

World's First Pentagonal-Shaped Diffuser

**Overturning conventional wisdom and
opening up a bright future**

AERATOR KUH KAI

エアレーター 空海



- Collisions and agitation inside the pentagonal-shaped tube
- Free intermittent running and denitrification
- More than 20% power cost reduction
- Free from sludge flocculation and clogging

Solace.co.,ltd

Wonders of Regular Pentagon

●Wonders of Regular Pentagon

Echinoderm such as starfish, petals of cherry blossoms and hibiscus, etc., have naturally evolved into a **pentaradial** symmetrical pattern with respect to earth's gravitational pull.

Golden ratio --- between lengths of each side and the diagonal line, and between lengths of line segments divided by the point of intersection between diagonal lines is 1:1.618.



●Discovery of Fullerene C60:

1996 Nobel Prize in Chemistry

[Sir Harold Walter Kroto, et al. of the University of Sussex in England, according to an Asahi Shimbun article dated October 11, 1996]

This structure has carbon atoms at the apexes of polyhedrons of a **pentagon** and a hexagon like the surface of a soccer ball.



The discovery of C60 triggered an explosion in the amount of research and development for a wide variety of applications such as electronic materials.

※The discovery inspired by a circular structure of regular pentagons and hexagons at the Canadian National Exhibition Dome was awarded the Nobel Prize in Chemistry.

●Discovery of regular pentagonal quasicrystals:

2011 Nobel Prize in Chemistry

[Dr. Daniel Shechtman, Technion - Israel Institute of Technology, according to articles in The Asahi Shimbun and The Shikoku Shimbun dated October 6, 2011]

Regular pentagonal quasicrystals: Structure of a complex combination of regular **pentagons** consisting of alloy atoms.

Quasicrystals are expected to be used in industrial product such as engine heat insulating parts because they are extremely hard and heat is not easily transferred.

Quasicrystals have a mysterious atomic arrangement, and this quasicrystal arrangement has created controversy as quasicrystals being unorthodox crystals that deviate from the conventional definition.

Although the initial quasicrystals were unstable, the discovery and assessment of applications of stable quasicrystals by Professor Aoi, et al., of Tohoku University led to a Nobel prize.

●Aerator KUH KAI:

World's First **Pentagonal-Shaped Diffuser**

Air and sludge drawn into the pentagonal tube turn and rise while churning in a spiral, and air bubbles are broken down into fine particles and circulate in a tank to accelerate purification of drainage.



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※This product was developed by the new industry challenge support project of the SMB support fund project 2011 of the Kagawa Industry Support Foundation.

Stirring condition in a transparent water tank

Quasi sludge Beads/Tetron yarn



① Whole tank volume: 170L



② Sludge drawn into a tube rises while colliding against and stirring with air and turning.

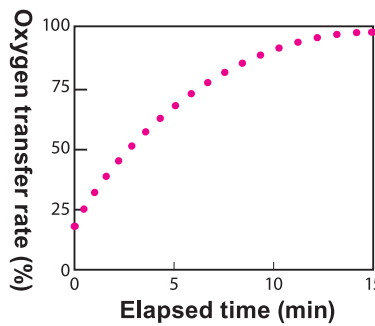
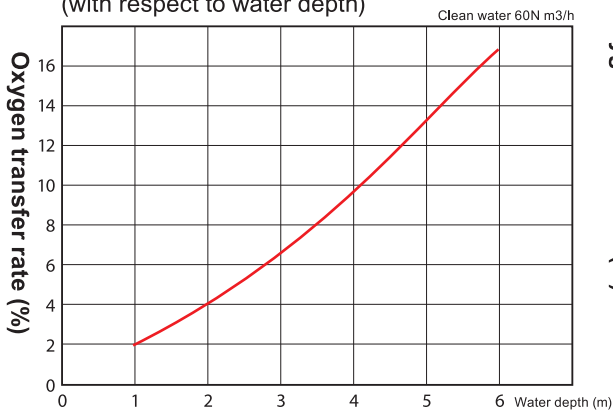


③ Sludge stirred in a tube churns in a spiral and circulates in the tank for purification.

Data

Model	Material		Connection	Weight	Air supply volume [m ³ /min]			Occupied area [m ²]	Adaptable water depth [m]
	Main body	Piping			Lower limit	Standard	Upper limit		
KA-L	Stainless steel (POM)	SUS	40A	7.2	0.4	1.1	1.5	6~12	1~
KA-M	Stainless steel (POM)	SUS	20A	4.8	0.1	0.3	0.5	4~5	1~

Comparison data of oxygen transfer rate (with respect to water depth)



