MicroNano bubbles for water treatment

Invented, Developed and Widely used in Japan

ANZAIKANTETSU CO,LTD

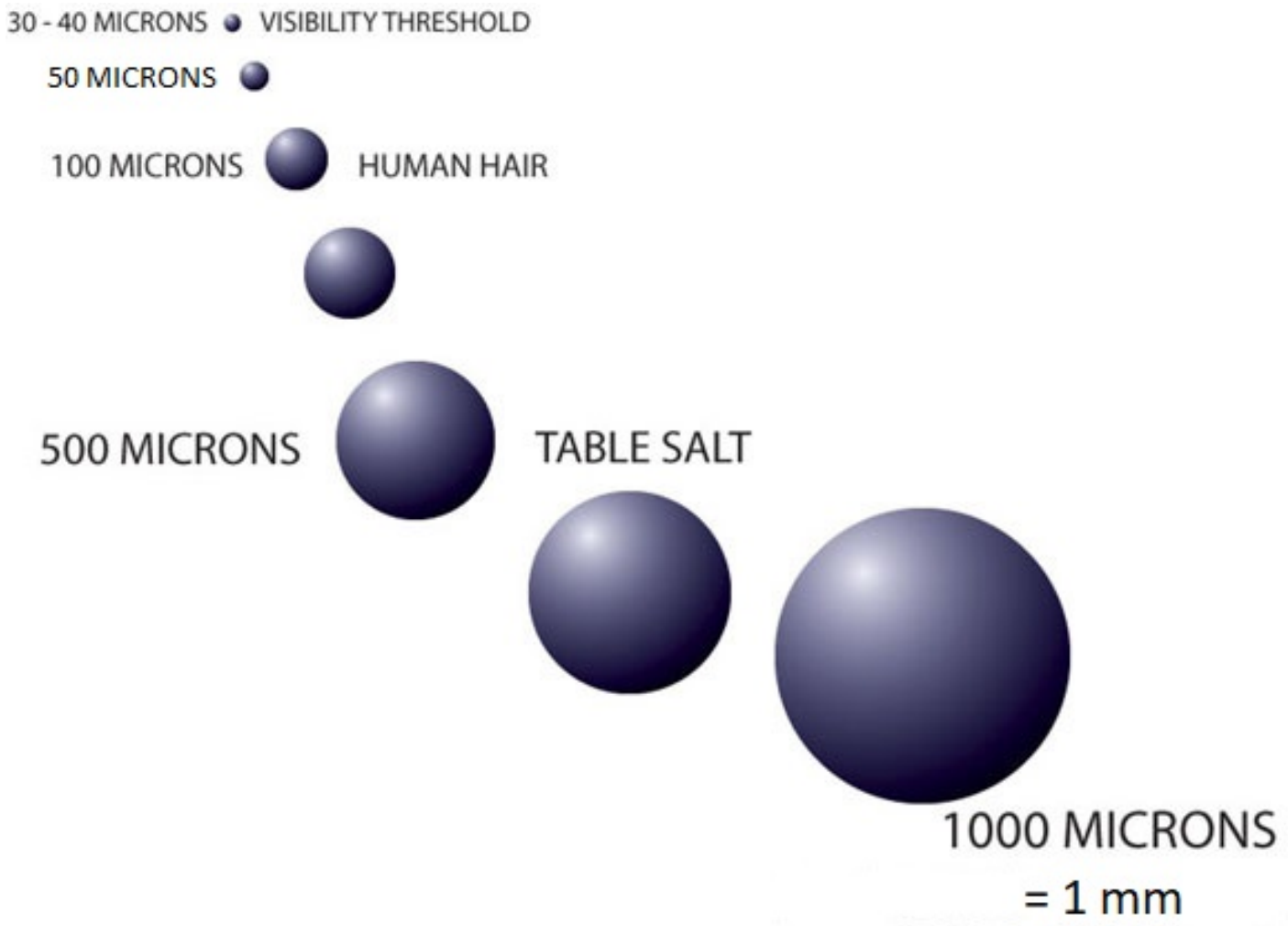
MCS section

PACIFIC DRIVELINE LTD

MARINE & INDUSTRIAL DRIVELINE SPECIALISTS

What are Micronano Bubbles?

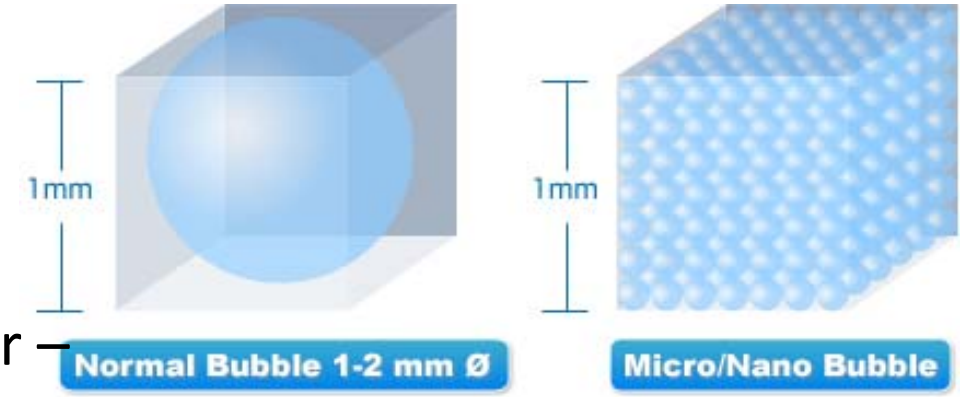
- Very small gas bubbles.
- The diameter of micronano bubbles has not yet been defined.
- It seems appropriate to consider gas bubbles <50 microns as micronano bubbles.



