AIENCE
Changing Water Treatment Worldwide

Detailed document No.5

5 Hydrogen sulfide in a cesspit is reduced to zero

- Preventing hydrogen sulfide generation and cost reduction can be achieved at the same time

Aquablaster diffusion pipe
AQUABLASTER®

2019.12

Current state of cesspits

excerpt from the brochure published by the Tokyo Metropolitan Government

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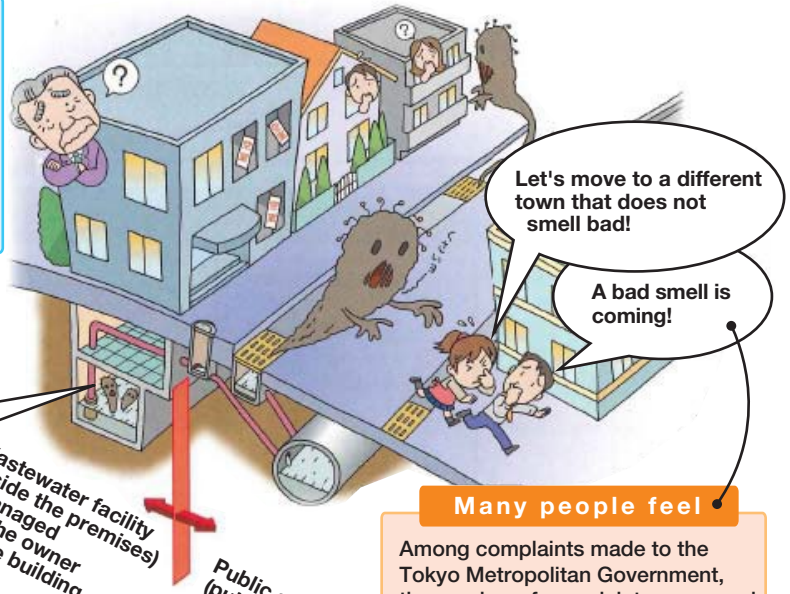
The number of buildings designed by considering global warming prevention measures is increasing, and smoking is prohibited inside buildings - everyone cooperates with each other to make our buildings and town environment better.It was believed that nothing could be done to get rid of foul odors coming from a cesspit (underground holding tank), but such a problem can be solved with everyone' cooperation.To make our town more attractive and prevent buildings from deteriorating as well, we would like to have your cooperation in eradicating unpleasant odors from a cesspit. Don't give up and avoid bad smells by pinching your nose! Let's remove them from our town!



Have you ever heard of this?

According to a study conducted by the Tokyo Metropolitan Government, many building owners were unaware that unpleasant odors were being generated and that such odors were coming from their buildings.This is because even though an odor coming from a cesspit is a strong offensive odor, it is generated only for a short period of time, such as a few minutes, and is hardly detected inside a building.

Many people feel

Among complaints made to the Tokyo Metropolitan Government, the number of complaints supposed to derive from odors from cesspits has become as many as several hundred per year. Moreover, it is thought that a large number of people feel bad even though they have not yet made any complaints.

What causes a bad smell?

You may think that your building has nothing to do with it.

It is caused by a cesspit.

When accumulated wastewater in the underground holding tank (cesspit) of a building becomes rotten, for example, hydrogen sulfide is generated. When wastewater containing hydrogen sulfide is pumped up and discharged into sewers, unpleasant odors come out from "street inlets" on secondary roads!

the Tokyo

Hydrogen sulfide is generated

When wastewater is accumulated, the state of putrefaction advances, generating hydrogen sulfide.

What will happen to the facility?

Hydrogen sulfide corrodes wastewater tanks and manholes and makes them crumble.

Foul odor

When wastewater containing hydrogen sulfide is pumped up and flows into sewers, foul odors come out from "street inlets" on secondary roads!

Street inlets on roads

If odor prevention measures are not taken in time, punishments may be applied.