Experiment conditions

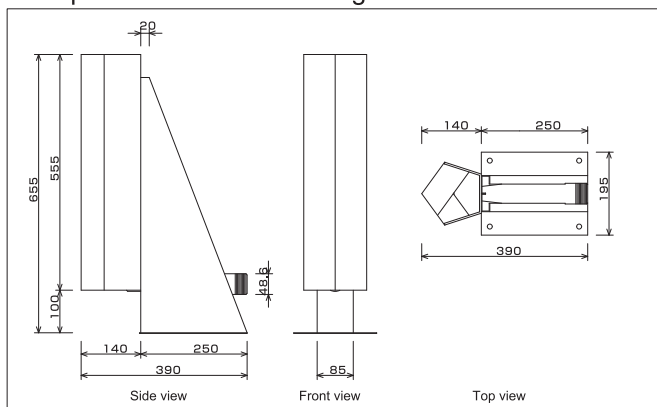
May 12, 2008

Water temperature: 18.3°C
 Water tank: 1m × 1m × 1m
 Blower: 300W 250L/min
 Dissolved oxygen meter: YSI Model 95
 Nitrogen gas was supplied to lower the dissolved oxygen saturation rate, then ambient air was supplied to the diffuser, and the time until which the dissolved oxygen saturation rate recovered was measured.

Experimental data regarding oxygen dissolution into tap water by use of the KUH KAI

(Assistant Professor Yoshihiro Yamada, Department of Applied Biological Science, Faculty of Agriculture, Kagawa University)

L-shaped dimensional drawing



For M-shaped dimensions, contact us.

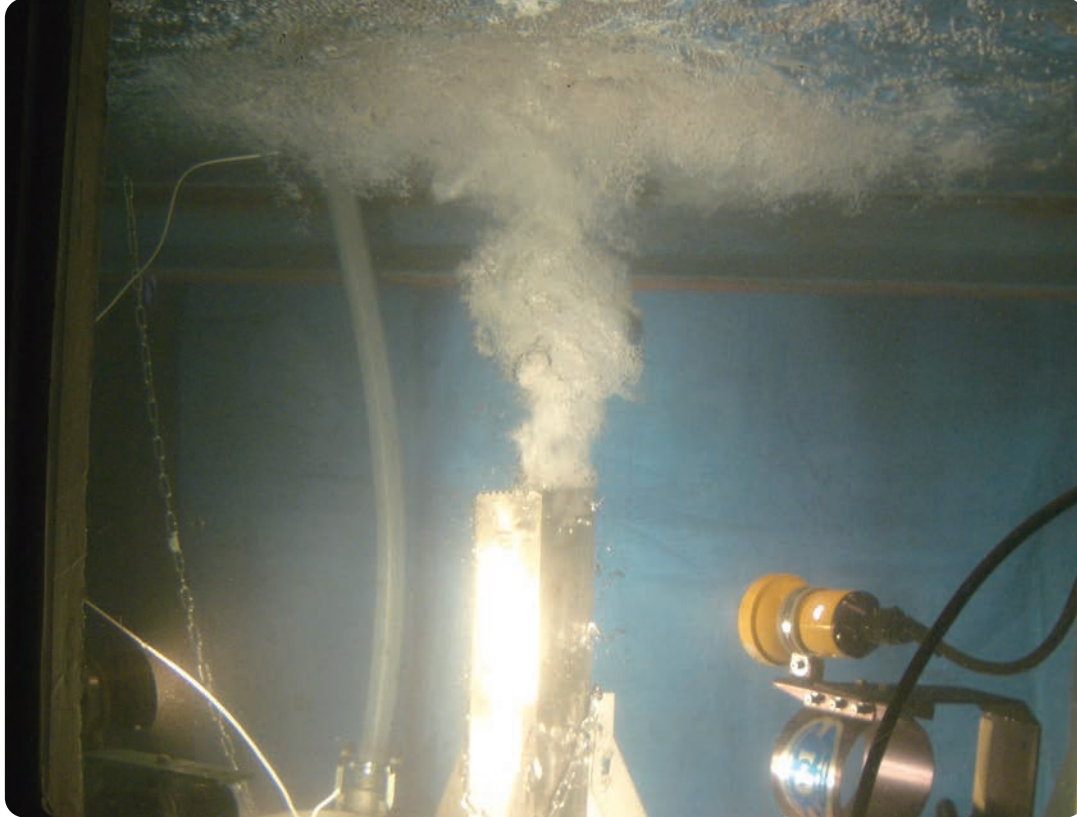


Resin mold (photographed from above)

World's First Pentagonal-Shaped Aerator KUH KAI

KUH KAI is an innovative product that collides, **stirs and breaks down sludge and air into fine particles** in a pentagonal tube of 65cm in length to accelerate purification of drainage.

Air jetted from a pentagonal tube diffuses and radiates outward while eddying in a non-conventional approach.



