6/6/2005

Plasmacluster Ions®*1 Proven Effective Against Airborne Highly Pathogenic H5N1 Avian Influenza

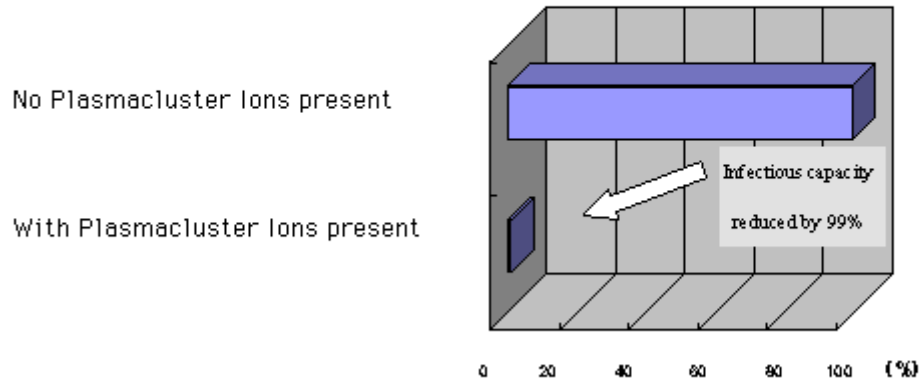
A World First Among Air Purification Technologies*2

Sharp Corporation has demonstrated that Plasmacluster Ions reduce activity of the highly fatal and highly pathogenic airborne H5N1 avian influenza ("bird flu") virus by 99%. This research was conducted in collaboration with Retroscreen Virology, Ltd., an organization which was established by one of the world's leading authorities on virology, Professor John S. Oxford of the University of London School of Medicine & Dentistry, and which works in compliance with Good Laboratory Practice*3 (GLP). Among the diverse range of air purification technologies available, Plasmacluster Ions are the first in the world to have been proven effective against this virus.

Plasmacluster Ion technology was developed in 2000 and is an air purification technology that disables airborne microorganisms by releasing positive and negative ions into the air. In the five years since its development, Sharp has been working together with academic research organizations around the world based on a "collaborative research approach to product marketing*4" and has demonstrated that Plasmacluster Ions are effective against a total of 26 kinds of harmful airborne substances, including bacteria, mold fungi, viruses and allergens. In addition, in November 2004, the mechanism by which Plasmacluster Ions cause cell death was explained: they damage the proteins on the cell membrane surface of bacteria. It has now been proven scientifically that they have the potential to be effective against a broad array of harmful airborne substances that have proteins on their cell surfaces.

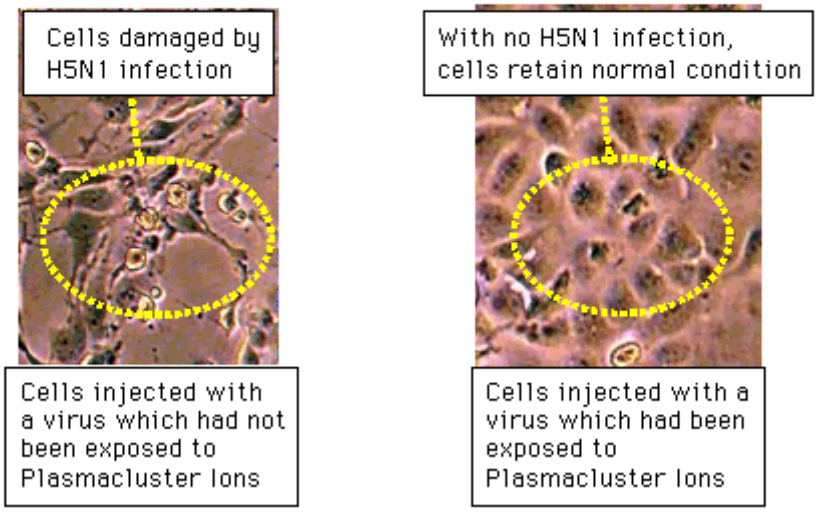
The type of avian influenza virus for which effectiveness has most recently been confirmed is the highly pathogenic H5N1 avian influenza virus, which has in fact taken a toll on human life. This research finding confirms that Plasmacluster Ions are effective against newly emerging viruses and has further expanded the fields in which Plasmacluster Ions demonstrate efficacy.