- Offensive Odor Control Law -

Once a complaint is made, the relevant organization is required to take some measures. If appropriate measures are not taken to prevent offensive odors at levels exceeding the control standard, the head of the relevant municipality must issue an improvement recommendation or order, and furthermore, a punishment such as imprisonment or a fine may be applied. Even for a settlement agreement in court, huge costs and time are required.If measures are taken after a complaint is made as above, not only is the burden heavy in terms of money and labor, but also the public image of the organization can be ruined. Do not think that things are OK as long as no complaint is being made. To avoid the above situation, let's make daily efforts to prevent foul odors!

(Excerpt from a Ministry of the Environment brochure"Offensive Odor Control Law Guide Pamphlet (September 2006)")

Cesspit putrefaction mechanism

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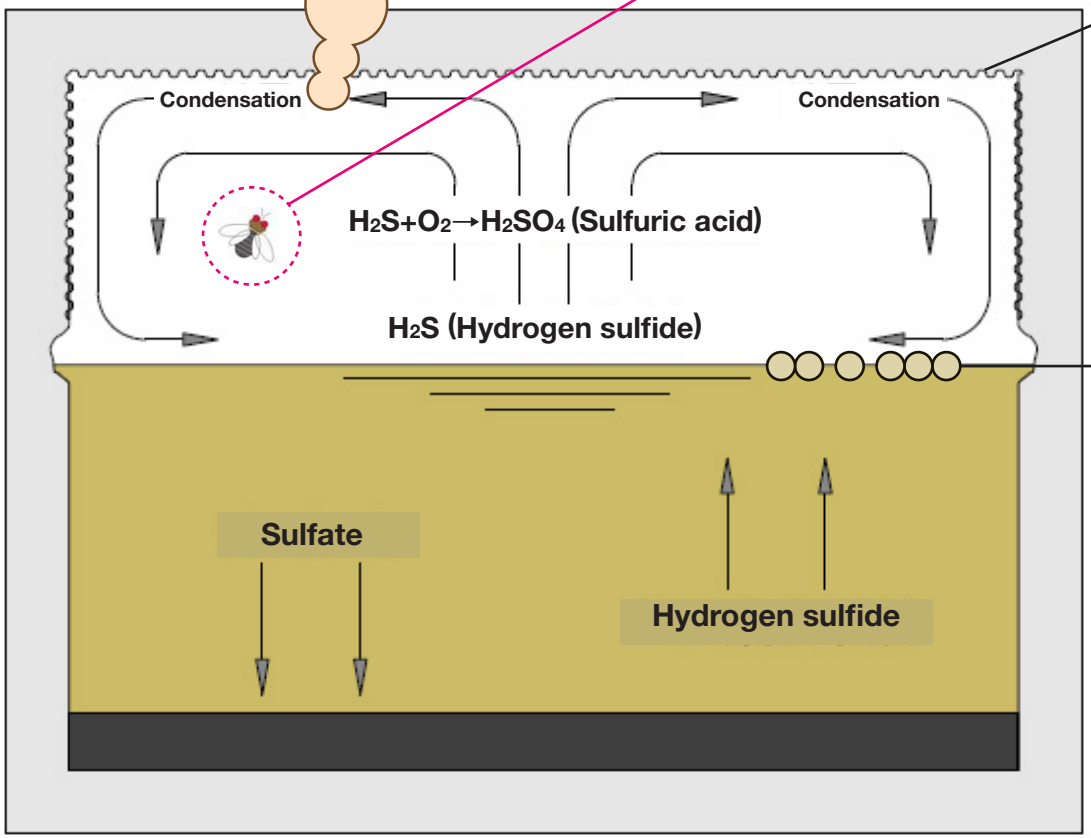
Foul odor (hydrogen sulfide) generation

Insect pest occurrence



Frame deterioration

Oil film and oil ball formation

In most cesspits, putrefaction advances due to a lack of oxygen, and hydrogen sulfide is generated, which eventually results in the deterioration of concrete in frames and sewers as well as the generation of bad odors.

Actual worksite conditions

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Hotel cesspit photo ①

An underwater stirrer was installed. The white blurred parts in the photo are numerous sand flies. A huge number of maggots grow in oil floating on the water surface, and the hydrogen sulfide concentration is over 50ppm.

