Research Proves for First Time Ever*[1] That Sharp's Plasmacluster*[2] Technology Inhibits Airborne Avian Influenza A (H7N9) Virus

Joint research conducted by Sharp Corporation and the Insitut Pasteur in Ho Chi Minh City, Vietnam has proven for the first time anywhere in the world that Plasmacluster technology*[3] can inhibit the infectiousness of the airborne avian influenza A (H7N9) virus. Tests conducted in a 1-m^3 box showed 99% inhibition of the virus in approximately 47 minutes.

In April 2013, the World Health Organization (WHO) first announced that the avian influenza A (H7N9) virus could infect humans. With the possibility that the avian influenza virus could mutate into a virus that could be transferred between humans and cause a pandemic, Japan's Ministry of Health, Labour and Welfare designated this H7N9 strain as a Category II infectious disease under Japan's Infectious Diseases Control Law.

This joint research centered on releasing Plasmacluster's positively charged hydrogen ions ($H^+(H_2O)_m$) and negatively charged oxygen ions ($O_2^-(H_2O)_n$) simultaneously into the air, which instantaneously bond on the surface of airborne substances such as viruses, becoming highly reactive OH radicals that break down the proteins on the surface of the viruses and inhibit virus activity. Sharp had previously proven that Plasmacluster technology can inhibit the effects of the H1N1*[4], H3N2*[5], and H5N1*[6] influenza viruses. The latest experiments show that Plasmacluster technology has the same inhibiting effects on another strain of avian influenza, H7N9, thus demonstrating that Plasmacluster is effective against a diverse range of influenza viruses.

Since introducing Plasmacluster technology in 2000, Sharp has conducted "academic marketing"*[7] in collaboration with some of the world's leading third-party scientific research organizations. So far, 25*[8] such organizations have shown the effectiveness of Plasmacluster in not only controlling harmful substances such as viruses, mold, bacteria, and allergens, but also in beautifying people's skin and hair. The clinical effectiveness and safety of Plasmacluster technology has also been proven*[9].

Sharp will continue to contribute to society through Plasmacluster by advancing this technology and proving even more ways that it can be effective.

The details of this joint research between Sharp and the Institut Pasteur will appear in the *Journal of Preventive Medicine* (ISSN 0868-2836) in December 2015, published by the Vietnam Association of Preventive Medicine.

Comment from the Institut Pasteur, Ho Chi Minh City, Vietnam

Our joint research revealed that Plasmacluster technology could inhibit the effects of the airborne avian influenza A (H7N9) virus. There currently exists the danger of a pandemic caused by a mutated strain of avian influenza. I believe that Plasmacluster can make an effective contribution to measures against such a pandemic.

*1 For air purifying technologies using ion generation or filters. As of November 17, 2015, based on Sharp research.
*2 Plasmacluster is a registered trademark of Sharp Corporation.
*3 In an airtight 1-m^3 box and with an average ion density of approximately 100,000 ions/cm^3.
*4 Also known as the Spanish flu or the Russian flu, this subtype of influenza was the cause of the flu pandemic in 2009. It is also currently called a seasonal influenza.
*5 A subtype of influenza known as the Hong Kong flu. It is also currently called a seasonal influenza.
*6 A subtype of influenza known as the highly pathogenic avian influenza.
*7 Collaboration with leading third-party academic research institutions to gather and analyze scientific data in order to apply findings to new products.
*8 As of November 17, 2015.
*9 According to testing by LSI Medience Corporation (inhalation toxicity test, eye and skin irritation test, corrosivity test, teratogenicity test, and two-generation reproduction toxicity test).

● Proven Effect against Airborne Avian Influenza A (H7N9) Virus

A Plasmacluster ion generating unit was placed inside an airtight 1-m^3 box. The box was filled with Plasmacluster ions (at densities of 50,000 ions/cm^3, 100,000 ions/cm^3, and 200,000 ions/cm^3), and a mist of the avian influenza A (H7N9) virus was infused into the box. After a set amount of time of infusing the virus mist at each ion concentration, the airborne viruses were collected and their infectiousness (infectious titer*[10]) was determined using the $TCID_{50}$ assay*[11], a widely used method in virus research. Results showed that compared to the control test (airflow containing no Plasmacluster ions), the presence of Plasmacluster ions inhibited 99% of the virus. It was also revealed that increasing ion concentration shortened the time it took to inhibit 99% of the virus.

*10 Infectious titer: A measure of the infectious level of a virus against cells.
*11 $TCID_{50}$ assay: A method of determining infectiousness of a virus by infecting cells with various dilutions of the virus.

