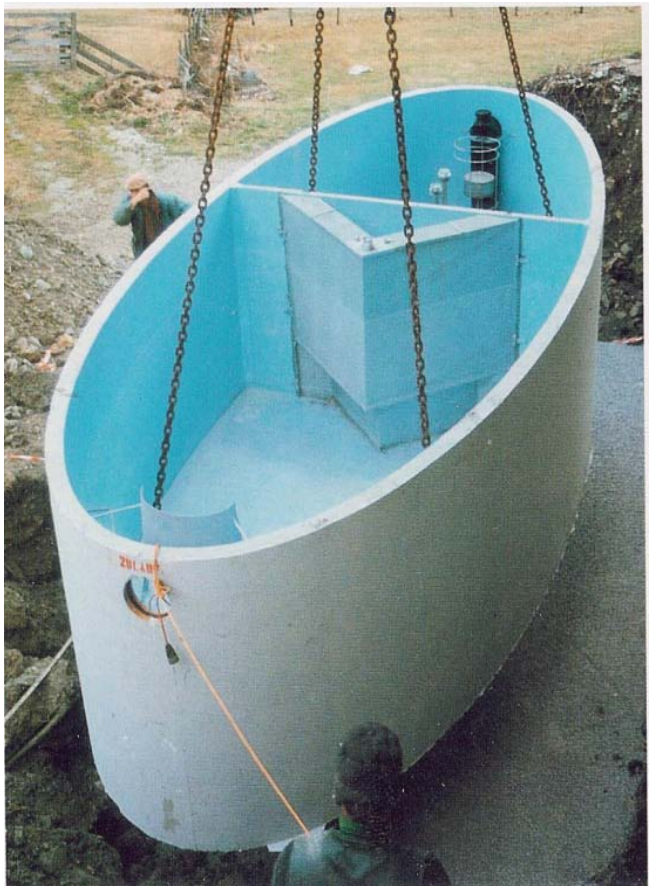
초기 강우시



소나기성 강우시

Rainfall of torrential rain





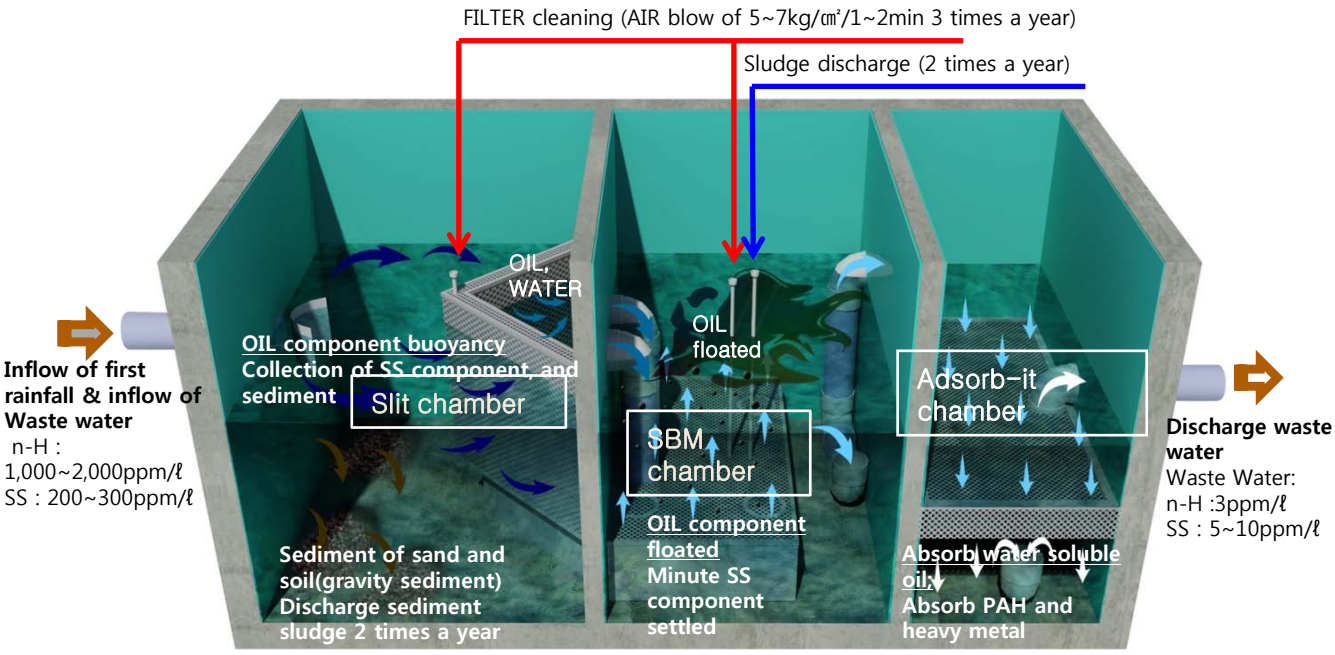
AOS SEPARATOR's treatment efficiency

Section		AOS SEPARATOR
Treatment efficiency	**BOD**	high(87.3~95.4%)
	COD	high(87.3~95.4%)
	SS	high(86.6~95.2%)
	N	high(90% or more)
	P	high(90% or more)
	Heavy metal	high(90% or more)
	n-H	high(94.8% or more)
Type of control	**Unattended**	Possible
	Attended	Easy to take care of
Construction cost		(based on 100)
Maintenance cost		Low

AOS SEPARATOR that is made of oval and integrated PC concrete structure has good durability to have no dead area of squared structure and to have even fluid flow throughout the tank and to prevent waterway from being formed and to keep safe treatment efficiency.

Construction of AOS SEPARATOR

AOS SEPARATOR Treatment System (600 ~6,500 ㎥/hr)



Construction of AOS SEPARATOR (SK Energy)

Construct large capacity disposal (1,000~6,500㎥/hr) by using squared concrete structure, and put discharge plate for dispersion of incoming fluid removes dead area of the tank and to give limitation on installation of absorb-it filter chamber according to properties of pollutants.

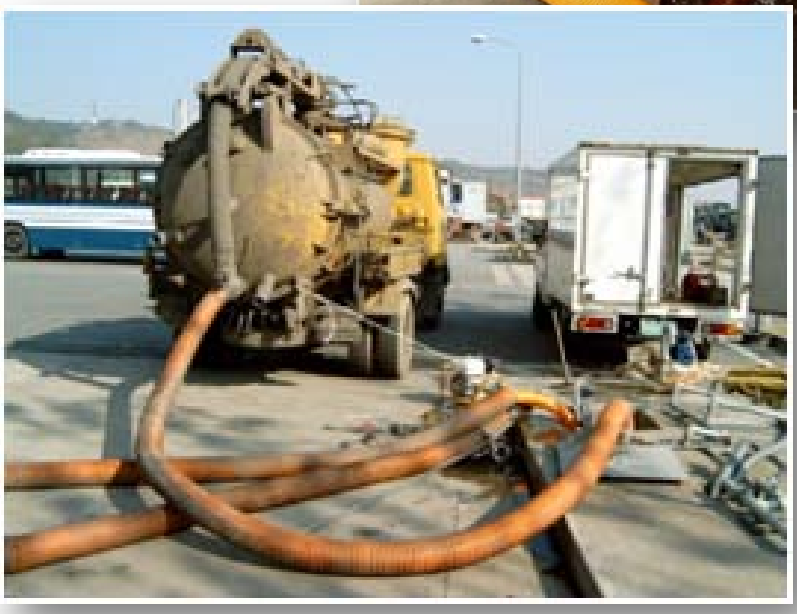
Adsorb-it filter chamber can remove large quantity of soil and sand pollutants, heavy metal and oil and PAH to be functional geo-textile for 10 times reuse.

Features of AOS® SEPARATOR

1. Easy maintenance

- **Physical floating and settling**
- **No failure of the drive**
- **No consumable for maintenance is needed;**
- **Semi-permanent life (30 years or more)**

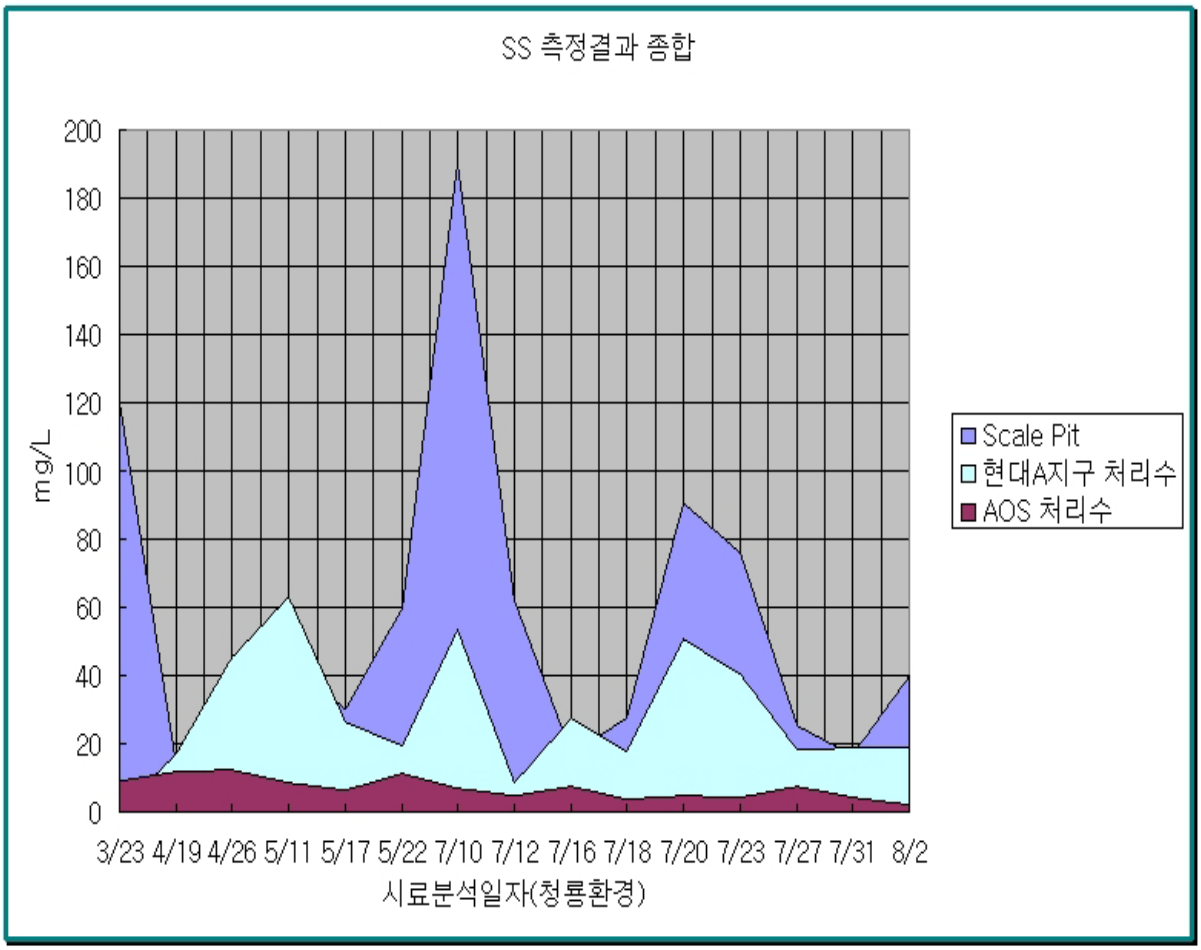
- Filter cleaning: Blow air by movable compressor before and after rain, and 1 time each quarter to keep filter clean.
- Working pressure: 5~7kg/㎠, 5~10sec/3 times,



-Discharge deposit 2 times a year.