Advantages of Nanobubbles

<u>Very High Oxygen Transfer Efficiency</u> due to:

- Large surface area.



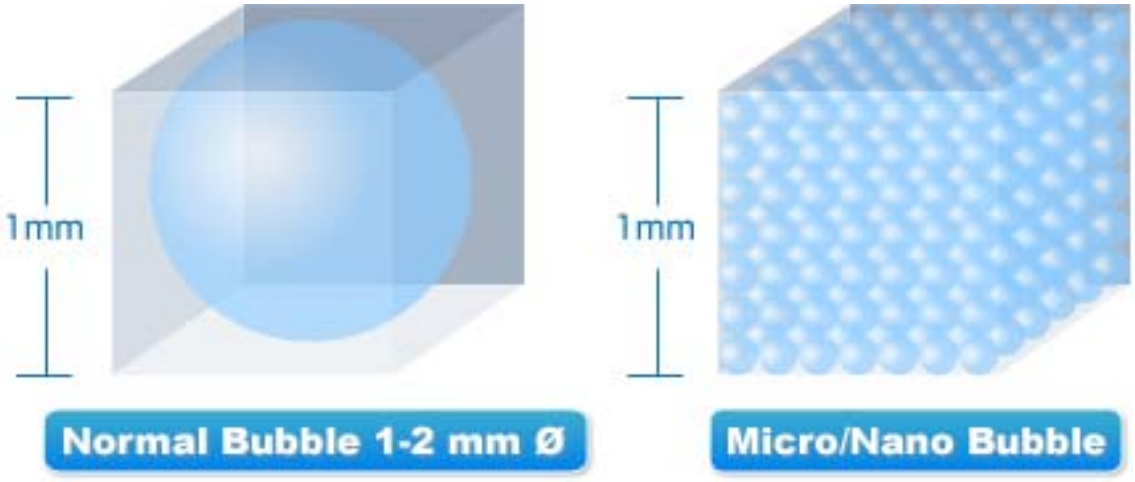
- Longer duration of contact with water –

1) Very Low buoyant force on the air bubble –

   Hence bubbles do not rise to the surface immediately like fine bubbles.

2) Nanobubbles eventually sink to the bottom.

Micro Bubble to Nano Bubble

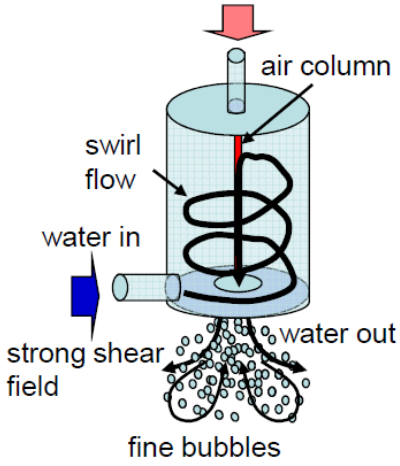


Bubble Diameter	No. of bubbles	Volume (cu. mm.)	Surface Area (sq. mm.)	Factor Increase
1 mm = 1000 microns	1	1	12.56	1
100 microns	1000	1	125.6	10
50 microns	8000	1	251.32	20
10 microns	1,000,000	1	1256.6	100

How are micronano bubbles created?

1) Swirl Type Liquid Flow Method

- Gas Transfer Efficiency: 65%
- Size Limitation: upto 3 inches
- Running Cost: 11KW/10L/min
- Fairly low bubble number density

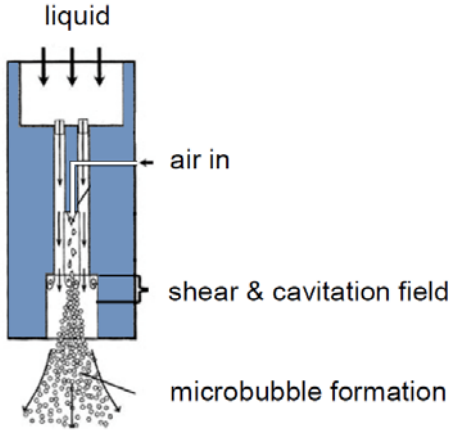


2) High Pressure Dissolution Method

- High Pressure Pump Required
- Size Limitation
- Bubbles generated through nucleation and cavitation through sudden depressurization of the system

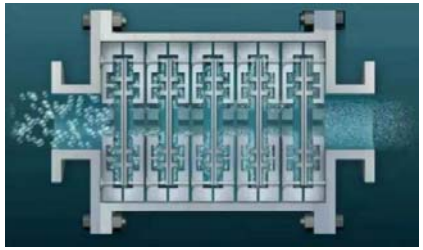
3) Ejector Method

- Gas Transfer Efficiency: 35%
- High Pressure Pump Required
- Size Limitation: upto 2 inches
- Running Cost: 15KW/10L/min



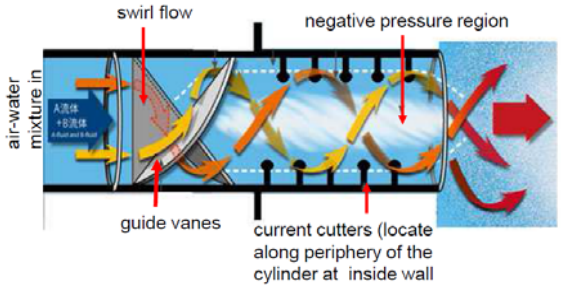
4) HoneyComb Method

- Gas Transfer Efficiency: 35%
- Complex Structure
- High Pressure Pump Required
- Size Limitation: upto 2 inches
- Running Cost: 18KW/10L/min



