November 5, 2010

Sharp Proves Ability of High-Density Plasmacluster Ions[*1] to Eliminate (in a 1-m^3 box) Airborne Bacteria and Odors, as well as Inhibit Infectivity of Canine Parvovirus[*2] in an Animal Hospital

Sharp Corporation, in cooperation with the Animal Clinical Research Foundation[*3] (Yoshihisa Yamane, President; and Kazuaki Takashima, General Manager), has proved in an animal hospital that high-density Plasmacluster Ions (ion concentration: 25,000 ions/cm^3) reduce airborne bacteria and ammonia odors, which are the main causes of pet odors.

In addition, they proved that high-density Plasmacluster Ions (ion concentration: 25,000 ions/cm^3) can inhibit infectivity of airborne canine parvovirus (in a test using a 1-m^3 box, which conducted by Shokukanken Inc.[*4]).

Through these tests, it has been verified that high-density Plasmacluster Ions can contribute to a healthy and pleasant living environment not only for pets but also for pet owners.

The results of these studies will be presented at *the 31st Annual Meeting of Japanese Society of Clinical Veterinary Medicine* starting on November 19, 2010.

Based on the academic marketing[*5], Sharp is working in collaboration with academic research organizations around the world since the year 2000, has proven that Plasmacluster technology is effective in inhibiting the activity of 29 different kinds of harmful microorganisms, including viruses, bacteria, and allergens. Furthermore, it has been proven safe to humans[*6]. This time, Sharp has for the first time proved the multiple effect of Plasmacluster Ions in the field of pet care, increasing further the value of the technology. Sharp will continue to further evolve and verify Plasmacluster technology for the creation of healthier living environments.

Comments by Yoshihisa Yamane, President, and Kazuaki Takashima, General Manager, of the Animal Clinical Research Foundation

This time, the effect of Plasmacluster Ions in reducing airborne bacteria and odors was tested in an area where dogs are kept (of an animal hospital). In the future, Plasmacluster technology is expected to be applied to improve the environment of places such as operating rooms and examination rooms of animal hospitals, indoor pet breeding, and, the health and amenity of pet owners.

Furthermore, since it has been confirmed that Plasmacluster technology can inhibit canine parvovirus infectivity, which is feared by animal health care worker, this technology is expected to be used for not only protecting dogs' lives but also for protecting veterinary institutions from the spread of infectious diseases.

*1 Plasmacluster is a registered trademark of Sharp Corporation.
*2 A virus contagious among pets. Infection can result in death.
*3 A clinical research institute studying veterinary science.
*4 A research institute studying food and the environment, including areas such as microbiological inspection, food ingredient analysis, and sanitary surveys.
*5 A marketing technique where a product has its benefits scientifically verified in cooperation with top-of-the-line research facilities.
*6 Testing conducted by Mitsubishi Chemical Medience Corporation, including tests for inhalation toxicity and for skin and eye irritancy and corrosivity.

1. Verification of effect of high-density Plasmacluster Ions in reducing airborne bacteria and odors in veterinary hospitals

In the center of an 8.8-m^2 laboratory, a double-deck cage[*7] was installed. Two beagles were placed in the cage, one on each deck, and ion generators were installed on opposite walls on either side of the cage (Fig. 1 and 3).

* 7 A breeder's loft for pet animals.

Verification of Airborne Bacteria Reduction

Evaluation item:	Amount of airborne bacteria (bacteria collected with an air sampler[*8] was counted)
Methods:	Over a period of 12 days, the ion generators were turned on or off for two or three days at a time. During this time, the increase and decrease in the amount of airborne bacteria under each condition ("with ions" or "without ions") were compared.
Results:	Under the "with ions" condition (ion concentration: 25,000 ions/cm^3), the amount of bacteria always decreased compared to the "without ions" condition (Fig. 2). The "with ions" conditions all achieved class 10,000 of the NASA Standard Assay [*9] (amount of airborne bacteria is no more than 17.7 CFU/m^3). This is considered to be the acceptable level for general operating rooms.