2. Stable treatment efficiency

A case of Hyundai Steel Dangjin factory



✓Stable treatment system shall be introduced at pretreatment considering large quantity of irregular discharge of waste water;

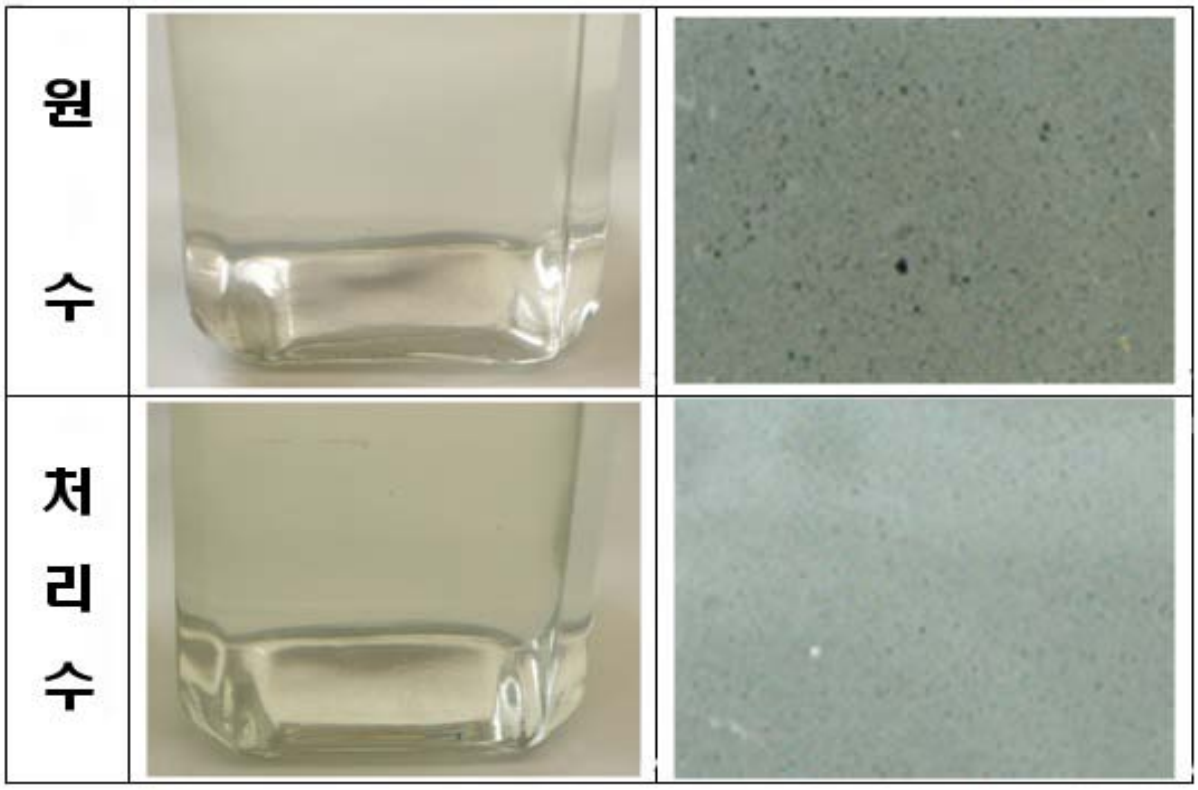
✓Lessen rear sand filter and carbon filter,

✓Reduce total pollutant into waste disposal plant to get waste water quality in stable way;

✓Save maintenance cost of total waste disposal plant (about 9 billion Won per 10 years)

✓Save existing civil engineering costs (Lessen civil engineering facilities 50% or more)

Do not attain better waste water quality without stable disposal plant.



X 1 time X 50 times

3. State-of-the-art Treatment

Run the unit unattended way in continuous circulation and without filter blocking for a long time by adhesion of ultra-high molecular polyethylene material, gravity and buoyancy and physical absorption of the filter (electric dynamics, electrostatic force, van der waals force, internal surface tension between particles by laminar flow.

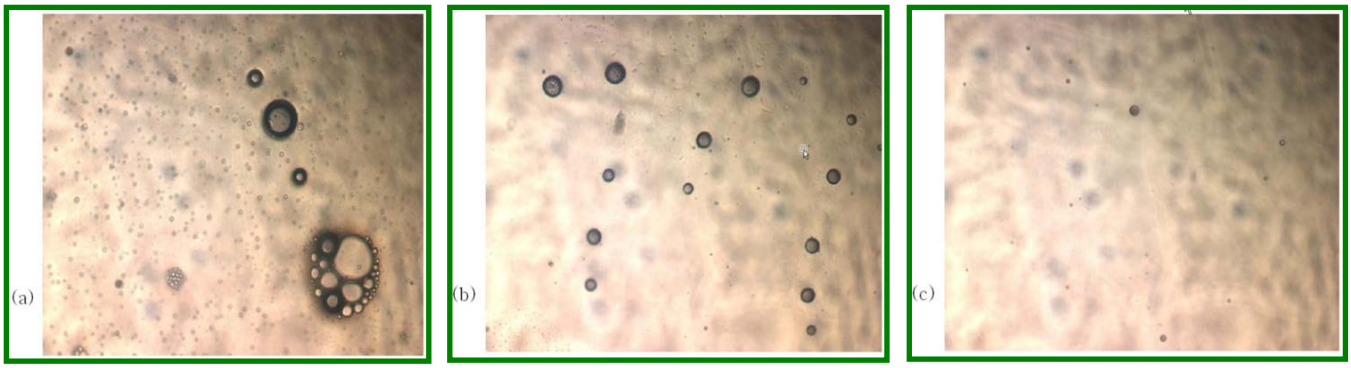


Image - Pro Plus system (Media cybernetics company) of image analysis program was used to show photograph of waste water before and after treatment by using optical microscope (Axioskop 2 plus, Zeiss) to investigate and to estimate particles.

Photographs of (a) influent, (b) effluent through media, (c) terminal effluent

4. Economic advantages

Waste water disposal plant, oil-water separator and non-point pollutant prevention facility for removal of non-point pollutants shall have pressure floating device and/or filter cartridge filled with absorbents to keep treatment efficiency and to exchange filtering material continuously and to dispose of waste of filtering material.

The treatment facility needs power and chemicals costs continuously to inspect and replace it at obsolete state and to increase maintenance costs.

So, installation cost, durability and maintenance cost of the disposal plant need to be inspected, and AOS type separator and non-point pollutant prevention facility for installation and maintenance of disposal plant are thought to be the most economical.

5. Cognition on the product

- **Local technology to be new product certified product of the Ministry of Industry and Resources of Korea (AOS type oil-water separator);**
- **Inexpensive maintenance and installation cost owing to simple structure. To be used 20 years in local and to install 300 or more cases.**

6. Technical advantages

- Ultrahigh molecular ethylene made filter's physical properties such as electricity dynamics, electrostatic force and van der waals force and internal surface tension between particles of laminar flow, gravity and buoyant were used to treat physically.
- Large capacity, and stable treatment efficiency at irregular rainfall
- The highest treatment efficiency of oil/ grease and SS that are basic pollutants of non-point pollutants.
- Better competitiveness at regulation of waste water quality after treatment in the future.
  GREASE : max 1ppm/Litter
- SS (floating matter): max 10ppm/Litter

Trial run result of first rainfall treatment facility at Samsung Electronics Giheung factory (1,300㎥/hr) in June 2006

Composition of standard pollutant

Contents	Volume percentage	Quantity of pollutant
Oil for heating + motor oil 6 (SALE 15/W40)	90 %	161.1 L
Standard type of pollutant (white colored soil)	10 %	14.3 L
Room temperature decontaminant (room temperature calcium carbonate)LOBAMAR140)	2 %	3.6 L
Total oil and water– Concentration liquid of the pollutant	100 %	179 L

Analysis result

Section	Test items	Waste water before treatment	After 20 minutes	After 115 minutes
KTR	SS	780.5	12.4	8.4
	n – H(mineral oil)	324,000	3.3	1.0
Cheongryong Environment Co.	SS	664.0	15.6	2.4
	n – H(mineral oil)	138,093	0.8	0.2

Trial run result of oil water separator at Hankook Tire Daejeon factory (40㎥/hr)(October 2013)

YOUR PARTNER FOR THE BEST QUALITY

TEST REPORT

우 150-038 서울특별시 영등포구 버드나루로 155 (영등포동8가) TEL (02)2164-0011 FAX (02)2634-1008

성적서번호 : TAK-011126
대 표 자 : 조선화
업 체 명 : (주)해동에이오에스
주 소 : 경기 화성시 마도면 마도공단로1길 8 아-103

접 수 일 자 : 2013년 09월 30일
시험완료일자 : 2013년 10월 14일

시 료 명 : 진흙챔버 만수위

시 험 결 과

시험항목	단위	시료구분	결과치	시험방법
노말헥산추출물질	mg/L	-	3730	수질오염공정시험기준 : 2012
부유물질	mg/L	-	7900	수질오염공정시험기준 : 2012
pH	-	-	5.9	수질오염공정시험기준 : 2012

용 도 : 제출용(한국타이어공업(주))

비 고 : 1. 이 성적서는 의뢰자가 제시한 시료 및 시료명으로
2. 이 성적서는 홍보, 선전, 광고 및 소송용 등으로

<Input of AOS SEPARATOR only>

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시 료 명 : 처리수#1

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노말헥산추출물질	mg/L	-	3.4	수질오염공정시험기준 : 2012
부유물질	mg/L	-	2.4	수질오염공정시험기준 : 2012
pH	-	-	6.6	수질오염공정시험기준 : 2012

용 도 : 제출용(한국타이어공업(주))

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2. 이 성적서는 홍보, 선전, 광고 및 소송용 등으로 사용될 수 없으며, 용도 이외의 사용을 금합니다.