Efficacy Against H5N1 Avian Influenza Virus



Suppressive Effect on Viral Infection Using Cultured Cells (MDCK cells*5)

(Magnification: 40 times)



*1 *Plasmacluster and Plasmacluster Ions are trademarks of Sharp Corporation.*

*2 *As of June 6, 2005*

*3 *In the OECD (Organization for Economic Co-operation and Development), Good Laboratory Practice is a set of standards intended to ensure the reliability of test results by reviewing operation management, test equipment, test design, internal audit controls, quality assurance systems, test results, etc., at all test facilities. Re-certification is required every three years.*

*4 *The "collaborative research approach to product marketing" verifies the effectiveness of a technology based on scientific data developed in collaboration with leading-edge academic research institutions. New products are then brought to market based on the results.*

*5 *Canine kidney cells*

Virus infection test using cultured cells
A Plasmacluster Ion Generator was placed in a box with a volume of one (1) m^3, and Plasmacluster Ions were generated (concentration: 7000 ions/cm^3). Then, aerosolized highly pathogenic avian influenza virus was sprayed into the box. Five minutes after the spraying was complete, the air in the box containing the airborne virus was sampled at 10-minute intervals. The virus was then extracted and injected into cell cultures. Changes in the cells were then observed over a four-day period.

Four days after injection, the cells injected with the virus that had not been exposed to Plasmacluster Ions were deformed and damaged. In contrast, cells injected with the virus that had been exposed to Plasmacluster Ions retained their normal condition with almost no change in evidence.

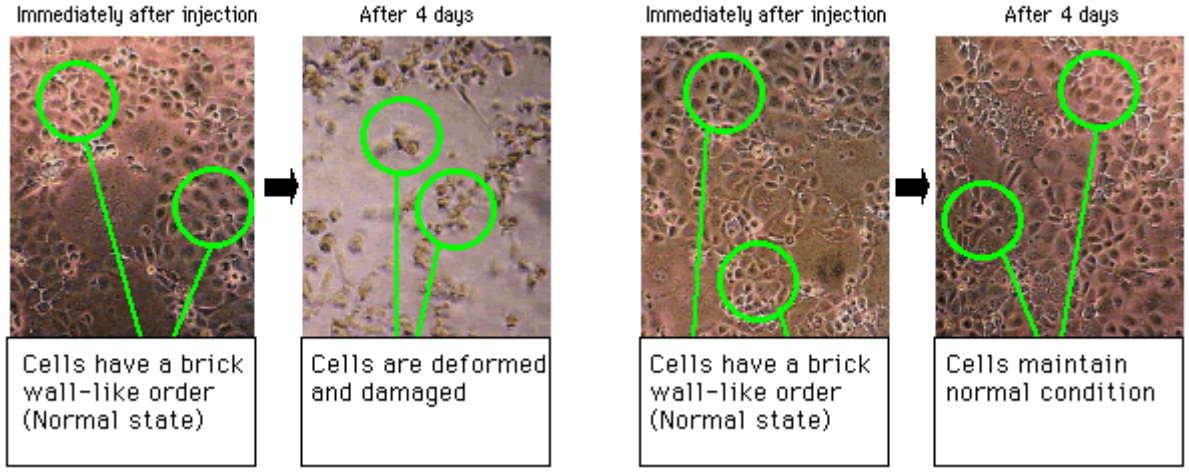
From this, it was confirmed that Plasmacluster Ions can reduce the activity of the virus by 99%. (The $TCID_{50}$ [Tissue Culture Infectious Dose 50%] assay, which is widely used in the field of virology, was used to evaluate the test results.)

Observation photographs of cells (MDCK cells) injected with virus samples

Cells injected with virus sample not exposed to Plasmacluster Ions

Cells injected with virus sample exposed to Plasmacluster Ions

(Magnification: 10 times)

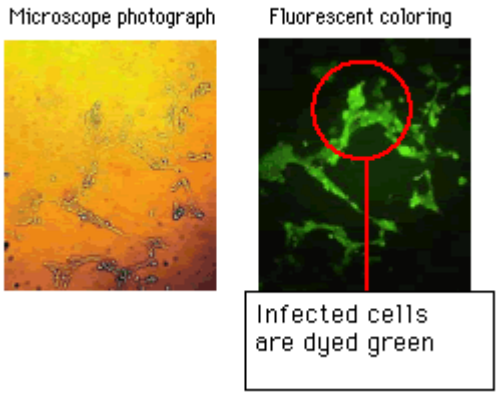


Analysis of cell antibodies with the Fluorescent Antibody Technique
Both the virus samples, those exposed to Plasmacluster Ions and those not, were injected into cells and the cell reaction to the viral infection was evaluated. This examination was conducted using the Fluorescent Antibody Technique, a standard method in the field of virus research. The technique involves dyeing cells with fluorescence to identify whether or not the cell is infected; if the cell has been infected by the virus, it will radiate.

