maxell
Within, the Future

News Release

27-Oct. 2020
Maxell Holdings, Ltd.

Confirmation of the novel coronavirus (SARS-CoV-2) inactivation effect of low-concentration ozone generated by Maxell's ozone anti-bacterial deodorizer

Implementation of the second cooperative investigation with Nara Medical University

Maxell, Ltd. (hereafter referred to as “Maxell”, company president: Keiji NAKAMURA) confirmed the novel coronavirus (SARS-CoV-2) inactivation effect of low-concentration ozone generated by Maxell's "OZONEO AERO (MXAP-AE270)"*1 ozone anti-bacterial deodorizer (hereafter referred to as “the equipment”) in a joint study with Nara Medical University (Professor Hisakazu YANO, Associate Professor Ryuichi NAKANO, Department of Microbiology and Infectious Diseases) (hereafter referred to as “the study”).

The study confirmed the inactivation effect on the novel coronavirus of a spatial ozone concentration of 0.05 ppm, which is below the occupational exposure limits*2 defined by the Japan Society for Occupational Health using an actual product of the equipment.

The test and confirmation of effectiveness in the study were implemented under proper pathogen containment measures ex situ at bio-safety level 3 (BSL3), and do not constitute proof of effectiveness in an actual-use environment using the equipment.

Since entering the sterilization and deodorant equipment field in 2015, Maxell has validated the effects of its products through joint studies with third-party institutions, universities, and research institutions, and has contributed its energy to the establishment and disclosure of evidence so that customers can use its products with a sense of security. This study is also positioned as one of those studies.

Moreover, Maxell is a member of the MBT Consortium Association*3 (administrative director: Hiroshi HOSOI, hereafter referred to as “MBT Consortium”) and will utilize the results of the study for the development of products and provision of services with the intent to establish a consortium called "urban development based on medical science."

*1 "OZONEO AERO (MXAP-AE270)" ozone anti-bacterial deodorizer: https://www.maxell.jp/consumer/mxap-ae270.html
An ozonizer with the same mechanism as that mounted on the professional-use ozone anti-bacterial deodorizer MXAP-AE400 and MXAP-AEA255. (The effects on the novel coronavirus have not been confirmed.)

*2 Allowable ozone concentration as defined by the Japan Society for Occupational Health: Recommendations of Occupational Exposure Limits (FY2019), *Journal of Occupational Health* Vol.61: 170-202, 2019.

*3 MBT Consortium: http://mbt.or.jp/.

■Evaluation test of inactivation effect of ozone on the novel coronavirus in the study

- Test ozone

Ozone generated by "OZONEO AERO (MXAP-AE270)" ozone anti-bacterial deodorizer (the equipment)

- Test virus

Novel coronavirus (SARS-CoV-2; 2019-nCoV JPN/TY/WK-521 strain)

- Content of the test

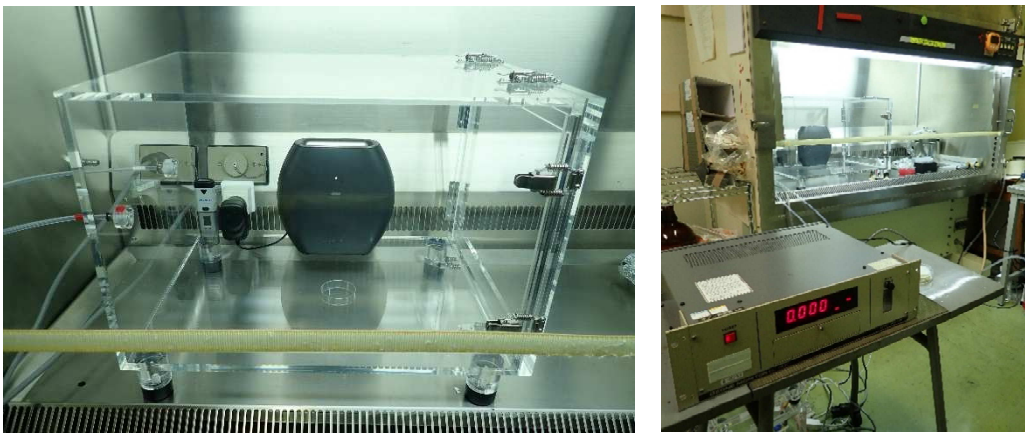
The equipment was installed and operated in a sealed acrylic box (external form: 520 x 400 x