*8 An apparatus that collects air for measuring the amount of airborne bacteria.
*9 A standard for the purity of air in biological clean rooms.

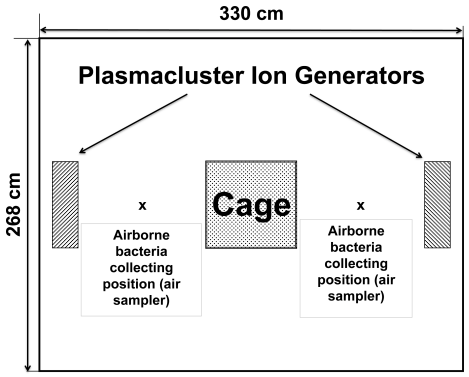


Fig. 1 Laboratory layout

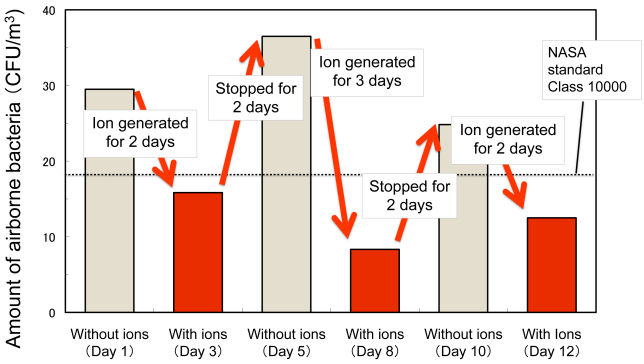


Fig. 2 The Changes in amount of airborne bacteria

Verification of Decrease in Ammonia Concentration

Evaluation item:	Ammonia concentration in air (measured with a gas detector tube[*10])
Methods:	Plasmacluster Ions were generated (ion concentration: 25,000 ions/cm^3) in a room. During this time, the concentration of ammonia under each condition (“with ions” and “without ions”) was compared.
Results:	Under the “without ions” condition, the ammonia concentration was 2.25 ppm. After ion generation started, the ammonia concentration gradually decreased, and after 29 days, the ammonia concentration had dropped to 0.56 ppm After 37 days, the ammonia concentration dropped to 0.34 ppm. (Fig. 4). The odors decreased from a level corresponding to odor intensity 3 (“easily detectable” on the six-level odor intensity indication method[*11]) to less than a level corresponding to odor intensity 2 (“faint but identifiable”).

*10 An apparatus that measures the concentration of a specific substance in the air. For this test, an apparatus for measuring ammonia concentration was used.

*11 A method commonly used in Japan for ranking odor intensity.

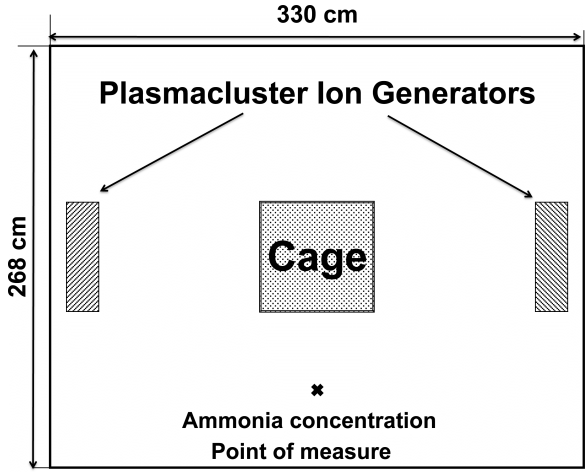


Fig. 3 Laboratory layout

Relation Between Ammonia Concentration and Six-Level Odor Intensity Indication Method

Ammonia concentration (ppm)	Odor intensity	Description
40	5	Very strong odor
10	4	Strong odor
2	3	Easily recognizable odor
0.6	2	Recognizable slight odor
0.1	1	Barely sensed odor
—	0	No odor