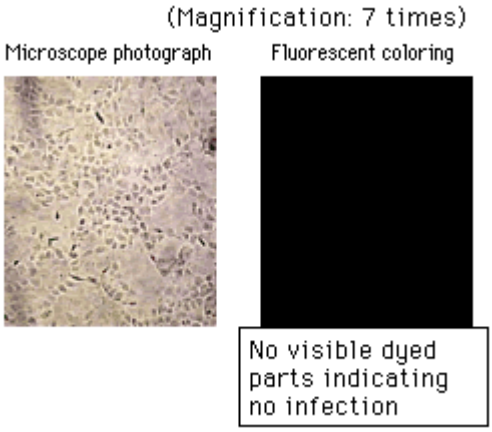
In cells injected with the virus “not exposed” to Plasmacluster Ions, fluorescent coloring indicative of a viral infection was present. And, in contrast, the coloring was not present in cells injected with the virus “exposed” to Plasmacluster Ions. From this analysis, the virus sampled in the presence of Plasmacluster Ions was verified to have lost its capacity for infection.

Fluorescent coloring photograph of cells (MDCK cells) injected with virus samples

Injected with a virus sample not exposed to Plasmacluster Ions



Injected with a virus sample exposed to Plasmacluster Ions



About Highly Pathogenic Avian Influenza ("Bird Flu")

Various types of influenza virus are classified according to two types of "spikes" on the virus surface (H: hemagglutinin and N: neuraminidase), and among these, viruses that infect poultry and cause illness and death are well known, such as H5N1, H7N7, H9N2, etc.

In contrast to mildly pathogenic influenza viruses which infect and proliferate only in the respiratory organs and intestinal tract and whose symptoms remain relatively minor, highly pathogenic influenza viruses infect and multiply throughout the entire body. In poultry, the mortality rate approaches 100%.

Since 1997, avian influenza has taken a tremendous toll on poultry in Hong Kong, the Netherlands, Vietnam, Cambodia, Thailand, Korea and Japan. Furthermore, in Vietnam, Cambodia and Thailand, its transmission to humans, who were previously not considered susceptible, has been confirmed with the occurrence of 97 patient cases and 53 deaths[*6]. This current research proves the efficacy of Plasmacluster Ions on the highly pathogenic H5N1 avian influenza virus, which has in fact taken a toll on human life.

**6 As of May 19, 2005; according to a news release from the World Health Organization (WHO).*

Overview of Plasmacluster Ion Technology

A plasma discharge generates positive ions (H^+) and negative ions (O_2^-) from water vapor in the air. These ions have the property of clustering around microparticles, and thus, they surround harmful substances such as airborne mold, viruses and allergens. At that point, a chemical reaction occurs on the cell membrane surface, and they are transformed into OH radicals, a powerfully active but unstable material, which robs the harmful substance of a hydrogen atom (H). As a result, they are inactivated by severing the protein on the cell membrane, opening holes. The OH radicals instantly bond with the removed hydrogen (H),

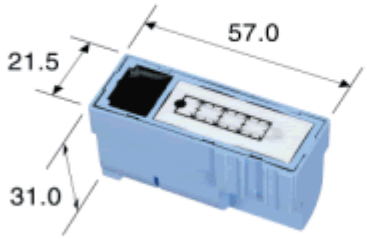
forming water vapor (H_2O), and return to the air.

1) The Plasmacluster Ions are the same positive and negative ions found in abundance in nature, for example, in woods and forests. They turn into OH radicals only on the surface of harmful substances to inactivate them, so they are completely harmless to the human body. The amount of ozone generated is less than 0.01 ppm, significantly below the 0.05-ppm value set as the standard for industry and for electrical equipment.

2) Compared to passive air cleaning systems that trap airborne contaminants by using a fan to draw air through a filter, air purification systems based on Plasmacluster Ions effectively eliminate bacteria by working directly on the air contained in the entire room.