On-the-spot Construction of AOS® SEPARATOR

Samsung SDI Head Office at Yongin (200㎥/hr)

<Installation of body of treatment facility>

<installation and backfill of inspection opening>

<compaction of embankment>


<After completion of construction work>

AOS SEPARATOR installation area

AOS SEPARATOR inspection opening

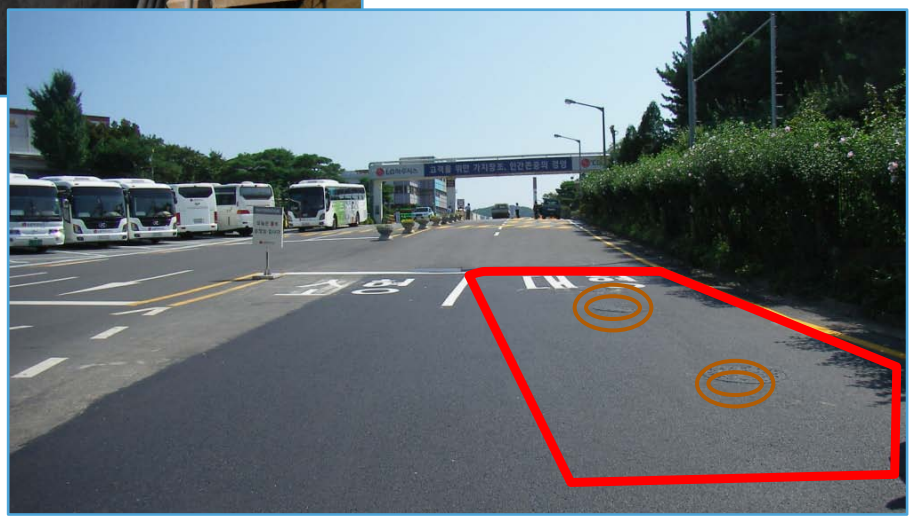
LG Hausys Ulsan factory (200㎥/hr)

<Construction site>

<Installations of AOS SEPARATOR>

Installation area of AOS SEPARATOR

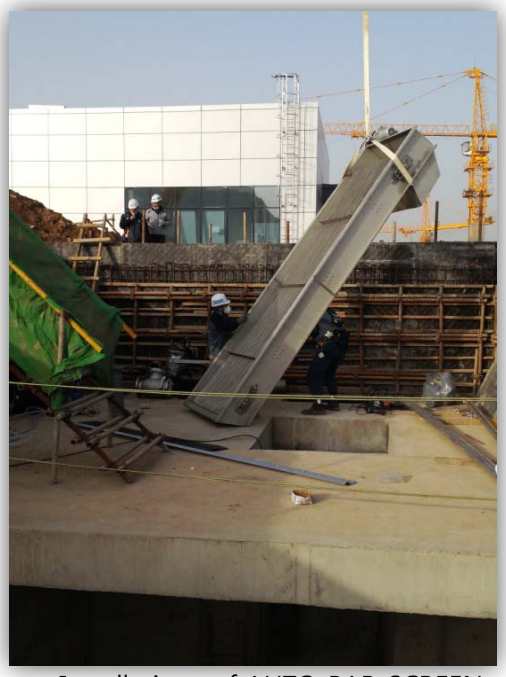
AOS SEPARATOR inspection opening



<After construction>

Samsung Electronics China M-PJT (800㎥/hr)

<Installation of AOS SEPARATOR structure>



<Installations of AUTO-BAR SCREEN>

<Installations of electric flood gate>

<Installations of AOS SEPARATOR>

SK Energy H-PJT (600㎥/hr)

<*Installations of* AOS SEPARATOR>

<Installations of slit chamber>

<Inflow of waste water before treatment>

<Inflow of waste water of filter>

Rainwater into filter has quite different color from that of inlet of waste water.

SK Energy H-PJT (500㎥/hr)

<*Installations of* AOS SEPARATOR>

<Installations of oval steel form>

<Completed oval structure of AOS SEPARATOR only>

Large capacity rain treatment plant of ash stockpile of Taean Generation Headquarters (6,000㎥/hr)

Production of frame of large capacity rain treatment plant at ash stockpile of Taean Generation HQ of Western Power

Install on the surface of ash stockpile to put float enough to support facility weighing 132 tons..

Put various kinds of materials on frame of treatment facility on surface of ash stockpile by float, and put filter and feed piping of waste water treatment.

To treat rain into ash stockpile and coal yard in power plant, install large capacity rain disposal plant on the surface of ash stockpile.

Large capacity rain treatment facility with 6 units of underwater pumps discharges waste water through piping (D=400x6Line) after high molecular filter and adsorb-it fiber filter cartridge.

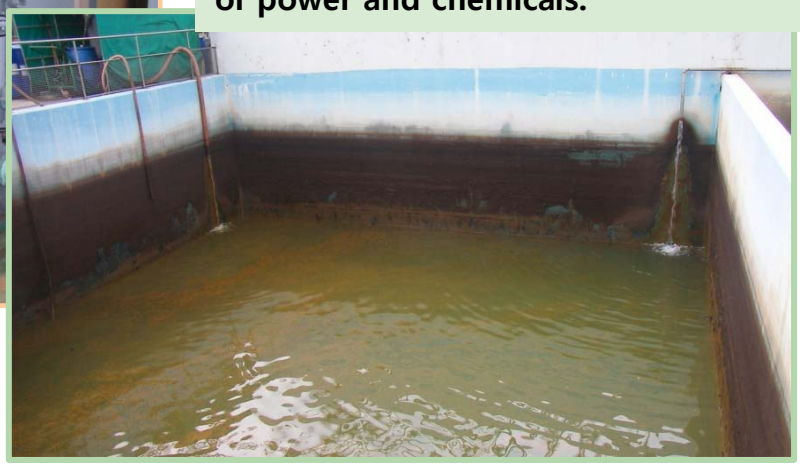
AOS® SEPARATOR Treatment Efficiency

Comparison of Treatment Efficiency [1]

Yeonggwang Nuclear Plant 1st Plant

I. A. F type of oil-water separator

I.A.F oil-water separator : Make use of power and chemicals.



<Treatment tank>

Yeonggwang Nuclear Power Plant 3rd plant

AOS type of oil-water separator

AOS type of oil-water separator : non-powered, gravity, floating force, electricity dynamics, electrostatic power and van der waals force, and internal surface tension between particles by laminar flow

<Treatment tank>

AOS® SEPARATOR Treatment Efficiency

Comparison of treatment efficiency [2]

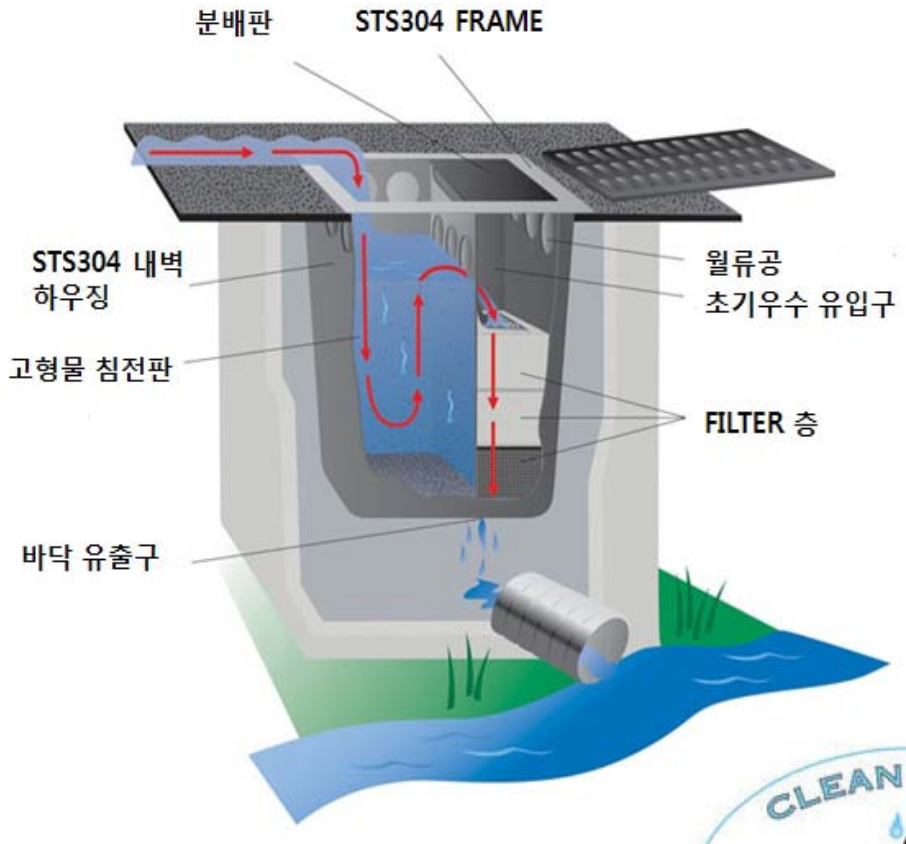
SK Oil Terminal Co., Ltd

Physical treatment facility by gravity, buoyancy, electric dynamics, electrostatic force, van der waals force and internal surface tension between particles by laminar flow from oil-water separator to non-point pollutant treatment facility

inlet of waste water before treatment

Outlet of treatment water

AOS® Roads collecting well non-point pollutants treatment equipment



1. Features

- Physical treatment facility by non-power
- Easy to maintain
- Absorb vegetable oil and mineral oil very well (20 times than weight)
- Remove rust and PAH(Polynucrear Aromatic Hydrocabon)
- Remove Fecal Coliform Bacteria completely
- Remove emulsified oil
- Make use of consumables again (save maintenance costs)
- Save disposal cost of the waste at exchange of filtering material (less than 1% of incineration residue).

2. Use

- first rainfall treatment facility of roads and bridge
- 2nd filter media of non-point pollutant facility of oil refinery, junkyard, car wash, maintenance & repairing and industrial site
- 2nd filter media of non-point pollutants treatment facility of rain and sewage duct

3. Make use of filter media again 10 times or more

AOS® collecting well non-point pollutants treatment equipment construction

<collecting well type of non-point pollutants treatment equipment of construction site of Yeongcheon Fire Station>

<collecting well type of non-point pollutants treatment equipment of drainage of Incheon Bridge>

AOS® collecting well non-point pollutants treatment equipment construction

Remove high concentration road pollutants into vegetation water tank by collecting type of non-point pollutants treatment equipment not to give damage to beauty at surrounding area by growth of vegetables and to treat first rainfall.

<collecting well type of non-point pollutants treatment equipment of vegetation water tank of Incheon Bridge >

AOS® collecting well non-point pollutants treatment equipment construction case

One year after opening of Incheon Bridge, three of vegetation water tanks around return way of tollgate have been contaminated dark by road pollutants to kill vegetation and devastate.

<Vegetation tank contaminated before construction>

<Dredge of sediment>

Vegetation water tank of detour road of Incheon Bridge was built up to give spectators comfortable rest place after opening, and accumulated pollutants killed vegetation to produce odor, so that collecting well non-point pollutants treatment equipment was built up at inlet of rainwater along with dredge of vegetation water tank.