5) Static Line Mixer

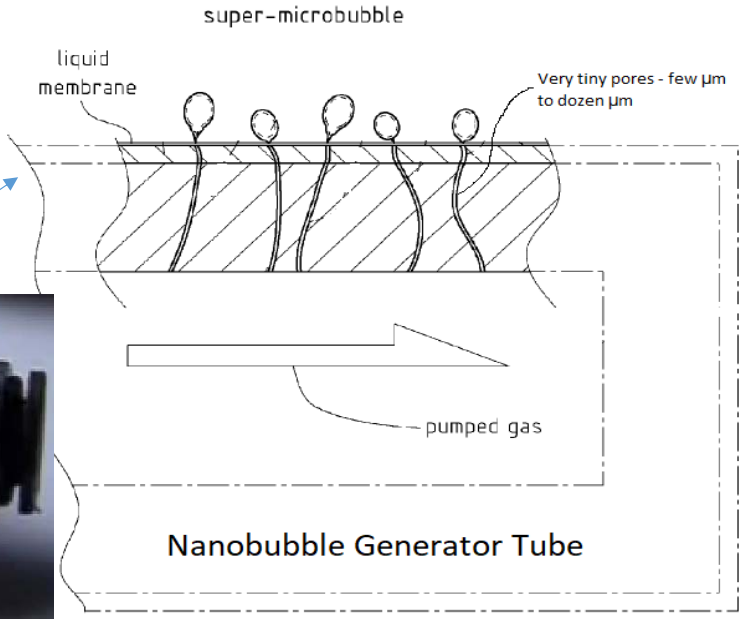
- High Pressure Pump required
- Need auxiliary systems for functioning
- Low gas transfer efficiency



(OHR Laboratory Corporation)

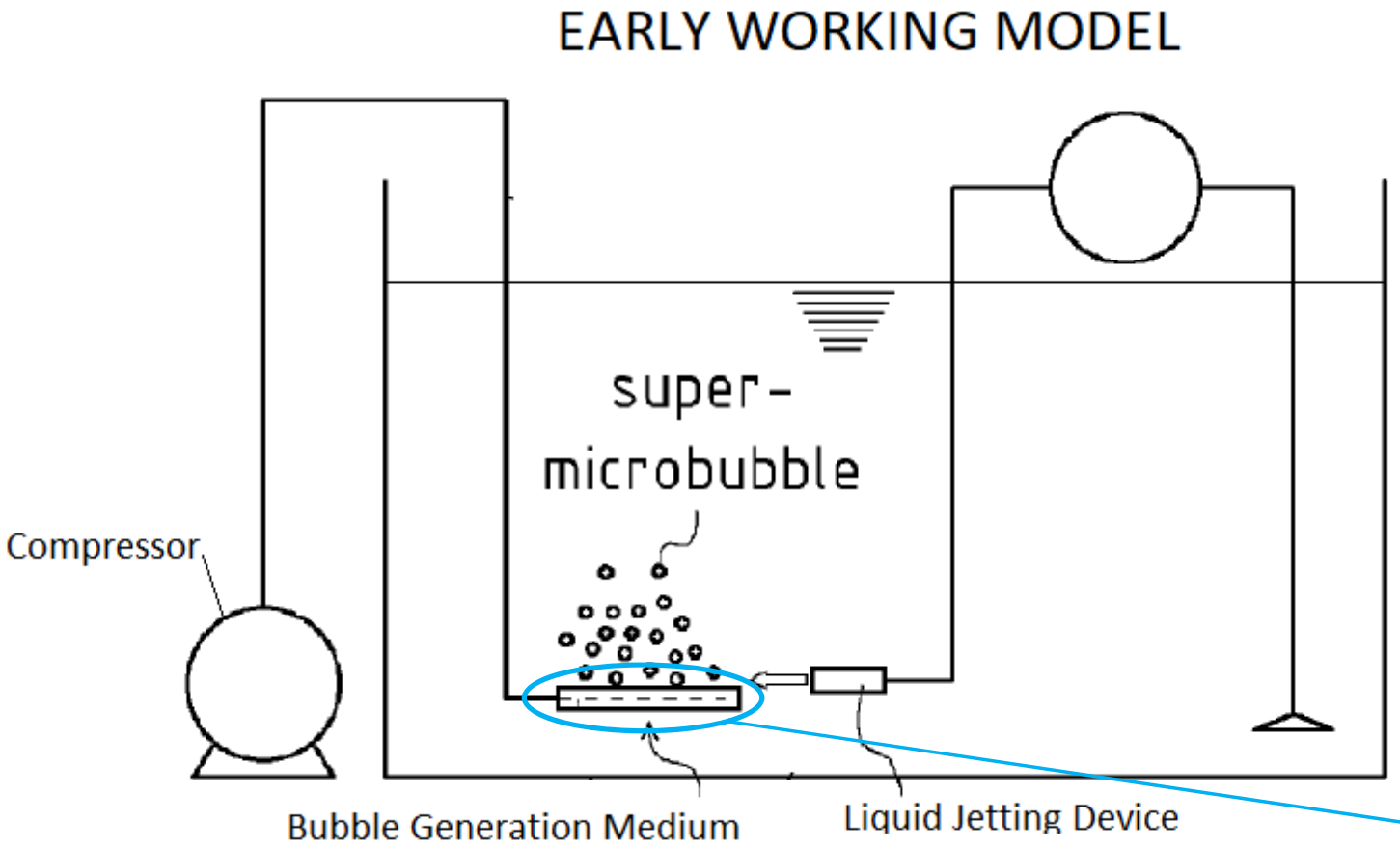
6) Ultrafine Pore Method

- Simple construction and working
- No size limitation
- Lowest power requirement
- Low operating cost: 0.75 KW/10L/min
- Gas Transfer Efficiency: **90%**