Hotel cesspit photo ②

Although aeration is performed, it just forms oil balls because the amount of air is not enough. The hydrogen sulfide concentration has exceeded 700ppm before, and the problem is yet to be solved.

Sewer pipe life shortened due to hydrogen sulfide

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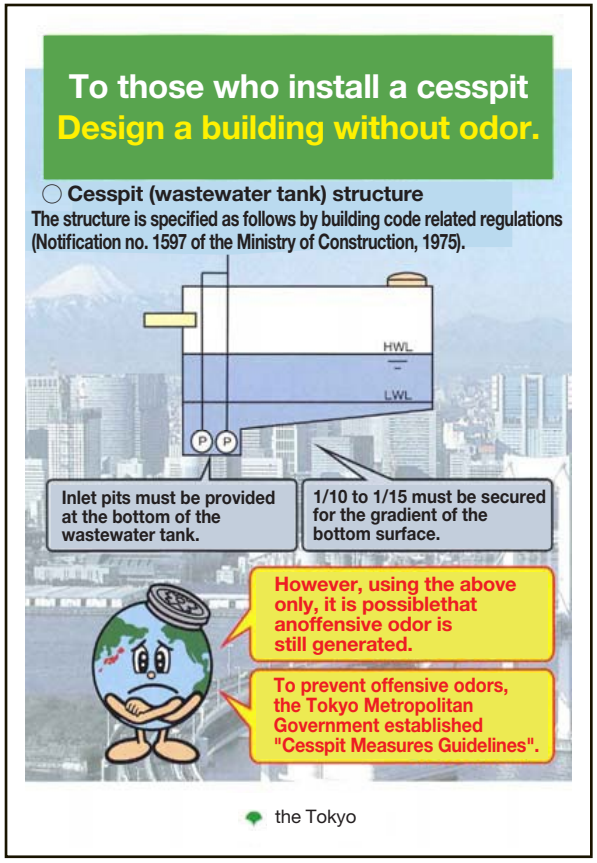
Now, sewer pipes are corroding steadily due to hydrogen sulfide produced from cesspits. It is of great concern to municipalities.

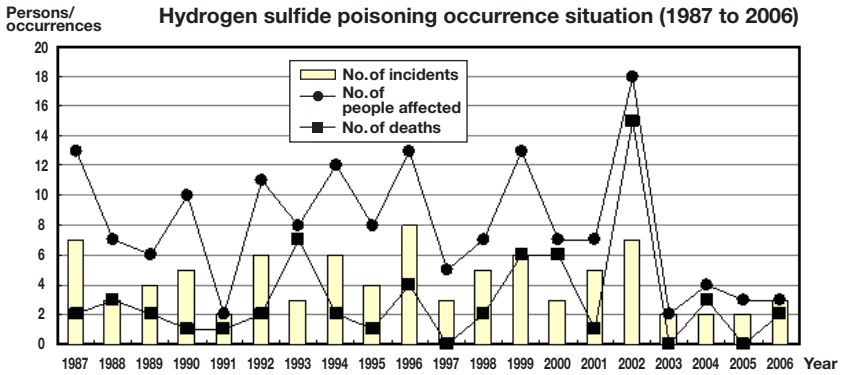


Tokyo Metropolitan Government Guideline Brochure
http://www.gesui.metro.tokyo.jp/ Measures against odors from cesspits

Differences in sewer pipe life due to differences in hydrogen sulfide concentration			
Pipe	Life (year)		Shortened life
	Hydrogen sulfide concentration Average: 4.1ppm	Hydrogen sulfide concentration Average: 11.6ppm	
400mm	39.1 years	13.8 years	25.3 years
450mm	44.0 years	15.6 years	28.4 years
500mm	50.9 years	18.0 years	32.9 years
600mm	65.5 years	23.1 years	42.4 years
700mm	81.1 years	28.7 years	52.4 years

According to the Tokyo Metropolitan Gov., Bureau of Sewerage survey data, a trial calculation shows that due to the influence of hydrogen sulfide produced from cesspits, if no measures are taken, the sewer pipe life will be shortened by a maximum of 50 years or more.