<Construction of vegetation soil zone>

AOS® roads collecting well non-point pollutants treatment equipment

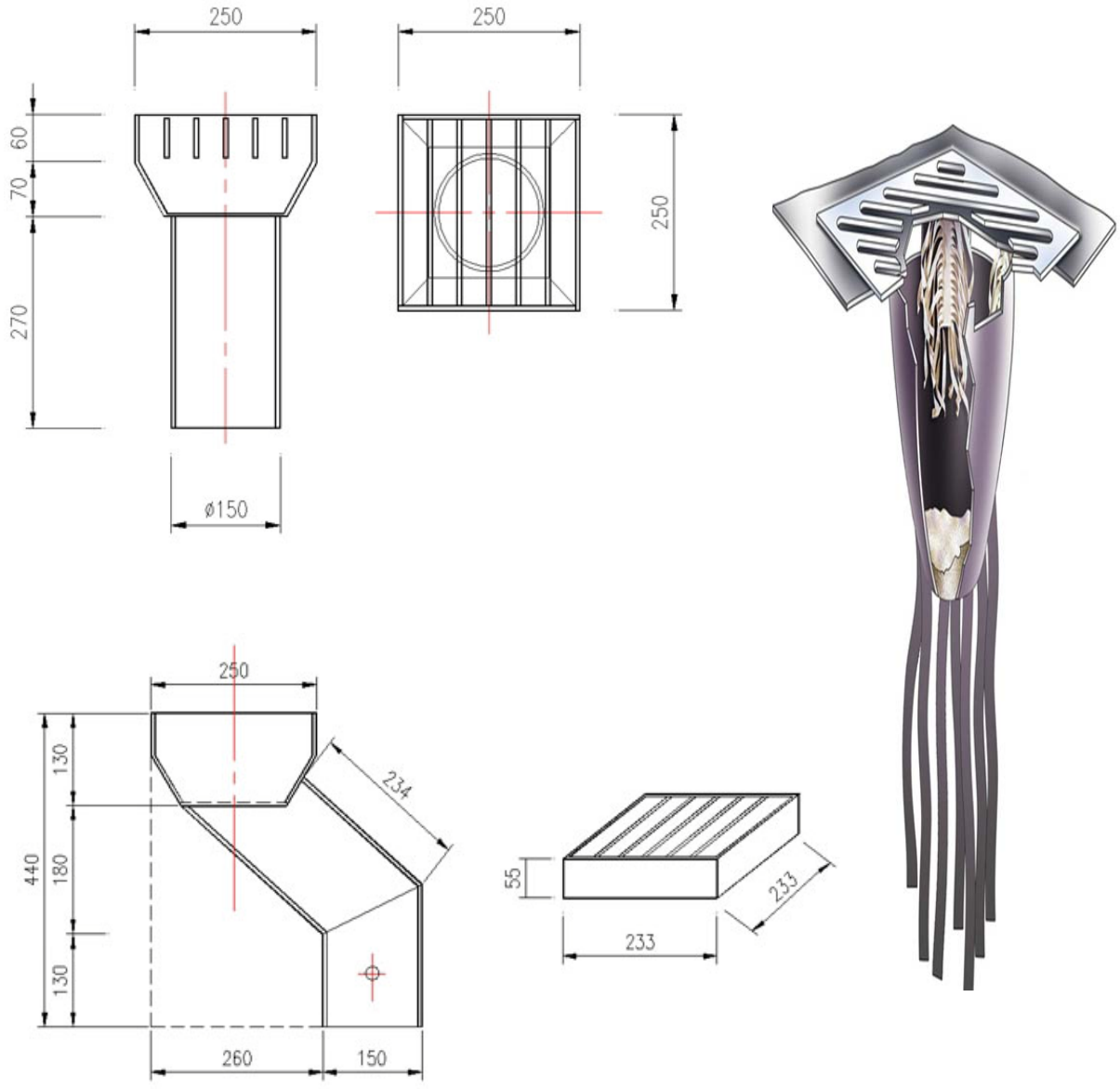
<collecting well of existin

Install first rainfall treatment facility for road collecting well not replacing collecting wells of not only new roads but also existing roads to save construction costs that is advantage than other first rainfall treatment facility for collecting well.
Life of filter media of the facility is 10 times or more longer than that of others to save maintenance costs greatly and to lessen waste disposal costs greatly to be economical.

▣ **Treatment capacity by specification**

road collecting well model	Treatment capacity (㎥/hr)	Dimension (m)
AOS-R1	1~2	W0.4 x L0.5 x H0.8
AOS-R2	2~3	W0.4 x L0.8 x H1.0
AOS-R3	3~5	W0.5 x L1.0 x H1.2
AOS-R5	5~7	W0.6 x L1.2 x H1.2
AOS-R7	7~9	W0.8 x L1.4 x H1.4
AOS-R9	9~12	W1.0 x L1.6 x H1.4
AOS-R12	12~15	W1.2 x L2.0 x H1..5

AOS® drain for bridge non-point pollutants treatment equipment



<first rainfall treatment facility for drain for bridge>

First rainfall treatment facility for drain for bridge can be installed without replacement of collecting well at not only new bridge but also existing bridge to save construction costs that is great advantage than other first rainfall treatment facilities.

The facility has 10 times or more life of filter media for first rainfall treatment than other facilities have, and fiber made filter cartridge can be put without changes of forms to be used for collecting wells of all kinds of bridges to save maintenance costs greatly and to lessen waste disposal expenses and to be economical.

Innovative Oil Spill Cleanup Product

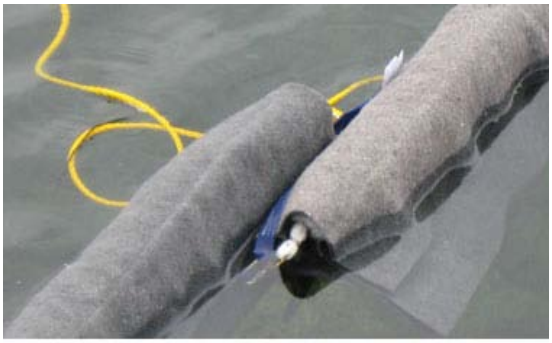
Vault Maintenance System Filter Sock
filters TSS and Oil below regulatory guidelines

Filter Booms
connected units spanning river

Boom and Dock Curtain
continuous collection of oil & sheen at fuel dock

8" dia. x 10' long Filter Sock
remove oil and suspended solids from water

8" dia. x 5' long Filter Sock
remove oil and suspended solids from water



Shore Guard aka "Dumbo Surfer"
connected units - 10" overlap - stainless steel clips

Hula Bug
control oil in catch basins and sumps

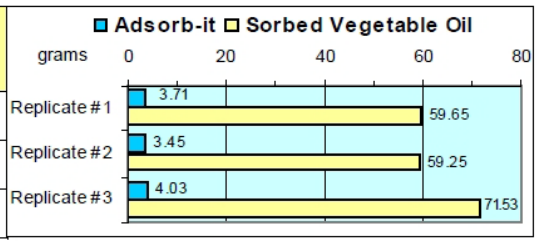
Vegetable Oil and Motor Oil Adsorption Capacity Analysis by Weight

Tests were performed on Adsorb-it® sorbent media to determine its capacity to sorb oils.

The tests were performed using guidelines described in ASTM Method F726-81, "Sorbent Performance of Adsorbents". This test method measures the maximum adsorption of oils and floating immiscible liquids. The materials tested were representative samples of Adsorb-it® bulk material. The oils used were 30W motor oil and a liquid vegetable oil. Three replicates were performed for each type of oil.

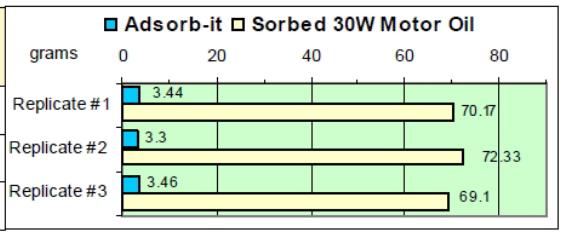
Vegetable Oil - Adsorb-it® adsorbed approximately 17 times its weight in vegetable oil.

Adsorb-it® Bulk Material	Adsorb-it® weight in grams	Sorbed Oil weight in grams	Adsorb-it® Ratio to Sorbed Oil
Replicate #1	3.71	59.65	16.1x
Replicate #2	3.45	59.25	17.2x
Replicate #3	4.03	71.53	17.7x

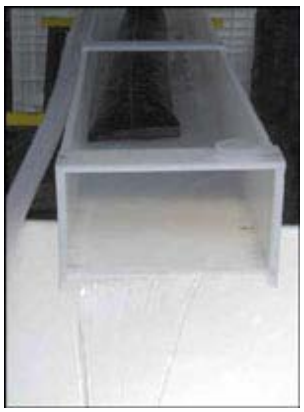


30W Motor Oil - Adsorb-it® adsorbed approximately 20 times its weight in motor oil.

Adsorb-it® Bulk Material	Adsorb-it® weight in grams	Sorbed Oil weight in grams	Adsorb-it® Ratio to Sorbed Oil
Replicate #1	3.44	70.17	20.4x
Replicate #2	3.30	72.33	21.9x
Replicate #3	3.46	69.10	20.0x



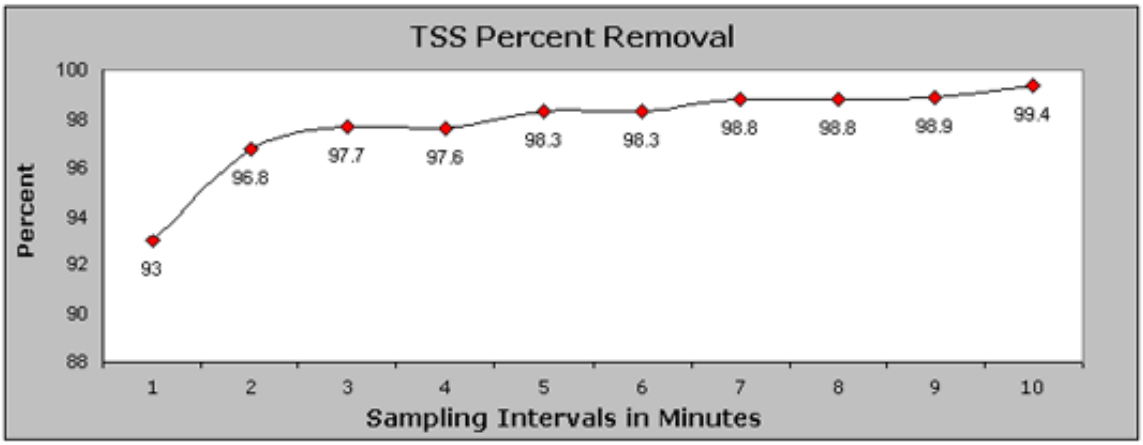
Oil & Grease EPA Method 1664				
Sample ID	**Sample Volume ml**	**Wt Residue**	**Oil &Grease Mg/L**	**Percent Removal**
Initial Sample	**500**	**1.136**	**2270 Mg/L**	**Unfiltered**
#1 Start - 5 min	500	< 0.001	ND	100
#2 Mid - 7 min	500	< 0.001	ND	100
#3 End - 10 min	450	< 0.001	ND	100