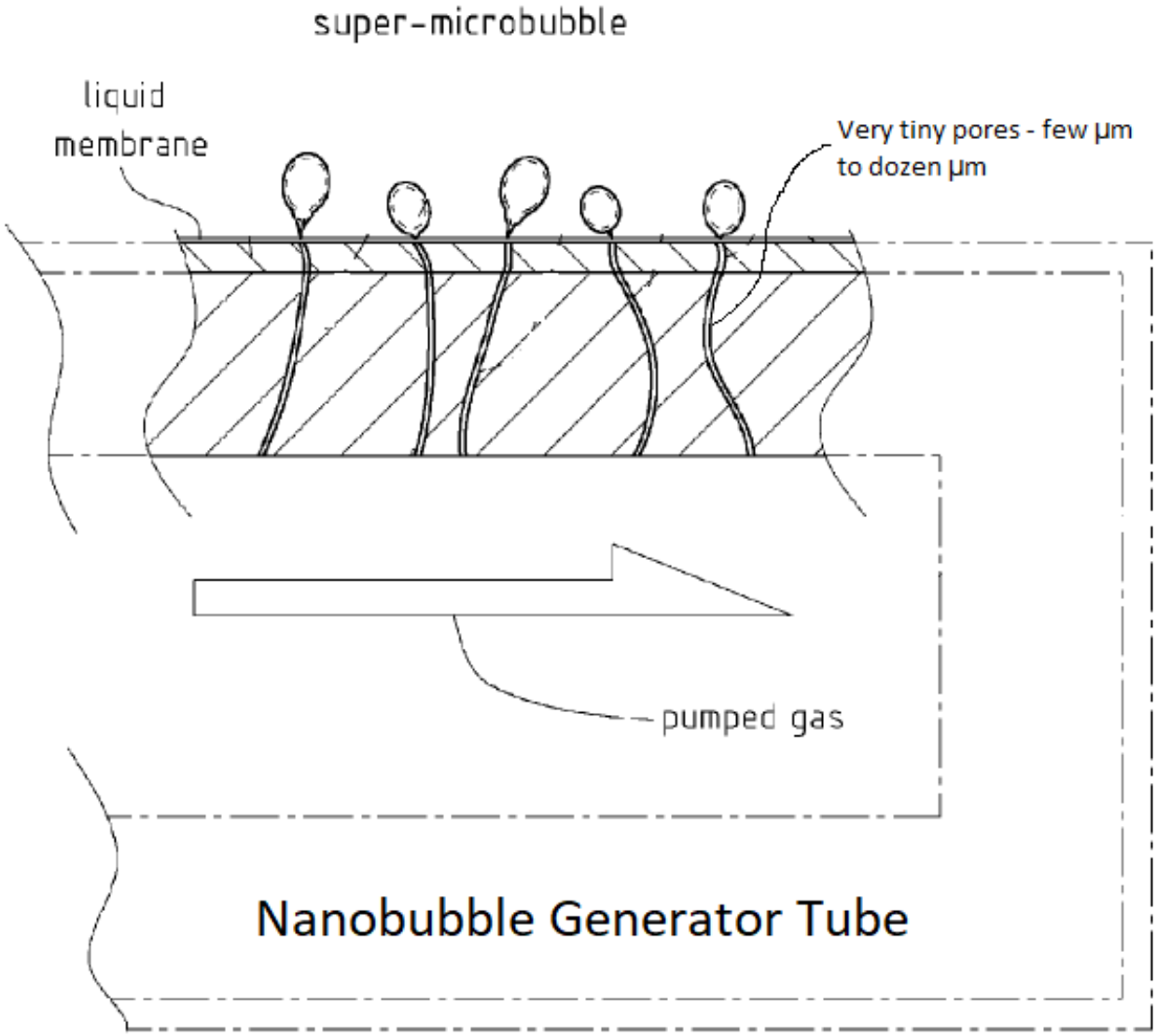
Ultrafine pore Nanobubble Generator Tube

How we create micronano bubbles?