340 mm, board thickness: 8 mm, cubic content: approx. 62 L), and a space where the concentration in the box is controlled to 0.05 ppm using a UV-absorption-type ozone concentration monitor (hereafter, “the box”) was prepared. The temperature and humidity within the box during the test were within the similar range as the general living environment (temperature 23±5°C, humidity: 60±5%).

A test piece was prepared by attaching 20 µl of virus fluid to a petri dish and allowing it to stand still for a constant time to dry it. The test piece was allowed to stand still in the box to be exposed to ozone. A test piece that had been allowed to stand still for the same time without exposing it to ozone was prepared as a control group. After the predetermined time had passed, 2 ml of culture medium was dropped onto each test piece and the virus was collected using a cell scraper, and the amount of virus was then calculated using the plaque assay technique. The test was conducted twice for each virus fluid.

The virus reduction rate was calculated using a logarithmic decrease value and the following formula.

Reduction rate [%] = $(1-1/10^{\text{logarithmic decrease value}})\times 100$



Scene of an experiment during the study

Left: Exposure to ozone within the box; Right: Concentration control using an ozone concentration monitor

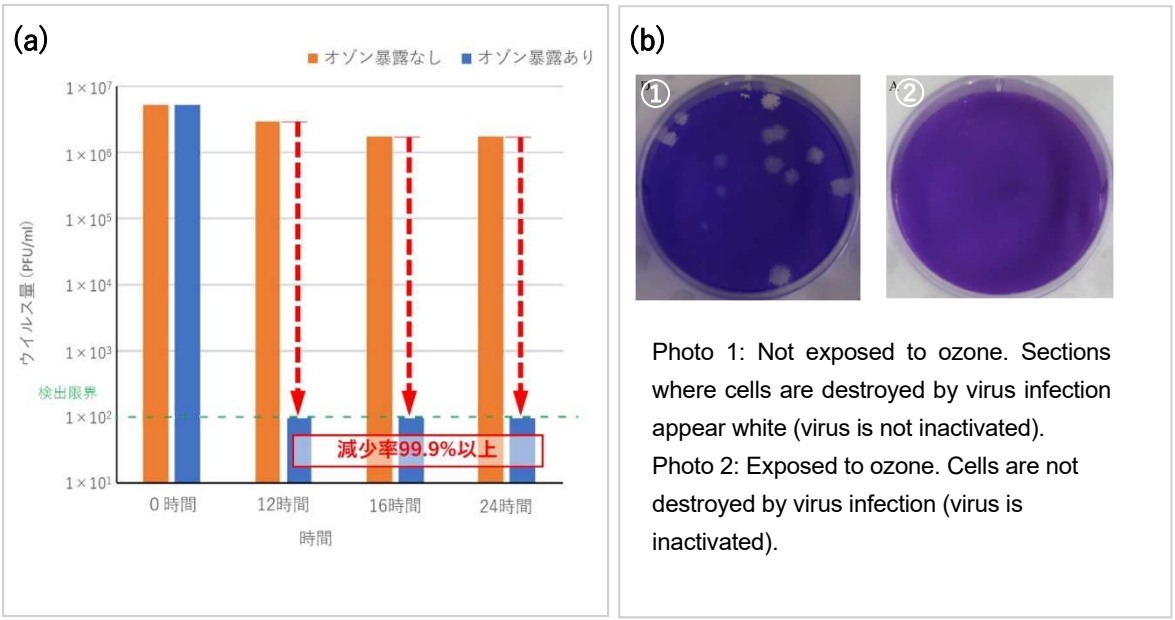
- Result

When the novel coronavirus was exposed to ozone, 5.25×10^6 PFU/ml of coronavirus amount decreased to 1.00×10^2 PFU/ml or less, below the detection limit, after 12, 16, and 24 hours. At each of these times, the virus decreased by 99.9% or more. These values are the average values of two tests.