Danger of hydrogen sulfide



The chart on the left shows statistics on industrial accidents caused by hydrogen sulfide, as published bythe Ministry of Health, Labour and Welfare. Every year,

Danger of hydrogen sulfide	
Hydrogen sulfide (ppm)	Effect
0.03	Smell detection lower limit
5	Unpleasant smell
50 to 100	respiratory tract irritation, conjunctivitis
100 to 200	Loss of sense of smell
200 to 300	Subacute poisonings in one hour
600	Fatal poisonings in one hour
1,000 to 2,000	Instantaneous death
* When the concentration becomes high, contrarily it becomes more difficult to detect an odor and the sense of smell is lost. Special care must be taken.	

Previous putrefaction prevention devices

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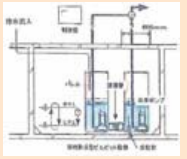
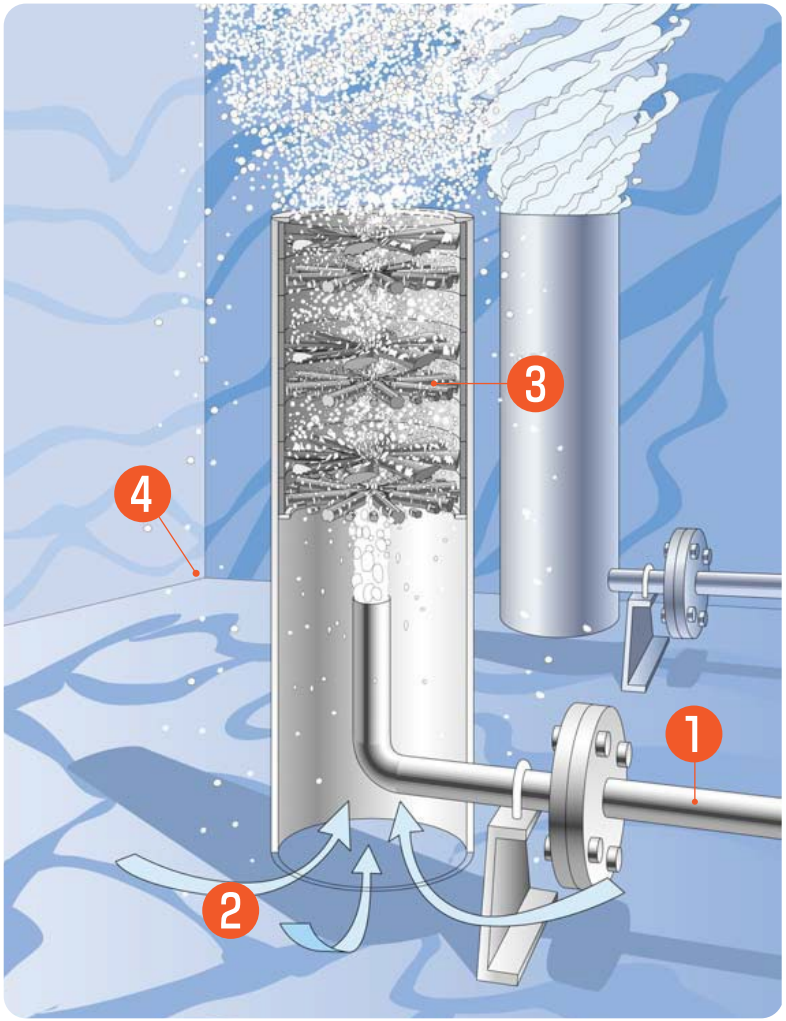
Method	Description	Feature and effect	Product	Conclusion
Jet ejector intake stirring method	Using the force of the water blast produced by a pump, air is taken in from the ejector to produce gas-liquid mixed currents.	The device can be easily installed at low cost. However, with kitchen wastewater load, it is difficult to secure a dissolved oxygen concentration of 2.0mg/L or more. Price: 400,000 to 1,000,000 yen/set. Installation cost required separately.		A ventilator is available from Aience. However, many such products must be installed to secure a dissolved oxygen concentration of 2.0mg/L; this method is therefore not so effective.
Shaft-aeration type underwater stirring aeration method	Using the force of a water blast produced by a pump, air is taken in from the ejector to produce gas-liquid mixed currents.	This method does not reach the point of stirring water in the pit efficiently, and compared to the Aquablaster diffusion pipe, it is not expected to be effective, and maintenance is also difficult. Price: 2 million yen/set of 4 units. Pump control panel included. Installation cost separately required.		A similar product, the Sludge Eater diffusion pipe, is available among Aience products. However, many such products must be installed to secure a dissolved oxygen concentration of 2.0mg/L; this method is therefore not so effective.
Underwater stirring aeration aerator method	In this method, water is stirred with pumps and air is fed with blowers at the same time.	Stirring water with pumps and feeding air with blowers appear to be effective at first, but it is not true because the oxygen dissolution efficiency is rather low considering power consumption. Price: 500,000 to 800,000 yen/set		In some hotels using this type of device, a problem with odor occurred. The Aquablaster diffusion pipe improved the situation related to not only odor but also water quality.
Immediate wastewater pump-up method	In this method, pumps are installed in the pit so that wastewater is discharged before it accumulates.	This method simply prevents water from accumulating in the pit. However, since wastewater is discharged with untreated oil content and while pH is low, it leads to sewer deterioration.		This method is symptomatic treatment, and does not give consideration to sewer pipe deterioration, so it does not seem to be a fundamental solution.