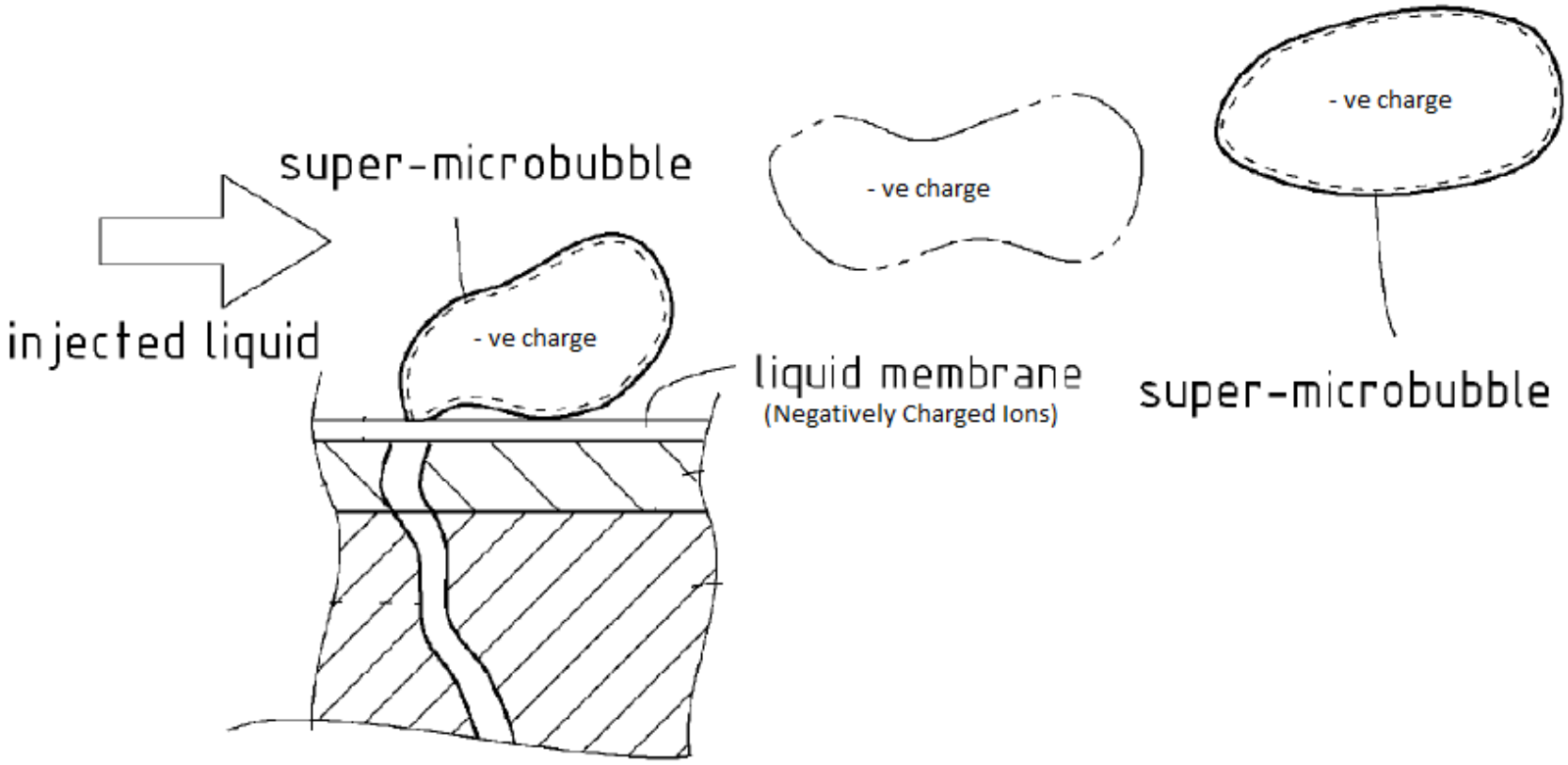


Bubble Generating Medium

- Rigid carbon ceramic compund
- High density material
- Electrically conductive - Hence negatively charged ions tend to range on the surface.
- Inorganic – no damage or degradation



Micro Bubbles are discharged from the nano pores of the nanobubble generator into liquid

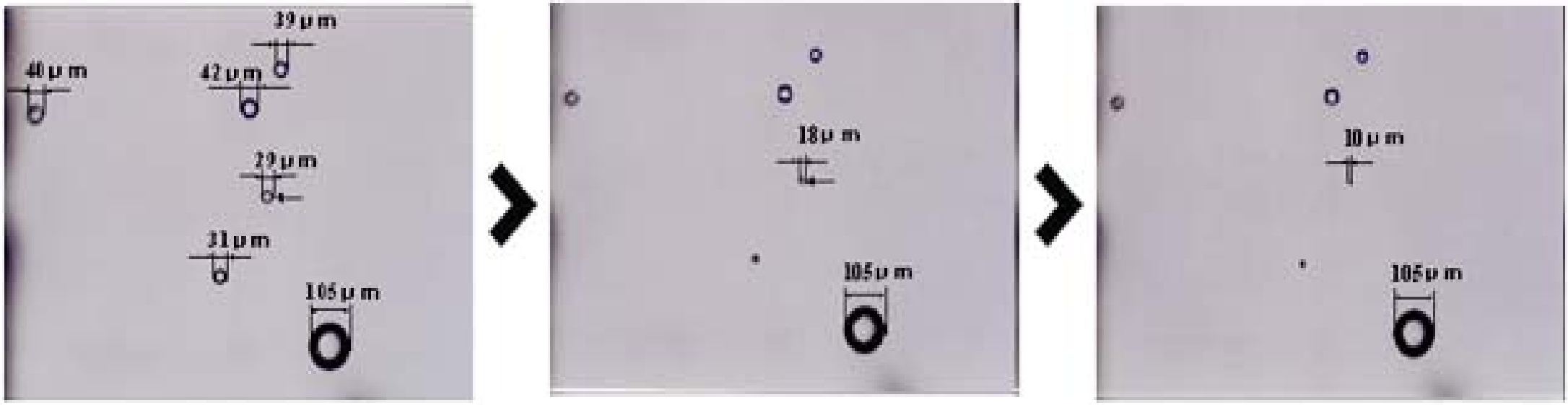


The bubbles would not coalesce because –

1) The super-micro bubbles separates from the bubble generation medium as soon as they are generated.

2) The bubbles generated become negatively charged by receiving the negatively charged ions from the surface of the Nanobubble Generator.