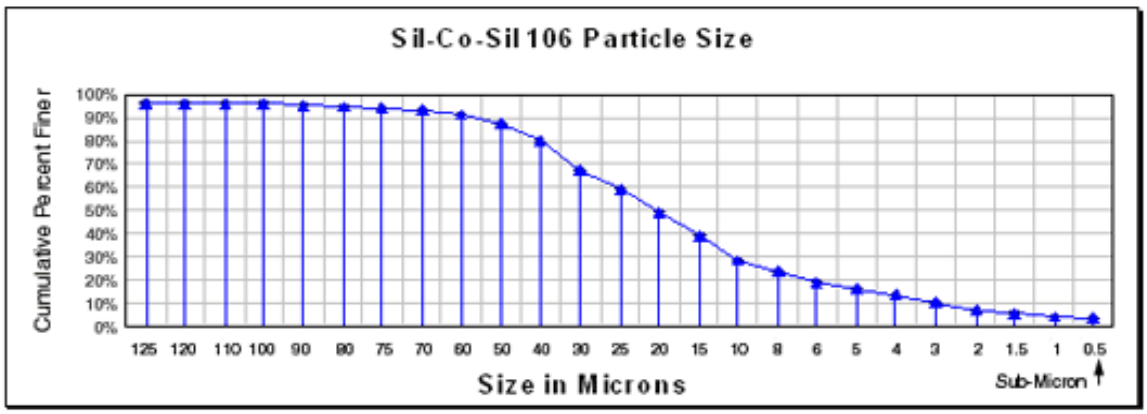
Filter Sock Vault Maintenance System

The samples were analyzed for Total Suspended Solids (TSS) using EPA Method 160.2.

TSS EPA Method 160.2			
Initial Sil-Co-Sil 106 with TSS of 2700 Mg/L unfiltered			
Sample ID	Time Interval	TSS Mg/L	Percent Removal
#1	1 min	222	93
#2	2 min	87	96.8
#3	3 min	72	97.7
#4	4 min	66	97.6
#5	5 min	49	98.3
#6	6 min	46	98.3
#7	7 min	34	98.8
#8	8 min	35	98.8
#9	9 min	33	98.9
#10	10 min	19	99.4

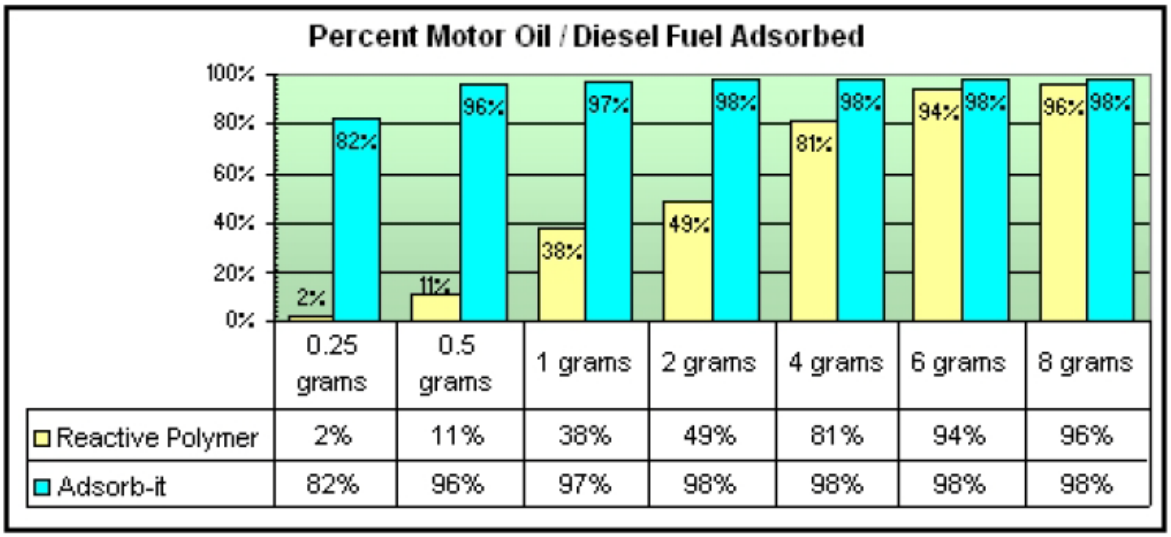


Conclusion: The filtration efficiency increased with time. This was due to sediments being deposited within the VMS, filling in the fabric's micron pores, allowing enhanced removal of sub micron particles. Flow rates will vary dependent on the sediment's micron ratings. Sil-Co-Sil 106 is an extremely fine powder, unlike normal sediments. Natural sediments such as soil or cinder clay allow much greater flow rates and loading as the larger particle sizes keep the fabric's micron pores from sealing off. The overall sediment removal rate from the total of the filtrate was 98.3 percent, which far exceeds the 80 percent standards for rating BMP devices..



Motor Oil / Diesel Fuel Adsorption from Water

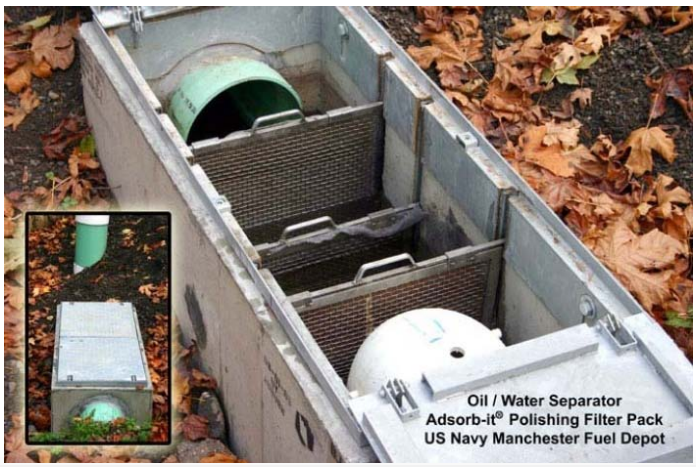
Adsorb-it and a granulated Reactive Polymer were tested to compare the uptake of a motor oil / diesel fuel mix from water. 200 ml of water and 10 grams of a motor oil / diesel fuel mix were added to pre-cleaned sample containers. Pre-weighed samples of sorbent, ranging from 0.25 grams to 8 grams, were added to each container and allowed to sorb. The sorbent was then removed and the contents of each jar were analyzed to determine the weight of motor oil/diesel fuel remaining. The graph below illustrates the results.



	0.25 grams	0.5 grams	1 grams	2 grams	4 grams	6 grams	8 grams
Reactive Polymer	2%	11%	38%	49%	81%	94%	96%
Adsorb-it	82%	96%	97%	98%	98%	98%	98%

Conclusions

Addition of 0.5 grams of Adsorb-it® sorbent material removes more than 96% of the oil/ fuel mix. The Reactive Polymer requires 8 grams to achieve the same results. With the a ddition of 0.25 grams the Adsorb-it® material reaches saturation, but removes more tha n 32 times its weight of the petroleum. The saturation point for the Reactive Polymer oc curs at approximately 3.6 times its own weight in oil.
The Adsorb-it® sorbent adsorbed the oil almost immediately on contact, while the Reacti ve Polymer sorbent required several minutes before its maximum saturation was reache d. When small amounts of the granulated Reactive Polymer were added, removal of the saturated material was difficult because the material did not clump or mat together. The Adsorb-it® sorbent was cohesive and easily removed.



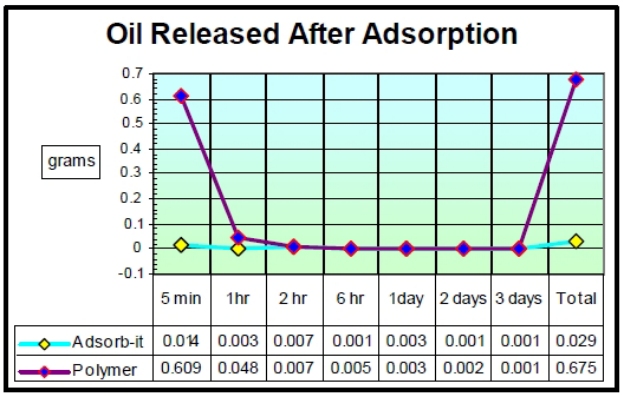
Geo-textile 나선형 부유필터

Studies have shown the remarkable ability of Adsorb-it® to filter and adsorb petroleum hydro carbons. In many applications, filter media is required to endure long dry periods subsequent to the retention of these hydrocarbons. It is imperative that a filter media have not only the ability to retain petroleum hydrocarbons in wet or dry conditions, but to function cyclically through wet and dry periods with a high degree of efficiency.

Method

For comparison, a retention study was performed using Adsorb-it® geo-textile filtration fabric and a granulated reactive polymer. This study was performed to document the relative oil loss from each media through alternating periods of flushing and drying.
20 grams of Adsorb-it® and 20 grams of granulated reactive polymer were placed into a filtration apparatus. 10grams of motor oil was poured onto the Adsorb-it® and 10 grams of motor oil was poured onto the granulated reactive polymer. Both were allowed to stand for 5 minutes. Subsequently, 1 liter of water was poured through each media. Additional flushing with water was continued at measured intervals up to 3 days. Flushing waters from each interval was collected and analyzed in accordance with EPA Method 413.1 to document the weight of any oil released from either media. The results of this study are presented in the graph and table below.

Results



Percent Oil Released		
Time	Adsorb-it®	Reactive Polymer
5 min	0.2%	6.1%
1 hr	< 0.1%	0.5%
2 hr	< 0.1%	0.1%
6 hr	< 0.1%	0.1%
1 day	< 0.1%	< 0.1%
2 days	< 0.1%	< 0.1%
3 days	< 0.1%	< 0.1%
Total	**0.3 %**	**6.8 %**

Removal of Emulsified Oil with Adsorb-it®

Sample	Result (ppm) Unfiltered	Result (ppm) Filtered with Adsorb-it®	% Oil Removed by the Adsorb-it®
Low Level	**24**	**3.2**	**87%**
Med Level	**140**	**7**	**95%**
High Level	**960**	**24**	**97%**

Conclusions

At the medium and high levels Adsorb-it® removed greater than 90 percent of the oil. Competing products that remove floating oil have generally proven ineffective with partially dissolved or emulsified oil.