However, none of the above was conclusive. But then…

Aeration method by using the Aquablaster diffusion pipe	A method of securing a dissolved oxygen concentration of 2.0mg/L or more with a diffusion pipe with high oxygen dissolution efficiency	When Aquablaster units are laid out properly according to the tank, since the oxygen dissolution efficiency is very high, to say nothing of putrefaction prevention, water purification can be expected. Price: 100,000 to 150,000 yen/㎥ (Actual capacity of water tank) Air blower, installation cost included		When an Aquablaster diffusion pipe unit is properly designed and laid out, the dissolved oxygen concentration reaches 2.0mg/L or more. This solves the problem.

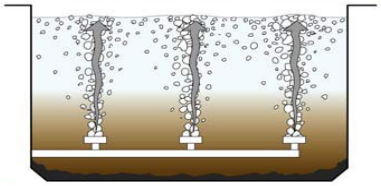
Diffusion pipe Aquablaster mechanism

Aquablaster diffusion pipe



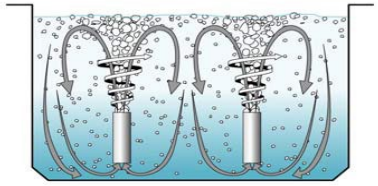
1. Air from the blower is emitted through the nozzle as a high speed air blast.
2. Water and sludge at the bottom are swept up by an air lift effect.
3. With special shaped fins newly developed by using fluid ynamics (patent pending),air and water are vigorously mixed together to generate nano air bubbles and swirling flows.
4. When swirling flows are generated, nano air bubbles are also supplied to the corner sections at the bottom of the water tank, where the dissolved oxygen concentration does not increase easily.

Conventional aeration system



Sludge accumulates at the bottom and becomes anaerobic.

Circulating aeration system



Oxygen spreads over the entire tank and sludge does not settle at the bottom.

Performance comparison table

Aquablaster diffusion pipe

Method	Capability to stop hydrogen sulfide	Oxygen dissolution	Stirring	Initial costs	Running costs	Problem solving capability
Full aeration method by using the Aquablaster diffusion pipe	10	10	9	6	8	10
Jet ejector intake stirring method	5	6	6	8	8	5
Shaft-aeration type underwater stirring aeration method	5	7	7	6	6	5
Underwater stirring aeration	5	7	7	4	3	3
Immediate wastewater pump pump-upmethodaerator method	3	2	2	8	8	5

Advantages of introducing the Aquablaster diffusion pipe

Aquablaster diffusion pipe

① The Aquablaster diffusion pipe can provide a fundamental solution to water putrefaction.