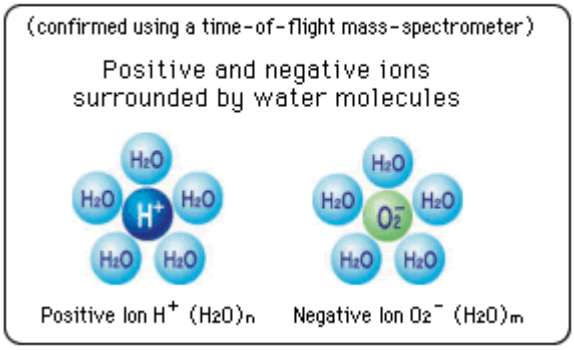
3) The Plasmacluster Ion Generator never loses its effectiveness by becoming dirty and never needs replacing like filters. It consumes a miniscule amount of electricity (0.5 W). Annual electricity costs for continuous use are around ¥100.

Plasmacluster Ion Generator



Units: mm

Chemical Composition and Structure of Plasmacluster Ions



Efficacy of Plasmacluster Ions on Various Pathogens Confirmed Through Collaborative Research

Target Substance	Species	Testing & Verification Organization	Date of Announcement
Fungi	Cladosporium (black mold, mildew)	Ishikawa Health Service Association	September 2000
		Universitäklinikums Lübeck University Clinic (Germany) (proliferation control effect)	February 2002
		CT&T (Professor Gerhard Artmann, Aachen University of Applied Sciences)	November 2004
	Penicillium, Aspergillus	Universitäklinikums Lübeck University Clinic (Germany) (proliferation control effect)	February 2002
	Aspergillus, Penicillium (two species), Stachybotrys,	CT&T (Professor Gerhard Artmann, Aachen University of Applied Sciences)	November 2004

	Alternaria, Mucorales		
Bacteria	Coliform bacteria (E. coli)	Ishikawa Health Service Association	September 2000
	E. coli, Staphylococcus (aureus), Candida	Shanghai Municipal Center for Disease Control and Prevention, China	October 2001
	Bacillus subtilis	Kitasato Research Center of Environmental Sciences	September 2002
		CT&T (Professor Gerhard Artmann, Aachen University of Applied Sciences)	November 2004
	MRSA (methicillin-resistant Staphylococcus aureus)	Kitasato Research Center of Environmental Sciences	September 2002
		Kitasato Institute Medical Center Hospital	February 2004
	Pseudomonas, Enterococcus, Staphylococcus	Universitäklinikums Lübeck University Clinic (Germany)	February 2002
	Enterococcus, Staphylococcus, Sarcina, Micrococcus	CT&T (Professor Gerhard Artmann, Aachen University of Applied Sciences)	November 2004
Allergens	Mite allergen (dust from dead mite bodies and feces), pollen	Graduate School of Advanced Sciences of Matter, Hiroshima University	September 2003
	Airborne allergens	Asthma Society of Canada	April 2004
Viruses	H1N1 influenza virus	Kitasato Research Center of Environmental Sciences	September 2002
		Seoul University, Korea	September 2003
		Shanghai Municipal Center for Disease Control and Prevention, China	December 2003
		Kitasato Institute Medical Center Hospital	February 2004
	H5N1 avian influenza virus	Retroscreen Virology, Ltd, London, U.K.	May 2005
	Coxsackie virus (summer colds)	Kitasato Research Center of Environmental Sciences	September 2002
	Polio virus	Kitasato Research Center of Environmental Sciences	September 2002
	Corona virus	Kitasato Institute Medical Center Hospital	July 2004

Profile of Professor John S. Oxford

- World authority on virology

- Professor, Institute of Cell and Molecular Science at St. Bartholomew's and The Royal London Hospital, Queen Mary's School of Medicine and Dentistry, London, U.K.
- Founder and Scientific Director, Retroscreen Virology Ltd.,

Expertise
Virology

Publications
- Published over 250 scientific papers
- Co-authored three standard texts:
  1) Influenza, the Viruses and the Disease
  2) Human Virology, a Text for Students of Medicine, Dentistry and Microbiology
  3) Conquest of Viral Diseases

Other Professional Activities
- Appeared on numerous radio and TV programs (BBC, National Geographic, etc.)
- Served as chairman of numerous international scientific and academic conferences

Conferences where Prof. Oxford will serve as Chairman in the near future:
1) Second European Conference on Influenza, September 2005, Malta
2) Optimizing Antiviral Drug Therapy Symposium, October 2005, Berlin
3) The Central Role of Antivirals for the First Pandemic of the 21st Century, January 2006, London

About the University of London
Established in 1836 as England's national university, the University of London consists of 19 colleges with a total of 115,000 students, one of the largest student bodies in the world.