	0 hours	12 hours	16 hours	24 hours
Not exposed to ozone	5.25×10^6	3.00×10^6	1.75×10^6	1.75×10^6
Exposed to ozone	5.25×10^6	$< 1.00\times10^2$	$< 1.00\times10^2$	$< 1.00\times10^2$
Rate of decline (%)	-	> 99.9 %	> 99.9 %	> 99.9 %

* Detection limit value: $< 1.00\times10^2$; rate of decline (%) is rounded down to two decimal places.

Changes in amount of virus due to the ozone (units: PFU/ml)



Example of change of virus amount depending on exposure to ozone (a) and virus infection evaluation result (b)

■ Test results

The test results confirmed that the ozone released into a space renders the novel coronavirus inactive, even below the occupational exposure limits [*2] defined by the Japan Society for Occupational Health, namely 0.05 ppm. They indicate that the ozone released into a space may be effective for preventing contact infection via substances infected with the novel coronavirus.

Note that the effect on a floating virus was not confirmed because of the restriction of testing equipment and facility. The actual production model of the equipment was used for the generation of the ozone, however, the effect was confirmed in an experimental facility. This result does not indicate the effect in an actual-use environment.

■ Meaning of confirmation of inactivation effect brought about by the study

Confirmation of the effect of high concentration (6.0 and 1.0 ppm)[*4] and low concentration (0.1 and 0.05 ppm)[*5] of ozone release into a space on the novel coronavirus have already been reported. In particular, the latter study confirmed the effect at below the occupational exposure limits [*2] defined by the Japan Society for Occupational Health that is same way as this study; however at high humidity (approx. 80%), not at the general living environment.

In this study, the effect of low-concentration ozone generated by an actual product of the equipment and controlled to a spatial concentration of 0.05 ppm at the general living environment (temperature: 23±5°C, humidity: 60±5%) was confirmed. Thus, Maxell believes that the study shows the possibility of using ozone widely for general public health purposes regarding the novel coronavirus even in low concentration that can be used in a manned environment, not only for high-concentration use in an unmanned environment such as fumigation.

As for the first cooperative investigation with Nara Medical University, confirmation of the inactivation effect of low-concentration ozone water generated by Maxell's professional-use ozone water generator "OZONEO AQUA Watermix (MXZW-WM100J)"[*6] on the novel coronavirus was released on October 15, 2020.[*7] Maxell believes both the first and this study

suggest that low-concentration ozone and ozone water may be sufficiently and widely utilized for people's lives.

*4 Report on high concentrations (6.0 and 1.0 ppm): Yano H, Nakano R, Suzuki Y, Nakano A, Kasahara K, Hosoi H: Inactivation of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by gaseous ozone treatment. *J Hosp Infect* (in press), doi: 10.1016/j.jhin.2020.10.004.

*5 Report on low concentrations (0.1 and 0.05 ppm): released by Fujita Health University: https://www.fujita-hu.ac.jp/news/j93sdv0000007394.html

*6 "OZONEO Aqua Watermix (MXZW-WM100J)" professional-use ozone water generator: https://biz.maxell.com/ja/living_life_equipment/mxzw-wm100j.html

*7 Announcement: https://ssl4.eir-parts.net/doc/6810/ir_material21/149487/00.pdf

■ Activities of Maxell

Maxell is engaged in the development of sterilization and deodorization technology and equipment as one of its health and beauty sector product groups in its electricity and consumer business. Maxell believes that the social roles and needs for sterilization and deodorization in this field will expand due to social conditions taking "with corona" and "after corona" into account, and that it can increasingly contribute to society by developing new technologies that respond to this problem and equipment with clearly verified and proven effects, and providing these to its customers in the form of products.

For the third goal of the 17 SDGs (Sustainable Development Goals) established by the United Nations, "Good Health and Well-Being - Ensuring healthy lives and promoting well-being at all ages," Maxell will continuously develop sterilization and deodorization technology and equipment utilizing the characteristics of ozone as one of the methods for accomplishing this goal.