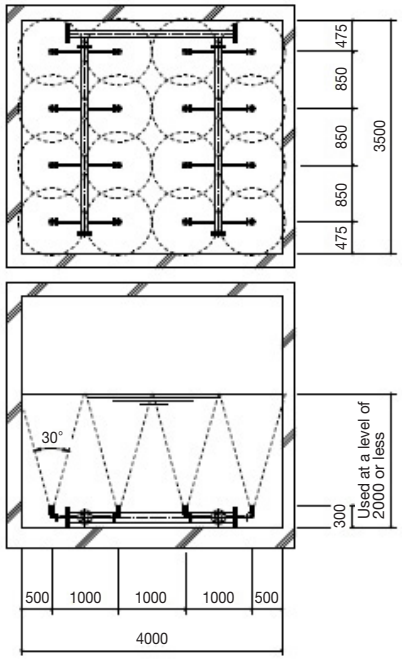
② The Aquablaster diffusion pipe prevents frame and device deterioration caused by hydrogen sulfide and maintains property values.

③ The amount of generated sludge is radically reduced, so that the equipment cost can be depreciated in a few years.

④ Insect pests attracted by putrid odors are fended off, making the facility sanitary.

Aquablaster diffusion pipe installation example

Diffusion pipe Aquablaster Type AS-200/250

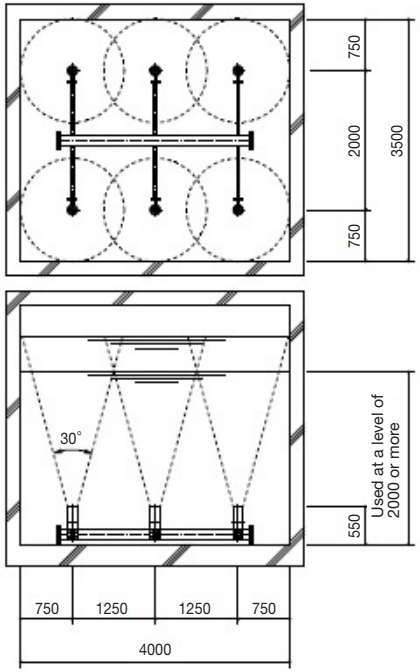


Diffusion pipe Aquablaster Type AS-200/250

Recommended water depth:
Used at a level of 600 to 2000mm
(This is not applicable when using in an adjustment tank. Usable also at a maximum water level of 4500mm)

Air injection angle : 30 degrees
(* The design is prepared so that injection trajectories intersect themselves on the water surface. Therefore, the lower the water depth, the more injection trajectories it takes.)

Diffusion pipe Aquablaster Type AL-1500



Diffusion pipe Aquablaster Type AL-1500

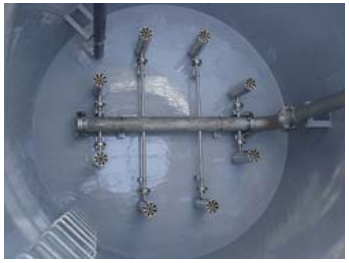
Recommended water depth:
Used at a level of 2000 to 6000mm
(This is not applicable to high-load circulating water like a paint booth or deep water aeration.)

Air injection angle: 30 degrees
(* The design is prepared so that injection trajectories intersect themselves on the water surface. Therefore, the lower the water depth, the more injection trajectories it takes.)

