Nano-Bubbles Made Stabilized, First in the World

- Holding ozone over long periods, and keeping Marine and Fresh Water Fishes Together in Water Saturated with Nano-Bubbles -

(Translation of the AIST press release on the 15 March, 2004)

Key points

- Nano-bubbles involving high potential for engineering use have been not available because of lack of technologies for manufacturing and stabilizing.
- We have successfully produced and made stable nano-bubbles by collapsing micro-bubbles in water containing electrolyte ions. The stabilization may be attributed to electrostatic expulsion of charges concentrated in bubble interfaces, and to concentrated ions acting as shells enclosing bubbles.
- Water containing ozone nano-bubbles retains sterilizing effects for over a month, while that saturated with oxygen nano-bubbles has bio-active effects. These effects may be utilized for medical treatment and food processing as well as for agriculture and fishery.

Synopsis

The Institute for Environment Management Technology (IEMT) of the National Institute of Advanced Industrial Science and Technology (AIST), an independent administrative institution, has successfully established technologies for making and stabilizing nano-bubbles, in collaboration with REO Institute, Co., Ltd. Nano-bubble refers to ultra-fine gas bubble of diameter less than 1μm (1μm=1/1,000,000 m). It usually occurs temporarily in the process of shrinking micro-bubble, but disappears soon because of its physical lability. Through the collaboration with REO Institute, AIST has succeeded in producing stabilized nano-bubbles by collapsing micro-bubbles instantaneously in water containing electrolyte ions. While detailed mechanism is to be analyzed further, it may be explained as following: in the process of collapsing micro-bubbles, ions in the solution are concentrated around bubbles to evolve electrostatic repulsive force and to suppress the total annihilation of bubbles. It may also be probable that concentrated ions work as shells protecting bubbles from dissipating gas from within. Water containing nano-bubbles is not so different physically from ordinary water, but some properties gas within the nano-bubble may be exhibited. For instance, water containing ozone nano-bubbles prepared by the technology developed in the present study can hold ozone in water for a month or longer, though ozone in open water dissipates out in a few hours under normal temperatures and pressure. This may ensure easy use of ozone water for sterilization in areas of medical treatment and food processing. Water including oxygen nano-bubbles is found to improve the adaptive capability of fishes and shellfishes to environmental changes and to exert activating effects to aqueous organisms. In an aquarium, filled with water of certain salinity saturated with oxygen nano-bubbles, it was possible to keep alive multiple species of fresh water and marine fishes together for a time period 6 months or longer. In this experiment, moreover, almost all of fishes weakened at the time of capture proved to return rapidly to healthy conditions, if kept in water of 1% salinity containing oxygen nano-bubbles. On the basis of these facts, the combination of oxygen nano-bubbles and a small amount of ozone nano-bubbles is expected to be useful for restoring health of fishes and shellfishes enfeebled by infectious disease while eliminating pathogens, such as bacteria and viruses. The technology will be applied to the cultivation of fishes and shellfishes without using antibacterial agents and antibiotics, as well as to medical treatment, food processing and livestock industry.

Three patents are being filed in regard to this study.

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