Adsorption Capacity of Adsorb-it® Compared to Other Oil Sorbent Media

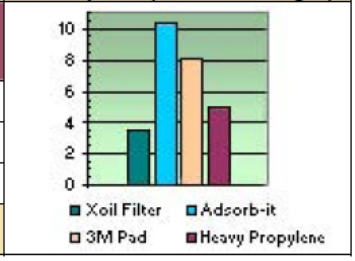
Polypropylene products are the most widely used oil adsorbent products on the market today... not the best... Just the most widely used. This study compares the adsorptive qualities of Adsorb-it®, 3M Polypropylene Pads, Heavy polypropylene geo-textile as used for storm water filtration, and Xoil bilge filter with Clerify filter media.

Method

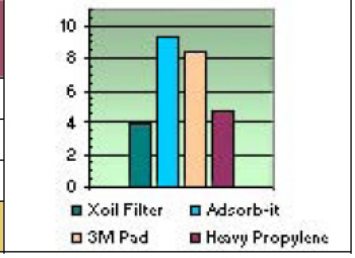
ASTM Method F726-81, "Sorbent Performance of Adsorbents" measures the maximum adsorption of oils and floating immiscible liquids. Testing under these ASTM guidelines, representative samples of the media to be tested were treated with three equivalent solutions of 50 weight motor oil, #2 diesel fuel, and a 50/50 solution of motor oil and diesel fuel. Each media was tested 3 times with each solution and the results of the 3 tests were averaged for each tested media to obtain an accurate representation of the adsorption capacity. Results of this adsorption capacity comparison are presented in the tables below.

Results

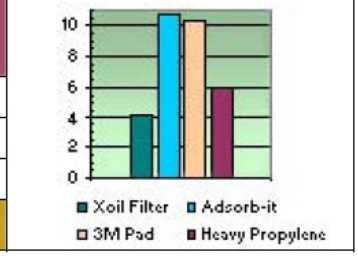
#2 Diesel Oil					Adsorption (times its weight)
weight in grams	Xoil Filter	Adsorb-it®	3M Pad	Heavy Propylene	
Dry Weight of Media	1.175	0.5674	0.873	0.3857	
Oil-Saturated Weight	5.453	6.4084	7.919	5.97	
Weight of Oil	4.278	5.841	7.046	4.9843	
Adsorption (times its weight)	**3.64**	**10.29**	**8.07**	**5.06**	



50/50 Diesel / Motor Oil					Adsorption (times its weight)
weight in grams	Xoil Filter	Adsorb-it®	3M Pad	Heavy Propylene	
Dry Weight of Media	1.1508	0.7448	0.9049	1.0635	
Oil-Saturated Weight	5.5925	7.666	8.5334	6.1893	
Weight of Oil	4.4397	6.921	7.6285	5.1258	
Adsorption (times its weight)	**3.85**	**9.29**	**8.43**	**4.82**	



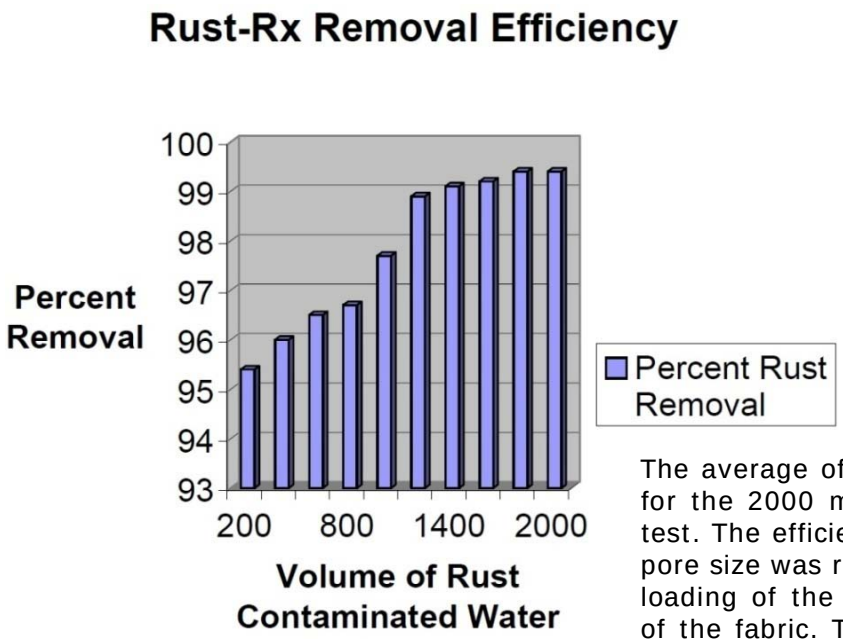
Motor Oil					Adsorption (times its weight)
weight in grams	Xoil Filter	Adsorb-it®	3M Pad	Heavy Propylene	
Dry Weight of Media	0.9886	0.7128	0.7935	0.98045	
Oil-Saturated Weight	5.2013	8.3665	8.9828	6.80125	
Weight of Oil	4.2128	7.6536	8.18925	5.8219	
Adsorption (times its weight)	**4.26**	**10.74**	**10.32**	**5.94**	



Conclusions

Test results clearly show that Adsorb-it® out-performed the other filtration media with an average adsorption factor in excess of 10 times the weight of the Adsorb-it® filtration fabric. 3M Polypropylene Pads ran second tothe Adsorb-it®, however, it should be noted that 3M Polypropylene Pads cannot be used as a filtration media because water will not readily pass through the polypropylene pad, nor can they be re-used as the Adsorb-it® can be.

Rust-Rx Filter Sock



The average of the rust removal is 98.3 percent for the 2000 mL of water rust mixture filtration test. The efficiency of the fabric improved as the pore size was reduced by the
loading of the rust within the interstitial spaces of the fabric. The particle size of the rust water mixture was between 0.5 and 5 microns at a pH of 4. At higher pH, the performance would be better as the particle size would increase due to hydroxide flocculation

Wash Wastewater Filtration

Parameter	Method #	Result Unfiltered	Result Adsorb-it® Filtered	Detection Limit	Units
Oil & Grease	EPA 1664	> 1000	6	5	ppm
Total Suspended Solids	EPA 160.2	230	10	5	ppm
#2 Diesel Fuel	NWTPHDX	910	3.4	.02	ppm
Motor Oil	NWTPHDX	15000	3	0.4	ppm
Arsenic	EPA 6020	ND*	ND*	0.006	ppm
Cadmium	EPA 6020	0.0018	ND*	0.0005	ppm
Chromium	EPA 6020	0.013	0.0044	0.001	ppm
Copper	EPA 6010	0.077	ND*	0.01	ppm
Lead	EPA 6010	0.011	ND*	0.01	ppm
Zinc	EPA 6010	2.1	0.85	0.01	ppm

As can be seen in the table above, Adsorb-it® sorbent was highly effective in removing organic pollutants and suspended solids from the sample. Especially notable is the reduction in oil and grease, diesel, and motor oil between the filtered and unfiltered samples.

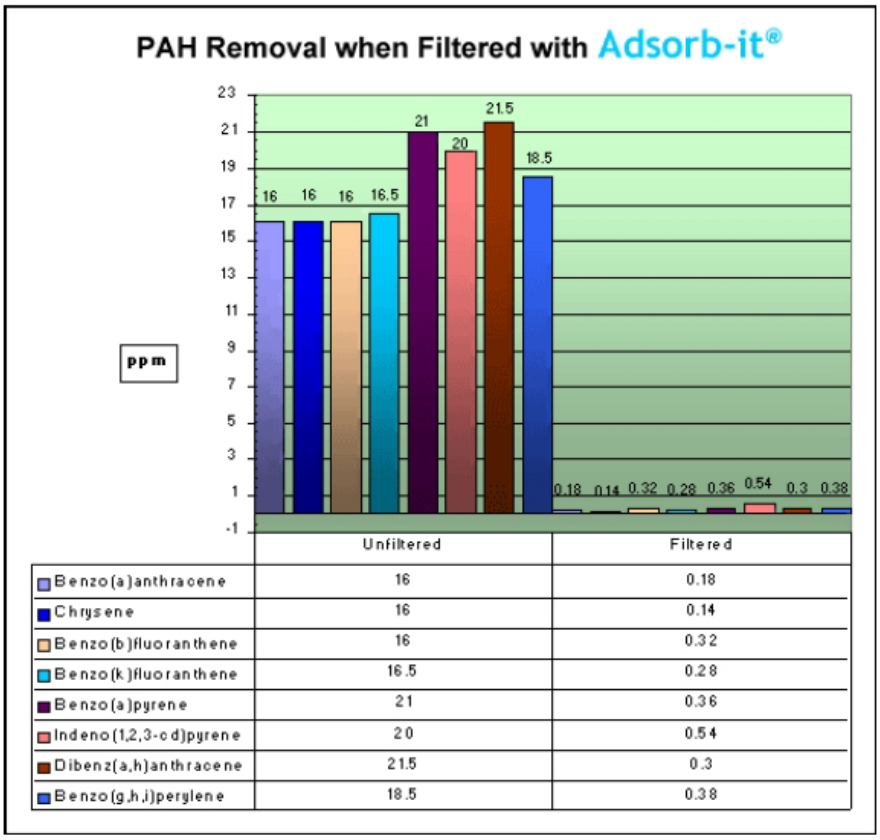
Polynuclear Aromatic Hydrocarbon (PAH) Removal

Method

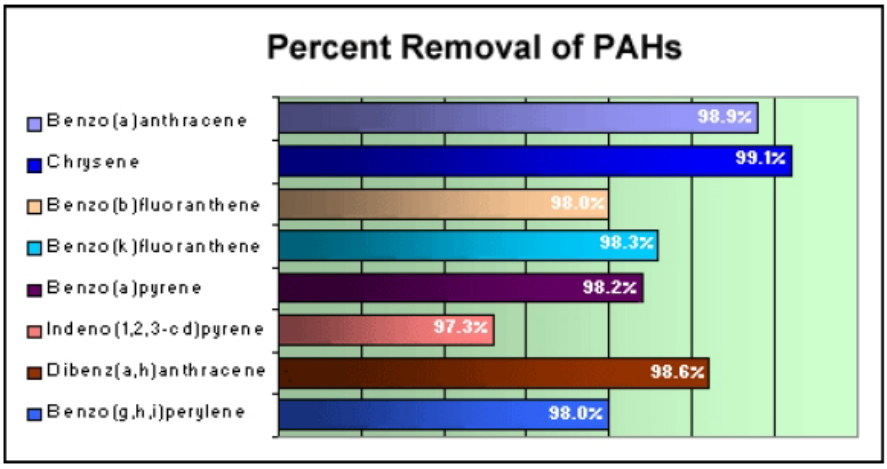
Analytical laboratory spiked aqueous samples were analyzed for PAH concentrations by USEPA Method 8270.

Those spiked samples were then poured through 20 grams of Adsorb-it® geo-textile filtration fabric and the water passing through the Adsorb-it® fabric was again analyzed by USEPA Method 8270 providing the results of analytical chemistry presented in the graphs below.