Supply examples

Aquablaster diffusion pipe

Food plant
Wastewater treatment pit
Water purification and putrefaction prevention
January 2009



Food plant
Wastewater treatment pit
Water purification and putrefaction prevention
February 2009

Fixed route bus storage yard
Car wash wastewater treatment pit
Water purification and putrefaction prevention
December 2008

Food plant
Wastewater treatment pit
Water purification and putrefaction prevention
January 2009

Vehicle factory
Circulating water pit
Putrefaction prevention and water purification
February 2009

Vehicle factory
Circulating water pit
Putrefaction prevention and water purification
April 2001

SHIMADZU CORPORATION Head office
Kitchen wastewater treatment pit
Water purification and deodorization
September 2007

Fixed route bus storage yard
Car wash wastewater treatment pit
Putrefaction prevention and water purification
July 2008

Industrial wastewater treatment
Aience is a water treatment professional not only in putrefaction prevention but also in wastewater treatment.

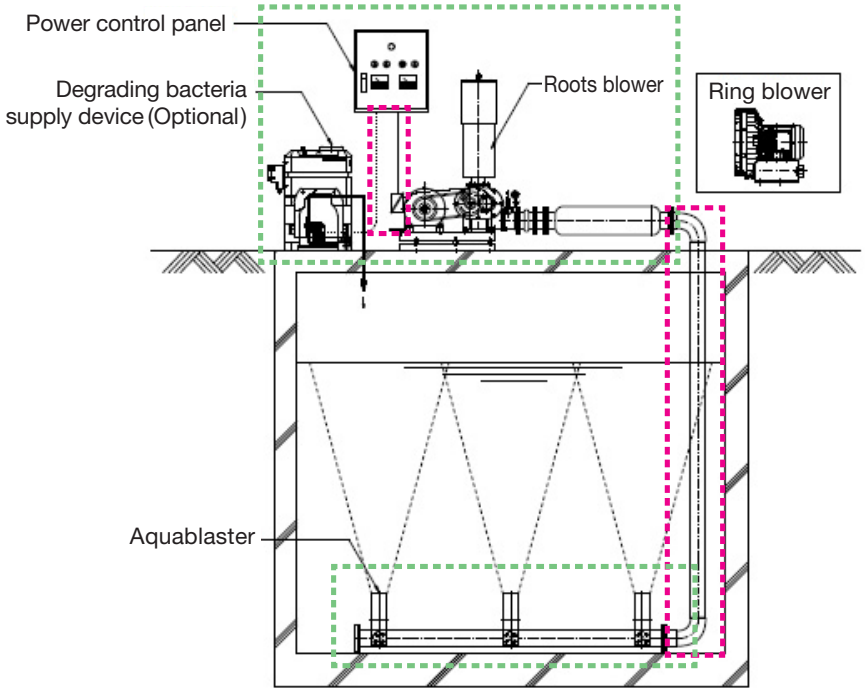
First class hotel
Kitchen wastewater treatment pit
Water purification and deodorization
February 1999

Truck manufacturing plant
Circulating water pit
Putrefaction and deterioration prevention
October 2008

Plastic drum test unit
We guarantee that hydrogen sulfide is not generated underwater, but you can use our test unit for checking, if necessary.

System's device configuration and scope of work

Aquablaster diffusion pipe



[Basic scope of work]

Design and manufacture from the Acquablaster diffusion pipe to header piping, 50L tank 30cc/min to ...roots blower selection and supply, degrading bacteria supply device(optional) selection and supply, power control panel design and supply

[Scope separate from basic scope]

On-site unit piping installation work, connecting piping work (material supply and work), electrical work for both primary and secondarysides, cost of transportation, cost of implementation management, cost of water quality analysis, cleaning of existing facility, removal of existing items, foundation and civil work

Aquablaster diffusion pipe		
Product name	Applied air volume (per unit)	Applied water depth
AS-200	0.15~0.20㎥/min	0.6~2.0m
AS-250	0.20~0.30㎥/min	0.6~2.0m
AL-1500	0.75~1.50㎥/min	1.5~6.0m

Aeration blower		
Model	Total air volume	Applied water depth
Ring blower	1.0~6.0 ㎥/min	0.6~1.2m
Roots blower	1.0~20.0 ㎥/min	1.2~6.0m

Degrading bacteria supply device (Optional)	
Model	Drip amount
50L tank	30cc/min to ...
100L tank	30cc/min to ...
200L tank	30cc/min to ...

https://www.aience.co.jp/en/