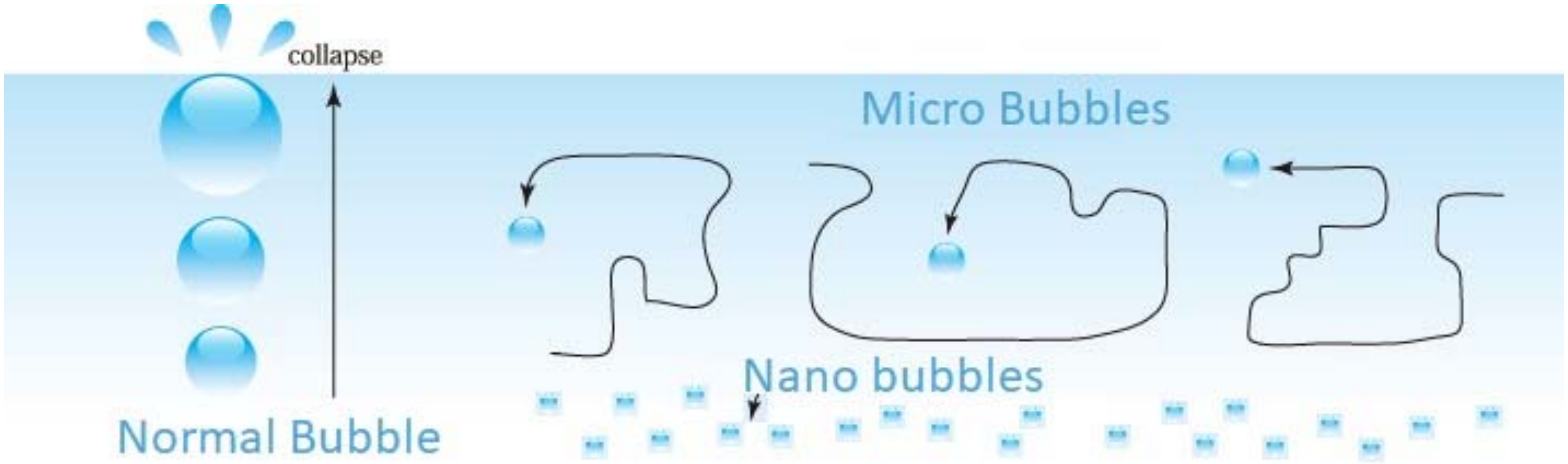
Micro Bubble to Nano Bubble



Bubbles with a smaller diameter than 50 microns get compressed by ions at the gas-liquid interface.

Micro Bubble to Nano Bubble

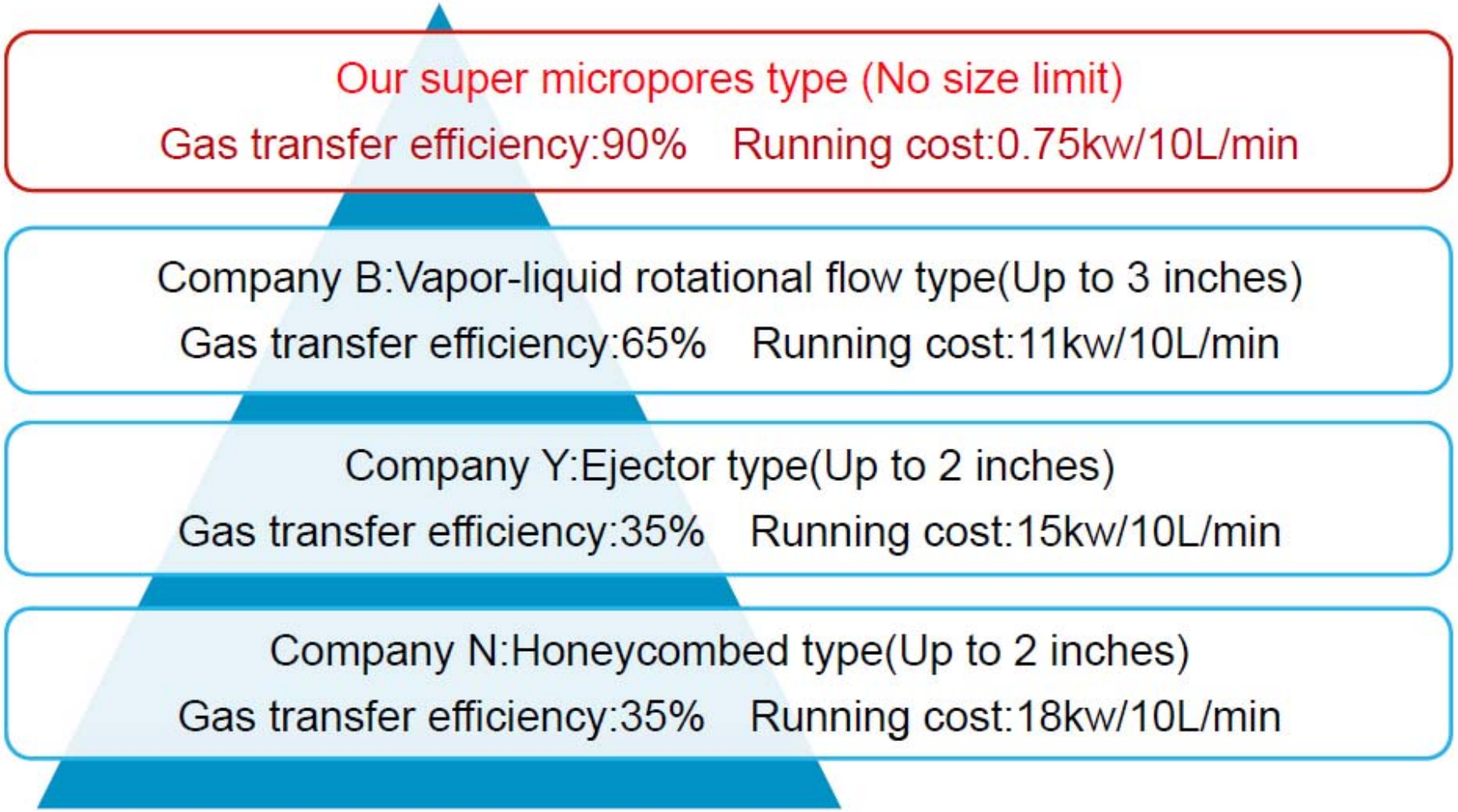
- MicroNano bubbles, due to lower buoyancy, do not rise to the water surface, rather float across various levels and eventually sink to the floor of the bed.
- This makes the oxygen deficient lower layers of water into an oxygen rich environment.
- This makes bacteria grow and accelerate breaking down of the organic matter