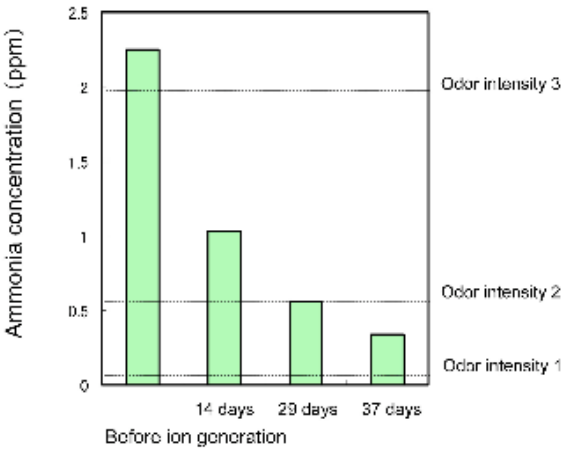


Fig. 4 The changes in ammonia concentration

2. Verification of Effect of High-Density Plasmacluster Ions Effectiveness at Inhibiting Canine Parvovirus in a 1-m^3 box

Evaluation Item:	Infectivity of canine parvovirus (as per TCID50 assay *12)
Test environment:	Plasmacluster Ion generator was placed in a 1-m^3 box, and ions were generated (ion concentration: 25,000 ions/cm^3).
Methods:	Canine parvovirus was sprayed in the box, and the conditions of “without ions” and “with ions” (after ion generation for five minutes) were compared for infectivity of the virus.
Results:	Compared to the “without ions” condition, infectivity of the virus was reduced by at least 99.8% for the “with ions” condition.

*12 An assay to check infectivity by inoculating a cell with the virus in the form of a virus solution that has been diluted in stages.

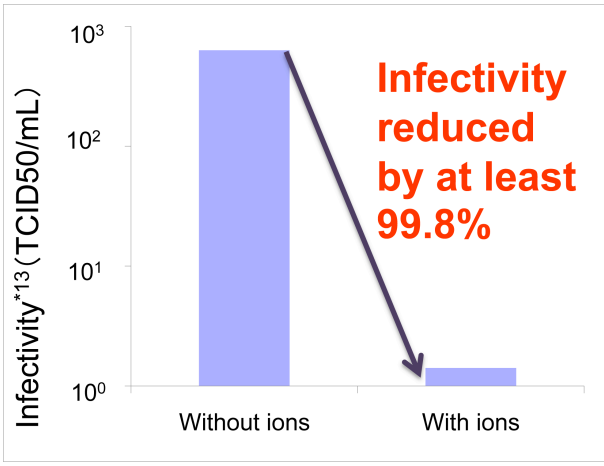


Fig. 5 The change in airborne canine parvovirus infectivity

*13 Value showing infectivity of virus cells; calculated using the TCID50 assay.

Animal Clinical Research Foundation

Established on April 1, 1991, the Foundation conducts clinical research into veterinary medicine. Other wide-ranging activities include publication of books on veterinary medicine, provision of information on academic conferences and lectures, human resource development including education and training of veterinary care staffs, and protection of natural resources through wild animal preservation management. Since 1996, the Foundation has also sponsored the *Annual Meeting of Japanese Society of Clinical Veterinary Medicine*, an event that is registered with the Science Council of Japan.

Yoshihisa Yamane, DVM, PhD, President of Animal Clinical Research Foundation

President of the Japan Veterinary Medical Association and Professor Emeritus.of Agriculture and Technology at Tokyo University. He created an ultra-compact artificial cardiopulmonary unit for animals in 1989 for the first time in the world and reported a successful operation with cardiopulmonary bypass, and is an authority on circulatory system in veterinary medicine. He became General Manager of Animal Clinical Research Foundation in 1991 and President of the foundation in 1996. In 2004, he became President of the Japan Veterinary Medical Association.