Results



	Unfiltered	Filtered
Benzo(a)anthracene	16	0.18
Chrysene	16	0.14
Benzo(b)fluoranthene	16	0.32
Benzo(k)fluoranthene	16.5	0.28
Benzo(a)pyrene	21	0.36
Indeno(1,2,3-cd)pyrene	20	0.54
Dibenz(a,h)anthracene	21.5	0.3
Benzo(g,h,i)perylene	18.5	0.38



Conclusions

The PAH removal efficiency of Adsorb-it® is in excess of 97%.

Adsorb-it® Sorbent's Impact on the Environment

Method

Adsorb-it® sorbent material was submitted to an analytical laboratory with NELAP (National Environmental Laboratory Accreditation Program) accreditation for the full suite of TCLP analyses. The results of the tests are summarized below.

Results

Volatile Organic Compounds (VOCs) / EPA Method 1311 / 8260B

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
Vinyl Chloride	ND*	0.2	mg/L	0.2
1,1-Dichloroethene	ND*	0.2	mg/L	0.7
2-Butanone	ND*	1	mg/L	200
Chloroform	ND*	0.2	mg/L	6.0
Carbon Tetrachloride	ND*	0.2	mg/L	0.5
Benzene	ND*	0.2	mg/L	0.5
1,2-Dichloroethane	ND*	0.2	mg/L	0.5
Trichloroethene	ND*	0.2	mg/L	0.5
Tetrachloroethene	ND*	0.2	mg/L	0.7
Chlorobenzene	ND*	0.2	mg/L	100

* ND=not detected at or above the method detection limit

RCRA Metals / EPA Method 1311 / 6010 / 7470

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
Arsenic	ND*	0.2	mg/L	5.0
Barium	0.25	0.005	mg/L	100
Cadmium	ND*	0.05	mg/L	1.0
Chromium	ND*	0.1	mg/L	5.0
Lead	ND*	0.1	mg/L	5.0
Selenium	ND*	0.5	mg/L	1.0
Silver	ND*	0.2	mg/L	5.0
Mercury	ND*	0.002	mg/L	0.2

* ND=not detected at or above the method detection limit

Conclusions

All parameters were well below the limits required by the test, showing that the Adsorb-it® sorbent material does not contribute to pollution of the environment.

Adsorb-it® Sorbent's Impact on the Environment

Residual Ash and Heating Value

Samples of the Adsorb-it® sorbent material were tested to determine the residue and the heating value.The ash was determined to be 0.65% by ASTM method D482 and the heating value was determined to be 7600 BTU/lb by ASTM method D240.

Chlorinated Pesticides / EPA Method 1311 / 8081

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
gamma-BHC (Lindane)	ND*	0.001	mg/L	0.4
Heptachlor	ND*	0.001	mg/L	0.008
Heptachlor epoxide	ND*	0.001	mg/L	0.008
Endrin	ND*	0.002	mg/L	0.02
Methoxychlor	ND*	0.01	mg/L	10
Chlordane (technical)	ND*	0.01	mg/L	0.03
Toxaphene	ND*	0.1	mg/L	0.5

* ND=not detected at or above the method detection limit

Chlorinated Herbicides / EPA Method 1311 / 8151

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
2,4-D	ND*	0.001	mg/L	10
Silvex (2,4,5-TP)	ND*	0.001	mg/L	1.0

* ND=not detected at or above the method detection limit

Semivolatile Organic Compounds/ EPA Method 1311 / 8270C

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
1,4-Dichlorobenzene	ND*	0.005	mg/L	7.5
2-Methylphenol	ND*	0.005	mg/L	200
3- & 4-Methylphenol	ND*	0.005	mg/L	200
Hexachloroethane	ND*	0.005	mg/L	3.0
Nitrobenzene	ND*	0.005	mg/L	2.0
Hexachlorobutadiene	ND*	0.005	mg/L	0.5
2,4,6-Trichlorophenol	ND*	0.005	mg/L	2.0
2,4,5-Trichlorophenol	ND*	0.005	mg/L	400
2,4-Dinitrotoluene	ND*	0.005	mg/L	0.13
Hexachlorobenzene	ND*	0.005	mg/L	0.13
Pentachlorophenol	ND*	0.005	mg/L	100
Pyridine	ND*	0.005	mg/L	5.0

* ND=not detected at or above the method detection limit

Patent & Certification(1)

신 제 품 인 증 서

제 품 AOS타입 유수분리기

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2005 년 07 월 01 일

MOCIE 산업자원부장관

NEP 신제품인증
NEW EXCELLENT PRODUCT
AOS 타입 유수분리기
2005년 6월 30일

특 허 증
CERTIFICATE OF PATENT

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고분자필터를 이용한 폐수 및 우수의 고형물 및 유수분리 처리 시스템

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(THIS IS TO CERTIFY THAT THE PATENT IS REGISTERED ON THE REGISTER OF THE KOREAN INTELLECTUAL PROPERTY OFFICE.)

2009년 02월 24일

특 허 청 장
COMMISSIONER, THE KOREAN INTELLECTUAL PROPERTY OFFICE

특 허 증
CERTIFICATE OF PATENT

특 허 제 10-0907935 호 (PATENT NUMBER)

출원번호 (APPLICATION NUMBER) 제 2007-0071891 호
출 원 일 (FILING DATE:YY/MM/DD) 2007년 07월 18일
등 록 일 (REGISTRATION DATE:YY/MM/DD) 2009년 07월 08일

발명의명칭 (TITLE OF THE INVENTION)
원통형 부유 고분자필터

특허권자 (PATENTEE)
(주) 해동에이앤씨(110111-2******)
서울 성북구 하월곡동 39-1 한국과학기술벤처타운 945

발명자 (INVENTOR)
김수해(601114-1******)
서울 금천구 시흥3동 984-44 건목프라자 405호

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2009년 07월 08일

특 허 청 장
COMMISSIONER, THE KOREAN INTELLECTUAL PROPERTY OFFICE

Patent & Certification(2)

특 허 증
CERTIFICATE OF PATENT

특 허 제 10-1128388 호 (PATENT NUMBER)
출원번호 (APPLICATION NUMBER) 제 2011-0101365 호
출 원 일 (FILING DATE:YY/MM/DD) 2011년 10월 05일
등 록 일 (REGISTRATION DATE:YY/MM/DD) 2012년 03월 13일

발명의명칭 (TITLE OF THE INVENTION)
수면부상형 우수처리장치

특허권자 (PATENTEE)
등록사항란에 기재

발명자 (INVENTOR)
김수해(601114-1******)
경기도 안성시 공도읍 덕봉서원로 99

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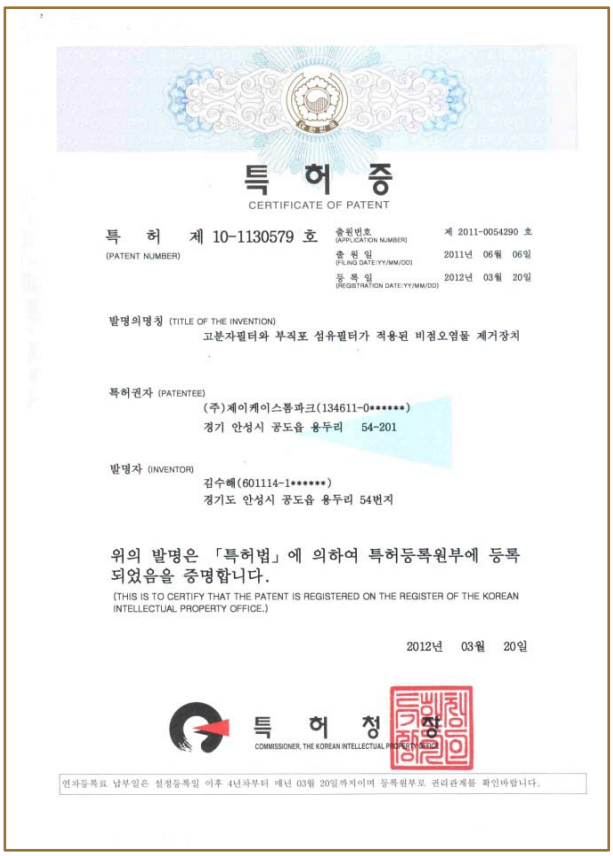
2012년 03월 13일

특 허 청 장
COMMISSIONER, THE KOREAN INTELLECTUAL PROPERTY OFFICE

연차등록료 납부일은 설정등록일 이후 4년차부터 매년 03월 13일까지이며 등록원부로 권리관계를 확인바랍니다.



특 허 증
CERTIFICATE OF PATENT

특 허 제 10-1130579 호 (PATENT NUMBER)
출원번호 (APPLICATION NUMBER) 제 2011-0054290 호
출 원 일 (FILING DATE:YY/MM/DD) 2011년 06월 06일
등 록 일 (REGISTRATION DATE:YY/MM/DD) 2012년 03월 20일

발명의명칭 (TITLE OF THE INVENTION)
고분자필터와 부직포 섬유필터가 적용된 비점오염물 제거장치

특허권자 (PATENTEE)
(주)제이케이스몰파크(134611-0******)
경기 안성시 공도읍 용두리 54-201

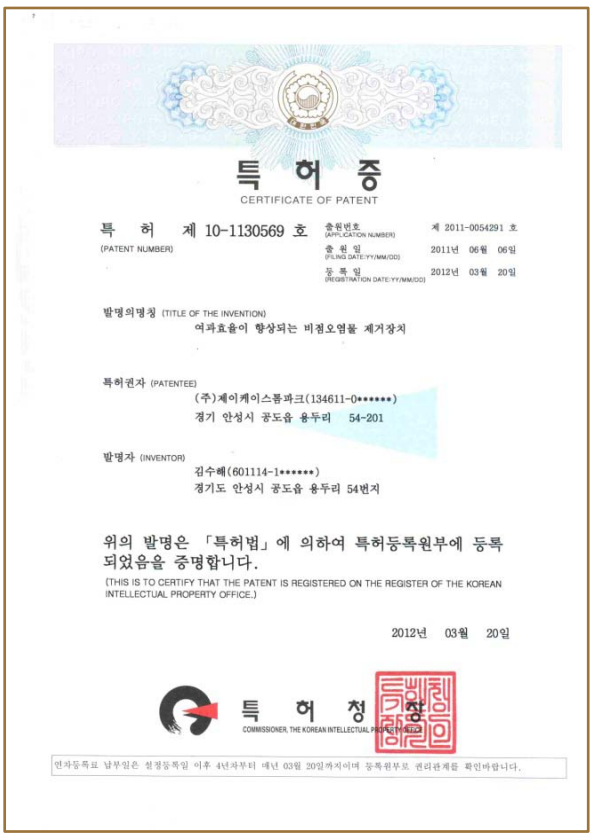
발명자 (INVENTOR)
김수해(601114-1******)
경기도 안성시 공도읍 용두리 54번지

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

2012년 03월 20일

특 허 청 장
COMMISSIONER, THE KOREAN INTELLECTUAL PROPERTY OFFICE

연차등록료 납부일은 설정등록일 이후 4년차부터 매년 03월 20일까지이며 등록원부로 권리관계를 확인바랍니다.