Queen Mary is one of the largest multi-faculty colleges of the University of London. Queen Mary merged with two distinguished medical colleges, St Bartholomew's Hospital Medical College, established in 1843, and the London Hospital Medical College, England's oldest medical school, founded in 1785, to form the School of Medicine & Dentistry. With nearly 8,800 students, the School provides education in a wide range of fields in addition to medicine and dentistry, including biology, chemistry, physics, electrical engineering, computer science, law, literature, and political science.

Dinstinguished Graduates
Alexander Graham Bell, Hirofumi Ito (first prime minister of Japan), John F. Kennedy, Mahatma Gandhi, H.G. Wells, Arthur C. Clarke; seven Nobel Prize winners.

About Retroscreen Virology, Ltd.
Founded in 1989 by Professor John Oxford, Retroscreen Virology Ltd. is a recognized leader in the research and testing of antiviral compounds and vaccines. In carrying out safety tests

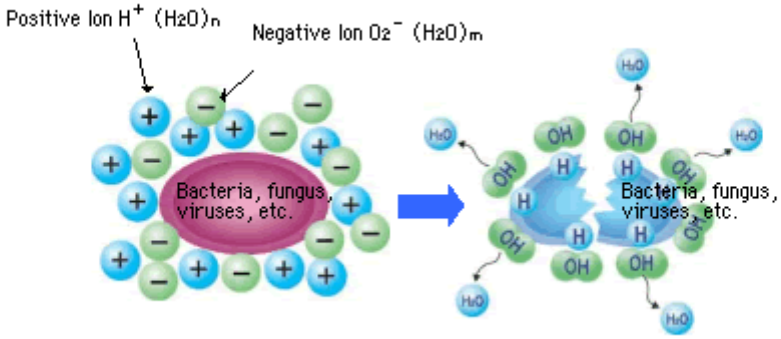
of chemical substances, the company works to extremely high standards in compliance with the principles of Good Laboratory Practice (GLP), an international management standard for maintaining high reliability, and has obtained accreditation under the quality control management standard ISO 9001.

Reference

Mechanism of Plasmacluster Ion for Inactivating Harmful Substances

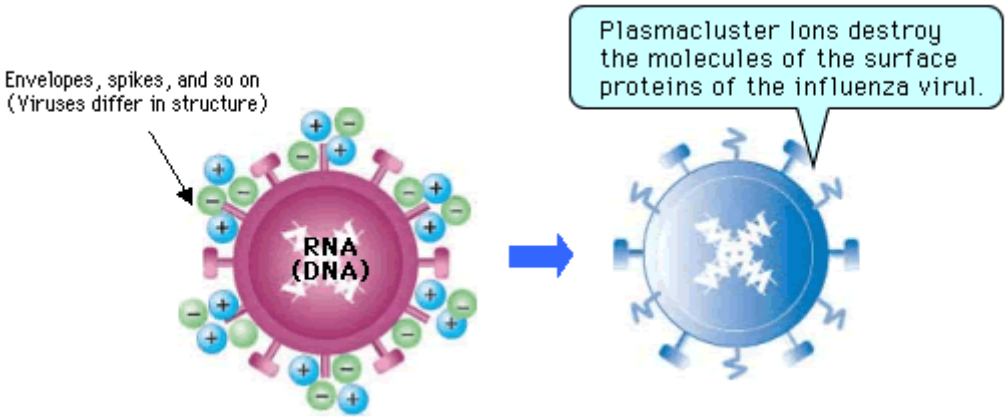
Mechanism for Inactivating Airborne Fungi

The positive (H^+) and negative (O_2^-) ions cluster together on the surface of airborne fungi, causing a chemical reaction that results in the creation of highly reactive OH groups called hydroxyl radicals (•OH). The hydroxyl radical will take a hydrogen molecule from the cell wall of an airborne fungi particle. Inhibits mold infestation as well as controls musty and household odors (caused in large part by mold fungi) as they occur.



Mechanism for Inactivating Airborne Virus

The positive (H^+) and negative (O_2^-) ions surround the hemagglutinin (surface proteins that form on organisms and trigger infections) and change into highly reactive OH groups called hydroxyl radicals (•OH). These take a hydrogen molecule from the hemagglutinin and change into water (H_2O). The ions destroy the virus surface structure, for example its envelopes and spikes, on a molecular level. As a result, the virus cannot infect even if it enters the body.



Mechanism for Deactivating Airborne Allergens

The positive (H^+) and negative (O_2^-) ions surround the airborne allergen and change into highly reactive hydroxyl radicals (•OH). The hydroxyls then deactivate the molecules of the

IgE antibody binding site of the allergen. No allergic symptoms occur even if allergens enter the body.