Norovirus Inactivated by using Micro-bubbles, First in the World

- Making it possible to market safe and good-tasting oysters -

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The Institute for Environmental Management Technology (IEMT) of the National Institute of Advanced Industrial Science and Technology (AIST), an independent administrative institution, has successfully inactivated norovirus, which is one of major pathogens causing food poisoning in winter, and previously designated as small round-structured virus (SRSV), by using micro-bubbles containing low concentration ozone.

The norovirus can be inactivated by adequate heat treatment. However, if shellfish such as fresh oysters infected with norovirus are eaten, acute gastero-intestitis may occur with symptoms of vomiting, stomachache, diarrhea and fever.

The currently available measures against the norovirus include cultivating oysters and other shellfish in sterile seawater, and using chlorine-based germicide. However, sterile cultivation is costly, and cold seawater in winter season lowers filtering capability of oyster to hamper effective viral eradication. The norovirus is resistant to chlorine-based germicide and sterilizing alcohol, and the use of high chlorine concentration will make shellfish unpalatable. For this reason, it has been urgently desired to develop effective method of inactivating norovirus.

The IEMT/AIST has been making basic studies on micro-bubble, with intention of exploring the possibility of its application in engineering. Micro-bubbles are ultra-fine gas bubbles in water of size less than 50 μm (micrometer, = 1/1,000,000 m = 10^{-6} m), and as they are suspended in water, the bubble size shrinks spontaneously to the level of nanometer (= 10^{-9} m), ultimately disappearing with gas within fully dissolved out.

The micro-bubbles are characterized by electrical charging and self-pressurizing effects, suggesting extensive possibility for engineering applications. The IEMT/AIST attempted to utilize these effects for making a breakthrough, and successfully inactivated the norovirus by using micro-bubbles of concentrated oxygen containing about 2 % ozone. The viral inactivation was verified in collaboration with the Tokyo Metropolitan Institute of Public Health (TMIPH).

While the present study proved the effective inactivation of norovirus suspended in water, seawater containing micro-bubbles has good penetrability and is expected to attack not only norovirus in live oysters under cultivation, but also that in unshelled oysters. The IEMT/AIST is going to expand the study further. The technique is expected to be applicable to suppressing legionella bacteria in a circulating bath system and carp herpes virus. With respect to this study, two patents are being filed.

Before the micro-bubble treatment

After the treatment