특 허 증
CERTIFICATE OF PATENT

특 허 제 10-1130569 호 (PATENT NUMBER)
출원번호 (APPLICATION NUMBER) 제 2011-0054291 호
출 원 일 (FILING DATE:YY/MM/DD) 2011년 06월 06일
등 록 일 (REGISTRATION DATE:YY/MM/DD) 2012년 03월 20일

발명의명칭 (TITLE OF THE INVENTION)
여과효율이 향상되는 비점오염물 제거장치

특허권자 (PATENTEE)
(주)제이케이스몰파크(134611-0******)
경기 안성시 공도읍 용두리 54-201

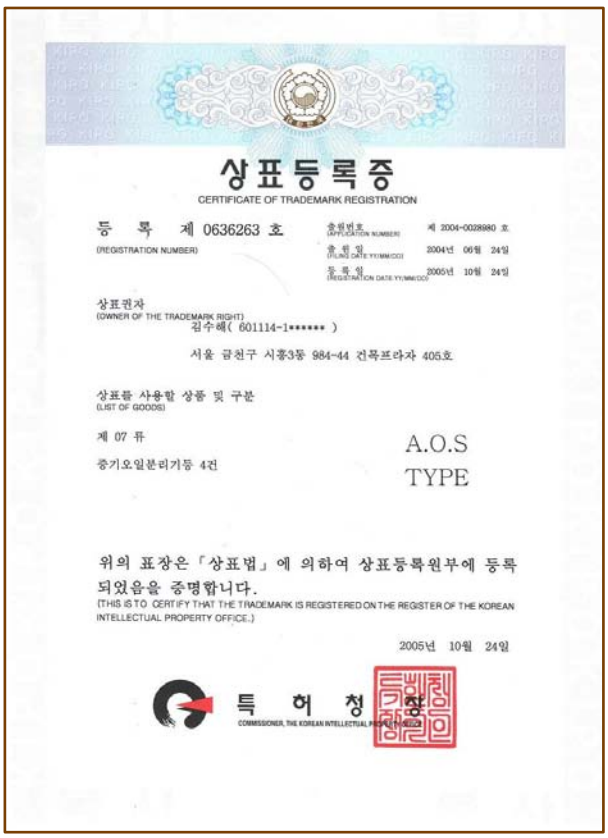
발명자 (INVENTOR)
김수해(601114-1******)
경기도 안성시 공도읍 용두리 54번지

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

2012년 03월 20일

특 허 청 장
COMMISSIONER, THE KOREAN INTELLECTUAL PROPERTY OFFICE

연차등록료 납부일은 설정등록일 이후 4년차부터 매년 03월 20일까지이며 등록원부로 권리관계를 확인바랍니다.



상표등록증
CERTIFICATE OF TRADEMARK REGISTRATION

등 록 제 0636263 호 (REGISTRATION NUMBER)
출원번호 (APPLICATION NUMBER) 제 2004-0028880 호
출 원 일 (FILING DATE:YY/MM/DD) 2004년 06월 24일
등 록 일 (REGISTRATION DATE:YY/MM/DD) 2005년 10월 24일

상표권자
(OWNER OF THE TRADEMARK RIGHT)
김수해(601114-1******)
서울 금천구 시흥3동 984-44 건록프라자 405호

상표를 사용할 상품 및 구분
(LIST OF GOODS)
제 07 류
증기오일분리기등 4건

A.O.S
TYPE

위의 표장은「상표법」에 의하여 상표등록원부에 등록되었음을 증명합니다.
(THIS IS TO CERTIFY THAT THE TRADEMARK IS REGISTERED ON THE REGISTER OF THE KOREAN INTELLECTUAL PROPERTY OFFICE.)

2005년 10월 24일

특 허 청 장
COMMISSIONER, THE KOREAN INTELLECTUAL PROPERTY OFFICE

AOS® SEPARATOR 시공 실적

No.	구 분	수량	용량 (㎥/hr)	설치 년도	설 치 장 소
1	AOS SEPARATOR	5	30	1998	김포공항
2	AOS SEPARATOR	10	30	1998	현대자동차서비스
3	AOS SEPARATOR	1	60	2000	대구국제공항 계류장
4	AOS SEPARATOR	1	30	2001	한전 용산변전소
5	AOS SEPARATOR	1	30	2001	한전 의왕변전소
6	AOS SEPARATOR	1	2,500	2001	철도청 용산철도기지창
7	AOS SEPARATOR	1	30	2001	한국유리공업군산공장
8	AOS SEPARATOR	1	60	2001	철도청 용산차량기지창
9	AOS SEPARATOR	1	30	2002	광명 송유관 누설현장
10	AOS SEPARATOR	1	300	2002	Camp howze
11	AOS SEPARATOR	3	10	2002	Camp stanton
12	AOS SEPARATOR	1	20	2004	아산 ㈜명신 농수로
13	AOS SEPARATOR	1	250	2005	삼보지질 괴산공장
14	AOS SEPARATOR	1	30	2005	독산동 1급 정비공장
15	AOS SEPARATOR	1	1,300	2006	삼성전자 기흥,화성
16	AOS SEPARATOR	1	200	2006	삼성전자 기흥,화성
17	AOS SEPARATOR	1	10	2007	GS Caltex 마산저유소
18	AOS SEPARATOR	1	10	2007	성남공군비행장
19	AOS SEPARATOR	1	30	2008	화성 물류창고
20	AOS SEPARATOR	1	10	2008	부산신항만
21	AOS SEPARATOR	1	30	2009	안산음식물처리시설
22	AOS SEPARATOR	1	50	2009	용인도시고속도로
23	AOS SEPARATOR	2	70, 40	2009	대구화물터미널
24	AOS SEPARATOR	2	6,500	2010	낙동강 22공구(현대건설)
25	AOS SEPARATOR	1	200, 75	2010	LG ,하우시스 울산
26	AOS SEPARATOR	2	200	2010	삼성SDI
27	AOS SEPARATOR	1	200	2010	해군2함대사령부
28	AOS SEPARATOR	16	10	2010	㈜흥건
29	AOS SEPARATOR	16	10	2010	㈜흥건
30	AOS SEPARATOR	2	4,500	2010	신안조선타운(비점신고완료)
31	AOS SEPARATOR	1	600	2011	SK건설 H-PROJECT
32	AOS SEPARATOR	1	80	2011	인천대교(삼성건설)
33	AOS SEPARATOR	2	30	2011	인천대교(삼성건설)
34	AOS SEPARATOR	2	20	2011	인천대교(삼성건설)
35	AOS SEPARATOR	3	6	2011	인천대교(삼성건설)

AOS® SEPARATOR 시공 실적

No.	구 분	수량	용량 (㎥/hr)	설치 년도	설 치 장 소
36	AOS SEPARATOR	1	500	2011	SK건설 H-PROJECT
37	AOS SEPARATOR	1	350	2011	SK건설 H-PROJECT
38	AOS SEPARATOR	1	6,000	2011	한국서부발전 태안발전본부
39	AOS SEPARATOR	1	200	2011	한국공항공사 김포국제공항.
40	AOS SEPARATOR	1	1,200	2011	한국공항공사 김포국제공항
41	AOS SEPARATOR	1	2,100	2011	한국공항공사 김포국제공항
42	AOS SEPARATOR	1	210	2011	한국공항공사 김포국제공항
43	AOS SEPARATOR	1	75	2011	㈜ 씨앤에프 아산공장
44	AOS SEPARATOR	1	45	2011	신고리 원자력 1,2호기
45	AOS SEPARATOR	1	45	2011	신고리 원자력 3,4호기
46	AOS SEPARATOR	1	45	2011	신월성 원자력 1,2호기
47	AOS SEPARATOR	1	90	2011	고리원자력 2발전소
48	AOS SEPARATOR	1	10	2011	부산신항만 2,3단계
49	AOS SEPARATOR	1	200	2011	삼성전자 온양캠퍼스
50	AOS SEPARATOR	1	25	2011	대전철도청 용산기지이전현장
51	AOS SEPARATOR	1	60	2012	부산철도차량정비창
52	AOS SEPARATOR	1	40	2012	한국타이어공업㈜대전공장
53	AOS SEPARATOR	1	90	2012	영광원자력 1발전소
54	AOS SEPARATOR	1	40	2013	에스쓰리알㈜
55	AOS SEPARATOR	1	35	2013	신울진 원전
56	AOS SEPARATOR	1	35	2013	UAE BRAKA 원전 1.2호기
57	AOS SEPARATOR	1	35	2013	UAE BRAKA 원전 3.4호기
58	AOS SEPARATOR	1	220	2013	인천아시아경기대회왕산마리나요트경기장
59	AOS SEPARATOR	3	800,200,150	2013	중국 섬서성 시안시 삼성전자 M-PJT
60	AOS SEPARATOR	2	360	2013	전라시설단 1전투비행단 유류저장지역
61	AOS SEPARATOR	1	700	2014	중국 섬서성 시안시 삼성전자 TEN-PJT
62	AOS SEPARATOR	1	110	2014	일본국 간사이전력 온다케발전소
63	AOS SEPARATOR	1	40	2015	논산축협 가축분뇨 지역단위종합관리센터
64	AOS SEPARATOR	1	10	2015	공주소방서
65	AOS SEPARATOR	1	10	2015	한국송유관공사 왜관저유소(국방부 경상시설단)
66	AOS SEPARATOR	1	40	2015	중국 대경유전
67	AOS SEPARATOR	2	500	2017	삼성전자 P-PJT 유수분리시설
68	AOS SEPARATOR	1	750	2017	삼성전자 P-PJT 유수분리시설
69	AOS SEPARATOR	1	2000	2017	삼성전자 P-PJT 유수분리시설
70	AOS SEPARATOR	1	130	2017	한국공항공사 양양국제공항 확장공사

외 다수

관 련 회 사

◈ ㈜ 해동에이앤씨 (대표자 : 김수해)
- 사업장 소재지 : 경기도 용인시 기흥구 흥덕1로 13. B동 1117호
- T E L : 031-213-5076. FAX : 557-5078

◈ 진흥이앤씨 (주) (대표자 : 전경호)
- 사업장 소재지 : 충남 공주시 전막2길 32-3(신관동)
- T E L : 041-854-3610 - FAX : 854-3614

◈ (유한)토마스코어
- 사업장 소재지 : 서울특별시 관악구 봉천동 7-2번지
- T E L : 02-883-8640, - FAX : 883-8602

해외 영업상황

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◈ ECO-TEC, INC.
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HD 해동에이앤씨(유)
HAE DONG A&C Co.,Ltd
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E-mail : greenhobby @korea.com
경기도 성남시 분당구 서현로 204. 엘지에클라트2, 1016호
TEL : 031)708-7677, FAX : 708-7079