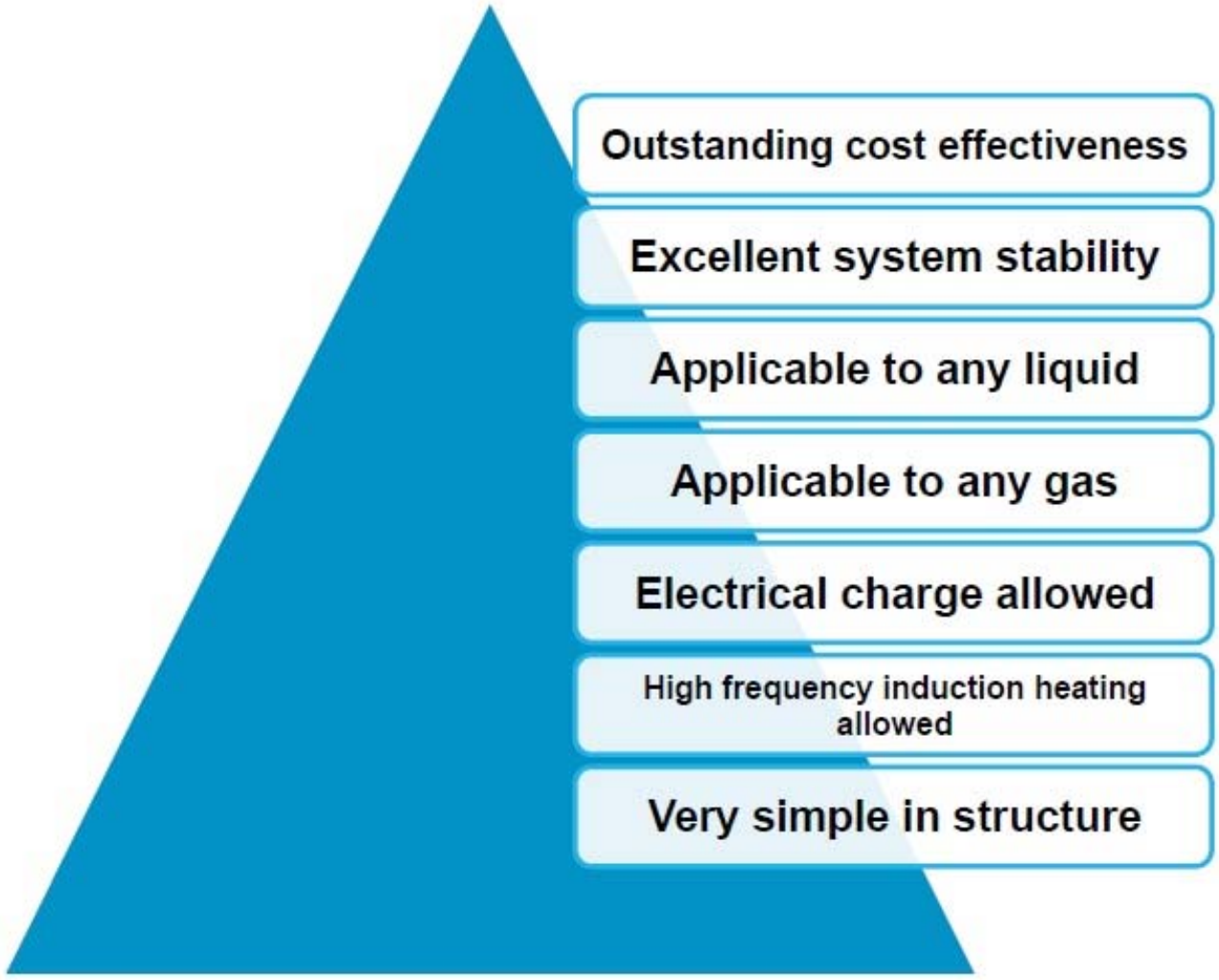
Advantages of our method

- The Micropore-type Microbubble Generating Unit that we have developed, the first in the world, can provide micronano bubbles using **very low energy** consumption.
- Required pressure difference between gas and liquid: 1 bar to 2 bar. Required liquid flow rate: 1m/sec
- **Gas transfer efficiency** of **90%** or more of any gas into any liquid.
- Volume of air required compared with fine bubble aeration: Approximately **25%**.