Photograph: Advanced Industrial Science and Technology (AIST) (Kagawa Prefecture)

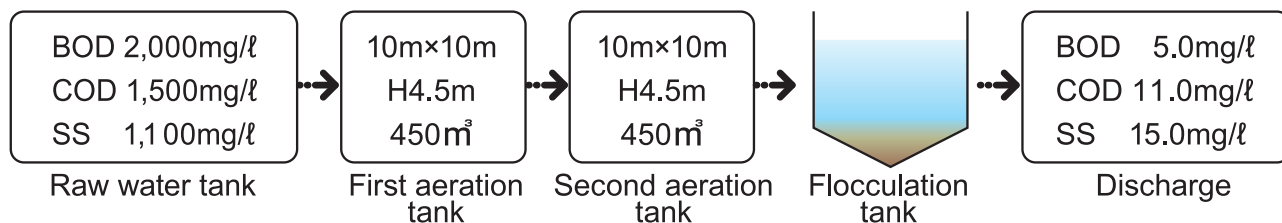
Features

- 1 Freely applicable at a water depth of more than 1m**
Freely applicable to existing or new equipment as long as the water tank depth is **more than 1m**.
- 2 No clogging (Pentagonal tube opening 80×130mm)**
No need to worry about clogging because of the large-diameter opening, and intermittent running and denitrification can be freely performed.
- 3 Power cost reduction Blower cost accounts for 70% to 80% of the electricity cost incurred for drainage treatment tank equipment.**
With small pressure loss of 40A for the air inlet and 25A for the discharge port, the power cost can be substantially reduced.
- 4 No sludge flocculation on the tank bottom and the oxygen transfer rate is high (Air-lift effects)**
Sludge on the tank bottom is drawn into the pentagonal tube, and sludge and air are broken down into fine particles while colliding, stirring, and turning to purify drainage while increasing the oxygen transfer rate.
- 5 Easy maintenance and management due to its simple structure**
The main body is made of stainless steel and the inside is made of molded resin. Maintenance free.
※The main body material and the installation method can be changed according to need.

Material

Brewing (miso) plant Aerator KUH KAI 24 units

Raw water tank inflow: 200 to 300m³/day



Food industry (ham) drainage KUH KAI introduced because offensive odors were generated due to sludge flocculation on the tank bottom (Inflow 600m³/day)

Raw water BOD after removal of sludge on the tank bottom: 2,200ppm → inflow at 1,400ppm after pressurized floatation, and 48 KUH KAIs introduced in aeration tanks.

	September 12, 2006 (rain) Water temperature: 25.9°C	December 12, 2006 (rain) Water temperature: 15.0°C
	Aeration tank inflow (before introduction)	Discharge (after introduction)
BOD	1,400mg/l	2.9mg/l
SS	900mg/l	6.8mg/l
Normal hexan	52mg/l	2.1mg/l

Food industry (freezing) drainage KUH KAI introduced due to diffuser deterioration (100m³/day)

8 KUH KAIs introduced (October 2010: 2 raw water tanks, June 28, 2011: 6 aeration tanks) introduced and an inverter (11 kw) installed

	June 28,2011(Fine) Water temperature:30.8°C	June 28,2011(Fine) Water temperature:30.8°C	September 28,2011(Fine) Water temperature:25.3°C	September 28,2012(Cloudy) Water temperature:22.9°C
	Aeration tank inflow (Before aeration tank introduction)	Treated discharge water (Before aeration tank introduction)	Treated discharge water (After introduction)	Treated discharge water (After one year)
BOD	779mg/l	4.9mg/l	Less than 1.0 mg/L	1.7mg/l
COD	478mg/l	25.2mg/l	5.0mg/l	4.7mg/l
SS	833mg/l	11mg/l	5.0mg/l	4mg/l
Power per week	1,319.8kwh	—	—	1,075.1kwh

※Power improvement rate: 18.5



Existing diffuser deteriorated and damaged due to clogging



KUH KAI installation condition



Aeration tank running condition

Aerator Performance Comparison

Category	Item	Air bubble type	Machine type	KUH KAI
Oxygen transfer rate	No clogging	×	○	◎
	Free intermittent running and denitrification	×	○	◎
	No sludge flocculation on the tank bottom	×	×	◎
	Impact on microorganisms (floc, etc.)	◎	×	◎
Maintenance	Power saving (small pressure loss)	×	×	◎
	Facility cost (easy installation and piping)	○	×	◎
	Running management (Parts replacement, etc.)	×	×	◎
	Servicing and durability	×	×	◎

KUH KAI delivery record ※See the attachmen

Uses

Drainage treatment

※Can be used at facilities troubled by animal oil and fat, persistent substances and offensive odors, etc.

Organic discharge: Food (processing, freezing, etc.) / beverage (including dairy and brewery) / livestock (night soil, etc.), etc.

Inorganic discharge: Plant discharge (dyeing, papermaking, semiconductors, liquid crystals, etc.) / chemical plant discharge (pharmaceutical, printing, etc.) / thermal discharge from power plants or steel manufacturers and its cooling / linen supply, etc.

Treatment in production line

※Superior in stirring and gas-liquid mixing and can be used in various fields.

Food/beverage plant (two liquid-mixing), etc.

Chemical/pharmaceutical plant (chemical reaction), etc.

Gas absorption/degassing, etc.

※Dissolution of harmful gas into liquid or diffusion and removal from liquid.

Stirring for neutralization

Effective mixing of undiluted solution and reagent such as undiluted solution and pH preparation reagent.

Other

Tightening effect on cultured fish by running KUH KAI before shipment can be expected.

※The KUH KAI can be used across a wide variety of applications other than the above. First, please contact us.