Kazuaki Takashima, DVM, PhD, General Manager of Animal Clinical Research Foundation

Director of the Japanese Society of Clinical Veterinary Medicine and General Director of Kurayoshi Animal Medical Center and Yonago Animal Medical Center.

Efficacy of Plasmacluster Technology in Inhibiting Virus Infectivity Confirmed Through Collaborative Research

Viruses	Tests/Results	Testing & Verification Organization	Outline
H1N1 human influenzavirus	• Tested in a 1-m^3 box • Exposed time: 25 min. • Reduced by 99.7%	Kitasato Research Center of Environmental Sciences, Japan Seoul University, Korea Shanghai Municipal Center for Disease Control and Prevention, China Kitasato Institute Medical Center Hospital, Japan	Pathogen virus of influenza infected to person
H5N1 avian influenzavirus	• Tested in a 1-m^3 box • Exposed time: 10 min. • Reduced by 99.0%	Retroscreen Virology, Ltd., London, U.K.	Highly pathogenic avian influenza virus gathered from person
Feline coronavirus	• Tested in a 1-m^3 box • Exposed time: 35 min. • Reduced by 99.7%	Kitasato Institute Medical Center Hospital, Japan	Pathogen virus of feline infections peritonitis virus. Same type of virus with SARS virus
Coxsackievirus	• Tested in one-pass • Exposed time: 3.3 sec. • Reduced by 98.9%	Kitasato Research Center of Environmental Sciences, Japan	Pathogen virus of summer cold
Poliovirus	• Tested in one-pass • Exposed time: 3.3 sec. • Reduced by 98.9%	Kitasato Research Center of Environmental Sciences, Japan	Pathogen virus of infantile paralysis
SARS virus	• Tested in one-pass • Exposed time: 3.3 sec. • Reduced by 73.4%	Retroscreen Virology, Ltd., London, U.K.	Pathogen virus of SARS
Canine parvovirus	• Tested in a 1-m^3 box • Exposed time: 5 min. • Reduced by 99.8%	Shokukanken Inc., Japan	A highly infectious virus that can cause death in dogs. Cause of sudden death and narcolepsy of the dogs

Efficacy of Plasmacluster Ions in Inhibiting Activity of Various Pathogens Confirmed Through Collaborative Research

