

## Development of the MU Magrator<sup>®</sup>, an aerator incorporating magnetism



GETTING THE WORLD INTO A BETTER ENVIRONMENT

### Increasingly diverse MU Aerator<sup>®</sup> models needed to achieve SDGs for the 21st century

The most pressing issue of the 21st century is finding a way to achieve sustainable development for humanity, society and the global environment. Integrated efforts are underway to reduce energy consumption and CO<sub>2</sub> emissions and so on to achieve a sustainable environment, society and economy in line with the United Nations Sustainable Development Goals (SDGs). (Fig. 1)



Fig. 1 Comprehensive efforts for the environment, society and economy to achieve SDGs

In the area of water treatment, the following conditions must be met:

1. Technologies must be environmentally friendly.
2. The treated water and sludge, etc. must be reusable.
3. The technologies must bring out the latent potential of water.

Wastewater treatment up to now has been beset by major problems, such as the need for large settling tanks, reaction tanks with a long hydraulic retention time (HRT), the need to use large quantities of chemicals, the enormous power usage and maintenance costs needed to operate facilities and treat large quantities of sludge, and so on. To resolve these issues, MU Company has developed the MU Magrator<sup>®</sup>, a new wastewater treatment technology that uses the powerful magnetic field environment created by a magnet to conduct treatment using the properties of water (the name "Magrator" is a combination of the words "magnet" and "aerator").

Incorporating magnetic treatment technology into wastewater treatment makes it possible to reduce the physical processes needed for the aqueous solution used for wastewater treatment, the reaction time and the quantity of chemicals used, which enables the overall apparatus to be downsized and achieves a more compact equipment design. It is a revolutionary wastewater treatment technology that can resolve many wastewater treatment issues.

Use of the MU Magrator<sup>®</sup> reduces running costs and offers other benefits as shown below.

**Wastewater treatment/sludge treatment:** (1) Reduces solids (2) Reduces flocculants, (3) Reduces odor (4) Enhances biological reactions

**Scale measures for equipment, pipes etc.:** (1) Ensures heating, cooling and pump efficiency (2) No need for scale inhibitors (3) Reduces need for cleaning

**Fishponds, swimming pools and hot springs:** (1) Reduces bacteria and reduces need for chlorine agents

**Dams, lakes and rivers:** (1) Reduces blue-green algae (2) Ensures dissolved oxygen

**Agriculture and livestock:** (1) Improves crop growth (2) Improves animal welfare (3) Reduces odors



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A revolutionary wastewater and exhaust gas treatment technology that helps to improve the environment, reduce energy consumption and achieve maintenance-free operation



# MU Magrator<sup>®</sup>

MMA-125, MMA-25, MMAH-25 Aerators

Generates "magnet-treated water" to improve wastewater treatment efficiency, prevent scale buildup, improve coagulation and settling efficiency and prevent equipment corrosion

Reduces power consumption by 20% or more and eliminates clogging through low pressure loss





# New definitive solution for wastewater treatment generates magnet-treated water

The innovative MU Magrator® reduces environmental load and brings out the latent potential of water

## MU Magrator® features



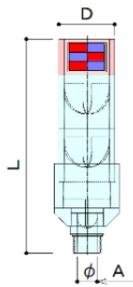
- Uses magnet-treated water to enhance reaction speed, reduce the quantity of chemicals used, prevent scale buildup, reduce sludge and odor, etc. The result is a more compact equipment design that enables the entire system to be downsized.
- The MU mixing element is equipped with a magnetic pass-through section and multiple agitating spiral mixing blades (MU Static Spiral Perforated Wings® or MU-SSPW) to mix the magnet-treated air and water in order to dissolve oxygen very efficiently and generate microbubbles.
- The unit has low pressure loss, dramatically reducing power consumption.
- The unit has no moving or sliding parts, has a clogging-proof configuration, and uses permanent magnets, ensuring maintenance-free operation.
- The air lift effect reduces sludge accumulation at the bottom of the tank.



## Diverse applications of the MU Magrator®



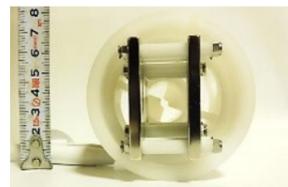
From left: (1) MMA-125-40PP, (2) MMA-25-PP, (3) MMAH-25-PP



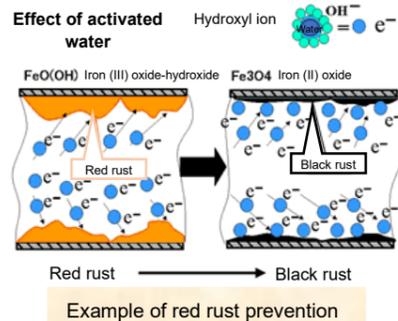
MMA-25-PP

**Major benefits:** Increased dissolved oxygen concentration, reduced chemical use quantities, reduction of foul odor and decay, reduction of E. coli and common bacteria, reduced scale buildup in pipes, prevention of red rust water, prevention of slime

**Applications:** Wastewater treatment for agriculture, fisheries, livestock, food production, household wastewater, water disposal, etc.