GAS TRANSFER EFFICIENCY



Advantages


Outstanding cost effectiveness
Excellent system stability
Applicable to any liquid
Applicable to any gas
Electrical charge allowed
High frequency induction heating allowed
Very simple in structure

Applications

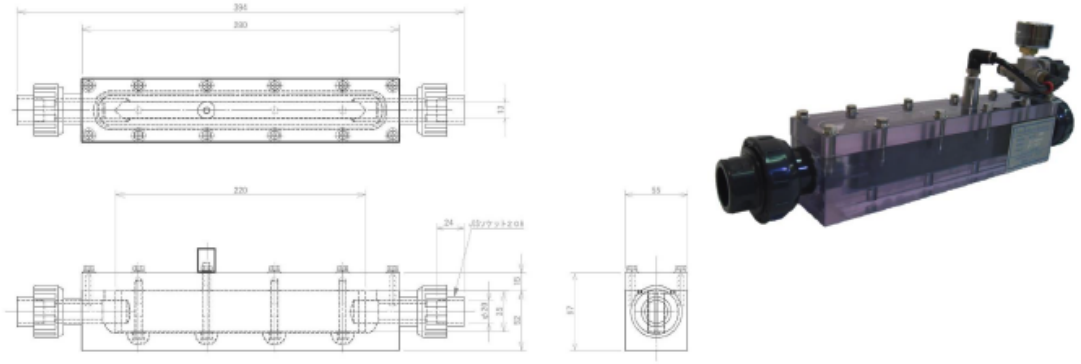
Sterilization capability	The agglomeration and collapse process of the micronano bubbles converts oxygen in the air into active oxygen, creating bactericidal molecules including OH and O_3.
Cleaning capability	Ions existing at the gas-liquid interface of the micronano bubbles decompose and adsorb oil and fat contamination, which allows removal of the contamination without the need for cleaning agents.
Bio-activation capability	It has been proven that the micronano bubbles penetrate deep into biological cells and enhance the immunity of the cells. This has allowed elimination of the need for antibiotics or reduction of the amount of antibiotic usage.
Growth promotion capability	It has been verified that using the micronano bubbles allows fish, crustacea and plants to be grown 20 to 30 percent larger than those grown in an ordinary manner.
Cell protection capability	It has been found that oysters grown with the micronano bubbles remain alive even if they are frozen to minus 20°C. This is likely because the micronano bubbles protect oysters' cells against damage due to freezing.
Heat transfer capability	The micronano bubbles can be used to raise or lower the temperature of a liquid rapidly and effectively.
Vaporization promotion capability	It has been proven that the micronano bubbles contained in a liquid promote vaporization of the liquid. Applications based on this effect include highly efficient water-cooled cooling towers and evaporation based desalination systems.
Environmental purification capability	The micronano bubbles help restore the biological balance in lakes, rivers or seas and remove odors and toxic substances produced by anaerobic bacteria. This effect stays for a long time even in a large water body such as oceans and seas.

Applications around the world excluding Japan

- UK - Waste water trials, Public space sanitisation using ozone, Hydroponics, Animal facility cleaning.
- USA - *lake cleaning*, cost reduction on ozone making machines, waste water treatment plants, swimming pool cleaning, aquarium cleaning, aquaculture (prawns and oyster farming), explosives for mining industry, food industry and algae food supplements.
- CANADA - waste water treatment plant, bath and shower treatments using CO2, remote site (mining communities) waste processing
- INDIA - ferric leaching for copper industry, salmon farming and salmon fry transportation
- SOUTH AMERICA – waste water plants and swimming pool cleaning
- AUSTRALIA – irrigation for agriculture, hydroponics and animal process plant sterilisation and waste control
- HOLLAND & SCANDANAVIA – water cleaning and aquaculture
- EASTERN EUROPE - waste water plants and swimming pool cleaning

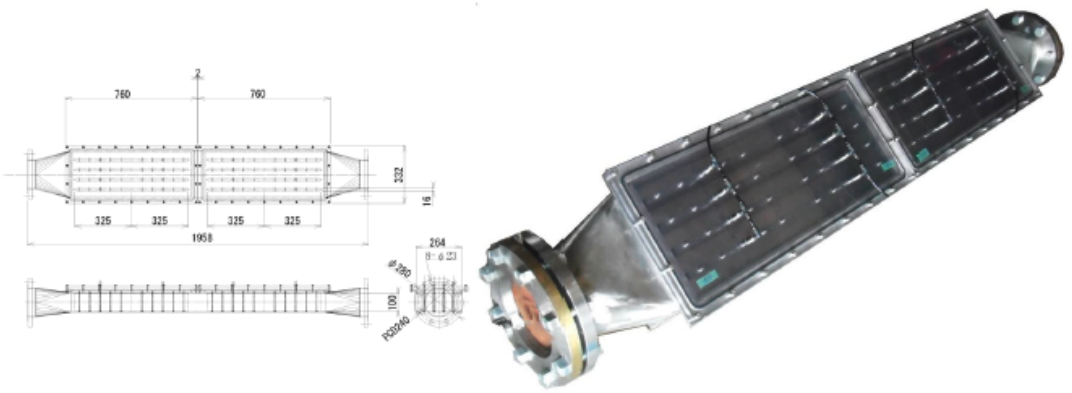
Latest models – Smallest & Largest

『20A/S Specifications』



Distribution Gas Volume :	1.25L/min(max) 0.2Mpa=29psig
Recommended Pump :	0.06kw~0.1kw
Water Flow :	0.015㎥~0.05㎥/min
Carbon Ceramic Dimension :	220mm × 35mm × 13mm
Treating capacity :	5㎥
Material :	Transparent PVC, (union used grey PVC)
O-ring packing :	Viton GS170
Connection method :	Adhesion or R3/4
Piping outer diameter :	ϕ20mm

『150A Specifications』



Distribution Gas Volume :	75L/min(max) 0.2Mpa=29psig
Recommended Pump :	11kw~30kw
Water Flow :	4㎥~6㎥/min
Carbon Ceramic Dimension :	325mm × 100mm × 16mm × 16pcs
Treating capacity :	1,500㎥
Material :	SUS316L / Cover : transparent PVC
O-ring packing :	Viton G630 × 2
Connection method :	JIC150A/10K Flange(Loose Flange)
Piping outer diameter :	150A(6inch)

Thank you

For more details, please contact us at

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