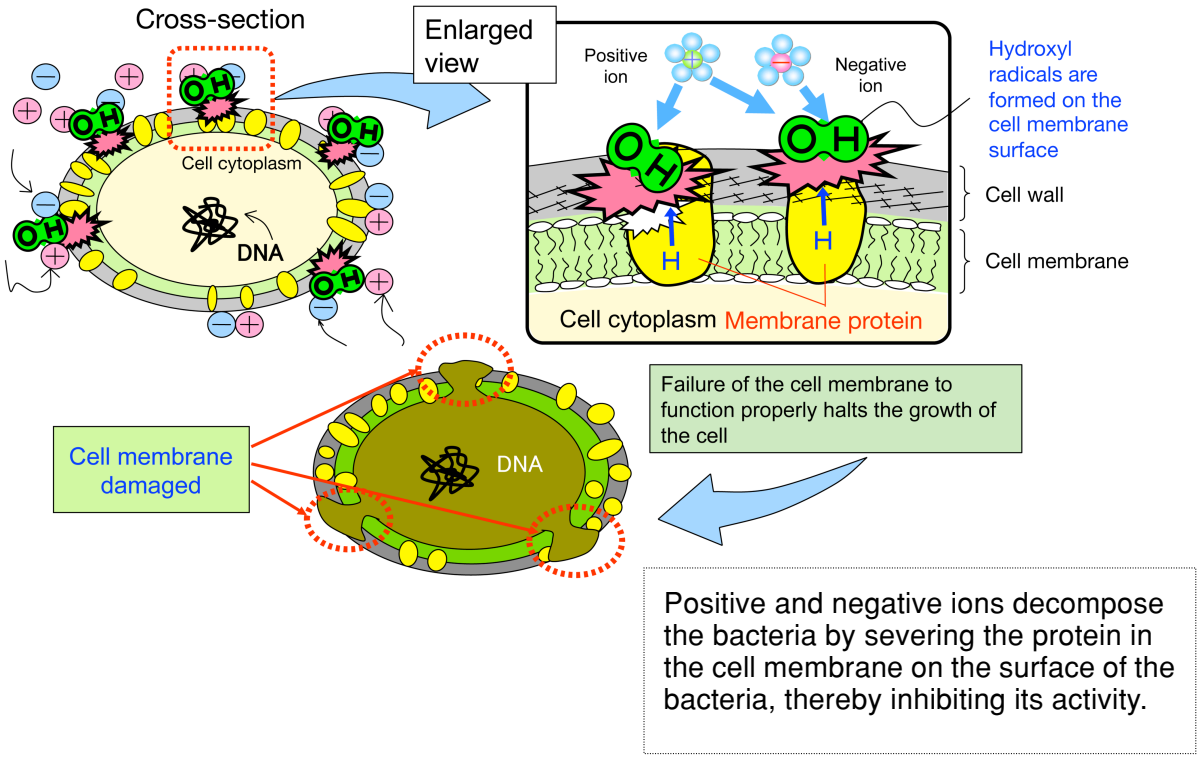
Target Substance	Species	Testing & Verification Organization
Bacteria	*Serratia*	Harvard School of Public Health (Dr. Melvin W. First, Professor Emeritus), U.S.
	Escherichia coli (*E. coli*)	Ishikawa Health Service Association, Japan
	E. coli, *Staphylococcus albus*, *Candida*	Shanghai Municipal Center for Disease Control and Prevention, China
	Bacillus subtilis	Kitasato Research Center of Environmental Sciences, Japan
		CT&T (Professor Gerhard Artmann, Aachen University of Applied Sciences), Germany
	MRSA (methicillin-resistant *Staphylococcus aureus*)	Kitasato Research Center of Environmental Sciences, Japan
		Kitasato Institute Medical Center Hospital, Japan
	MDRP (multi-drug resistant *Pseudomonas aeruginosa*)	Kitasato Institute Medical Center Hospital, Japan
	Pseudomonas, *Enterococcus*, *Staphylococcus*	University of Lübeck, Germany
	Enterococcus, *Staphylococcus*, *Sarcina*, *Micrococcus*	CT&T (Professor Gerhard Artmann, Aachen University of Applied Sciences), Germany
Allergens	Mite allergens, pollen	Graduate School of Advanced Sciences of Matter, Hiroshima University, Japan
	Mite allergens	Osaka City University Medical School's Department of Biochemistry & Molecular Pathology, Japan

Fungi	*Cladosporium*	Ishikawa Health Service Association, Japan
		University of Lübeck, Germany (growth-suppressing effect)
		CT&T (Professor Gerhard Artmann, Aachen University of Applied Sciences), Germany
	Penicillium, *Aspergillus*	University of Lübeck, Germany (growth-suppressing effect)
	Aspergillus, *Penicillium* (two species), *Stachybotrys*, *Alternaria*, Mucorales	CT&T (Professor Gerhard Artmann, Aachen University of Applied Sciences), Germany
Viruses	H1N1 human influenzavirus	Kitasato Research Center of Environmental Sciences, Japan
		Seoul University, Korea
		Shanghai Municipal Center for Disease Control and Prevention, China
		Kitasato Institute Medical Center Hospital, Japan
	H5N1 avian influenzavirus	Retroscreen Virology, Ltd., London, U.K.
	New-type H1N1 influenzavirus	Retroscreen Virology, Ltd., London, U.K.
	SARS virus	Retroscreen Virology, Ltd., London, U.K.
	Poliovirus	Kitasato Research Center of Environmental Sciences, Japan
	Coxsackievirus	Kitasato Research Center of Environmental Sciences, Japan
		Kitasato Institute Medical Center Hospital, Japan
	Coronavirus	Kitasato Institute Medical Center Hospital, Japan
	Canine parvovirus	Shokukanken Inc., Japan