MU Magrator® interior



### 【Main MU Magrator® Models】

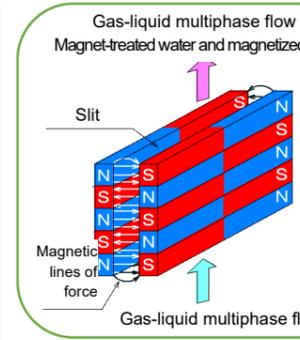
Specifications	Diameter (D) (mm)	Length (L) (mm)	Connection aperture (A) (mm)	Air flow range (m3/min)	Projected particle area (m <sup>2</sup> )	Proper water depth (m)	Weight (g)
MMA-25-PP	60	240	25A(1B)	0.33-2.0	5-7	1.5<	330
MMA-125-40-PP	140	500	40A(1-1/2 B)	0.7-2.2	5-10	1.5<	2,380
MMA-25-PVC	60	240	25A(1B)	0.33-2.0	5-7	1.5<	440
MMA-125-40-PVC	140	500	40A(1-1/2B)	0.7-2.2	5-10	1.5<	3,680
MMA-125-40-SUS	140	430	40A(1-1/2B)	0.33-3.5	5-12	1.5<	8,180
MMA H-25-PP	70	140	25A(1B)	0.33-1.6	5-7	1.0<	207
MMA H-25-PVC	70	140	25A(1B)	0.33-1.6	5-7	1.0<	207

Note: Air flow range and projected particle area may fluctuate according to water depth. Magnet placement will differ depending on effluent characteristics.

## MU Magrator® mechanism

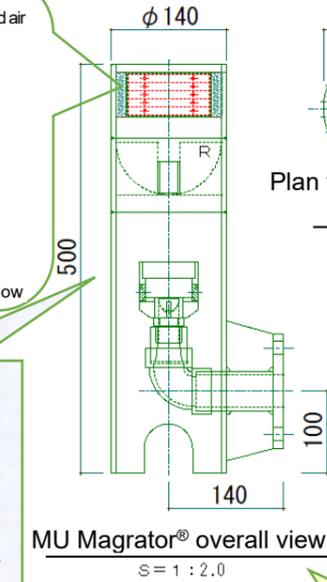


MMA-125-40-PP

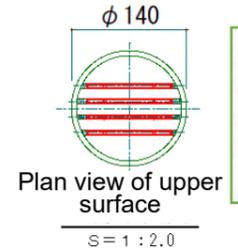


Water and air are subjected to repeated multi-layer division, rotation, confluence, inversion and shear, generating microbubbles.

The gas is converted into microbubbles, which expands the specific surface area and increases the exposure area of the magnetic lines of force, resulting in improved exposure efficiency.



MU Magrator® overall view  
S = 1 : 2.0



Plan view of upper surface  
S = 1 : 2.0

Large quantities of microbubbles are generated in the water. Millibubbles rise to the surface.



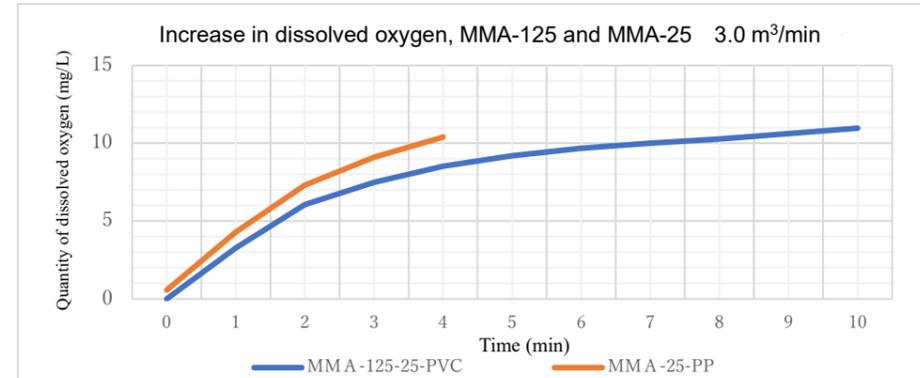
Bubble generation in water

## Comparison of aeration systems (reference)

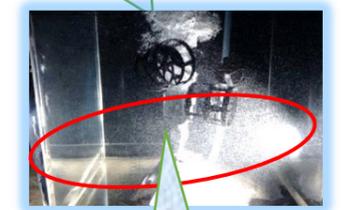
Item	Type of system	MU Magrator	Mechanical aeration system	Disc type
1. Oxygen dissolving efficiency		Large	Large	Small
2. Agitation force		Large	Medium	Medium
3. Pressure loss		Small	Large	Large
4. Clogging / reduction of function		No	Yes	Yes
5. Inverter / intermittent operation		Possible	Possible	Not possible
6. Dead space		No	Yes	Yes
7. Construction costs		Low	High	Low
8. Need for maintenance and inspections		No	Yes	Yes
9. Running costs		Low	High	Low

The MU Magrator® produces a powerful agitation force and air lift effect, with the result that the interior of the tank is agitated evenly, and the biological reactions of aerobic microorganisms are able to progress efficiently.

The MU Magrator® generates large quantities of microbubbles without the use of mechanical or electrical manipulation. This promotes oxygen enrichment in wastewater treatment conducted using the activated sludge method.



This graph shows the change in the quantity of dissolved oxygen when air is supplied to a test water tank at 3.0 m3/minute under conditions of clear water 20°C and MLDO = 0. The quantity of dissolved oxygen fluctuates approximately 10% depending on water temperature, tank shape, influent substrate, and so on. Accordingly, a safety margin should be provided when selecting the blower air supply volume. The graph shows that saturation is reached in a short period of time (8.84mg/L saturation at 20°C). The powerful aeration reduces BOD, N-hex, SS, odor, and sludge due to the physiological changes in bacteria, etc. and the effect of magnetic treatment. This helps to improve wastewater treatment facility operations by reducing power consumption and the need for maintenance and inspections and so on.



Microbubble generation