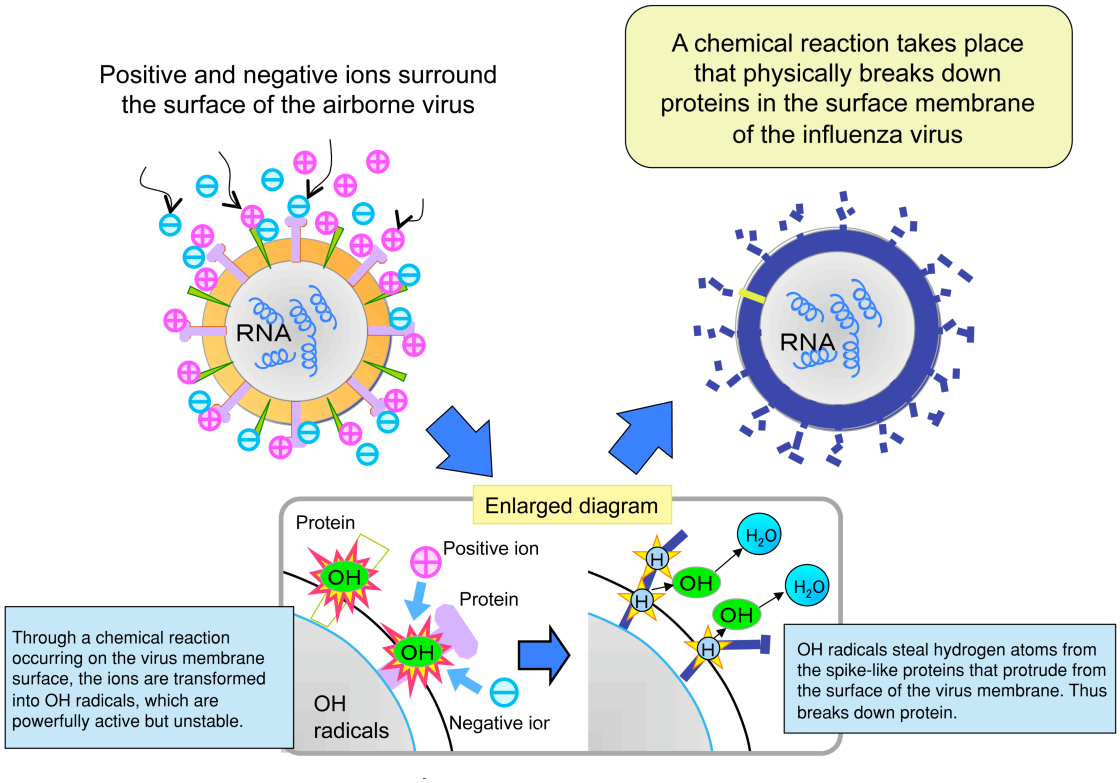
Overview of Plasmacluster Technology

Sharp's proprietary air purification technology in which positive ions [$H^+(H_2O)_n$]] and negative ions [$O_2^-(H_2O)_m$] are released into the air simultaneously. These positive and negative ions instantly recombine on the surface of bacteria, mold fungus, viruses and allergens floating in the air to form hydroxyl (OH) radicals, which have extremely high oxidation ability, and this chemical reaction decomposes proteins on the surface of bacteria and other pathogens, thereby inhibiting their activity.

Mechanism by which Bacteria are Inactivated (image)



Working Mechanism to Inhibit Infection by Airborne Viruses



Presumed Mechanism by which Odor is Effectively Suppressed (image)