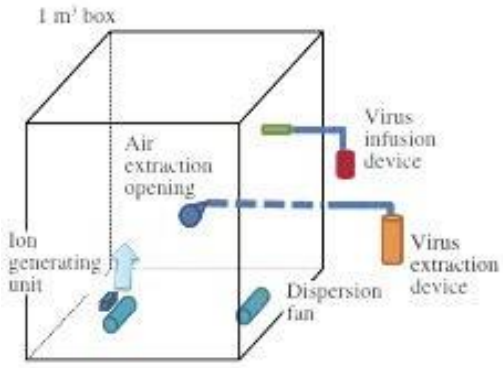


Figure 1: Testing device

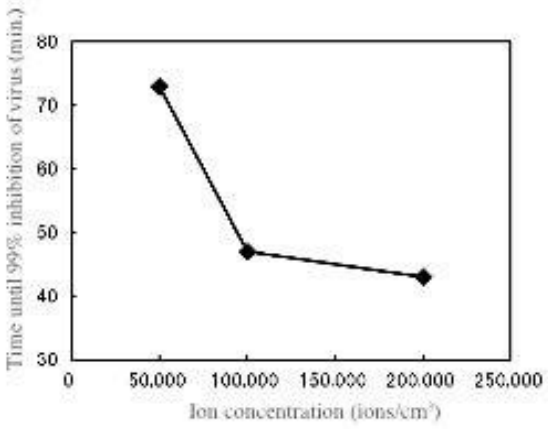


Figure 2: Relationship between ion concentration and time until 99% inhibition of virus

About the Institut Pasteur, Ho Chi Minh City, Vietnam

Established in 1891 in Ho Chi Minh City, Vietnam as the first overseas branch of the Institut Pasteur, established in 1887 in Paris, France by Louis Pasteur, the father of modern bacteriology. The institute was the first in the world to take a sample of the highly pathogenic avian influenza infecting people. Today, under the authority of the Vietnamese Ministry of Health, it conducts a variety of research, mainly aimed at improving and raising the standard of public health in Vietnam.

Institut Pasteur, Ho Chi Minh City, Vietnam

About Avian Influenza A(H7N9) Virus

Avian influenza is an infectious disease spread by domestic poultry carrying the influenza A subtype. Originally, it was transferred between waterfowl such as ducks and geese with no symptoms, but now this virus has spread to chickens and other domestic poultry. The avian influenza A (H7N9) virus has a low lethality among chickens and is classified as a weakly pathogenic avian influenza. However, since the WHO first reported in April 2013 that it had infected humans, there has been an increase of the number of human cases reported. Because of the danger of the virus mutating into a new strain with the ability to quickly spread among people and cause a worldwide pandemic, Japan's Ministry of Health, Labour and Welfare has designated the H7N9 strain as a Category II infectious disease under Japan's Infectious Diseases Control Law.

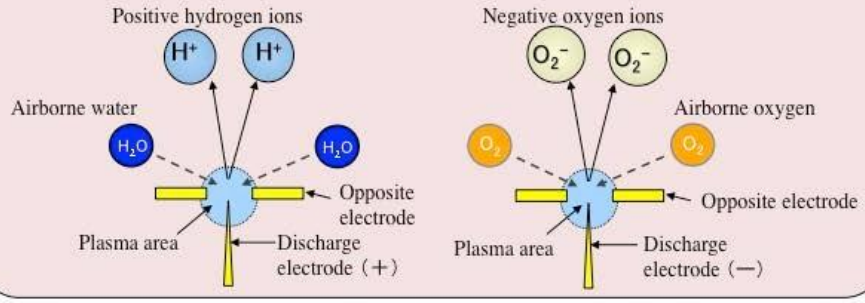
Reference: See a video explaining avian flu and how to prevent it (in Japanese only).
http://nettv.gov-online.go.jp/prg/prg9687.html

About Plasmacluster Technology

In Sharp's proprietary air purification technology, positively charged hydrogen ions ($H^+(H_2O)_n$) and negatively charged oxygen ions ($O_2^-(H_2O)_m$) are discharged simultaneously. These positive and negative ions instantaneously bond on the surface of airborne substances such as bacteria, fungi, viruses, and allergens, becoming highly reactive OH radicals (hydroxyl radicals) that break down the proteins on the surface of these bacteria and other substances. By chemical reaction, the OH radicals work to suppress the activity of those substances.

How Plasmacluster Ions Are Generated

Positive and negative voltages are applied to discharge electrodes to electrically split airborne water and oxygen molecules into hydrogen and oxygen. This creates positively charged hydrogen ions (H^+) and negatively charged oxygen ions (O^-).

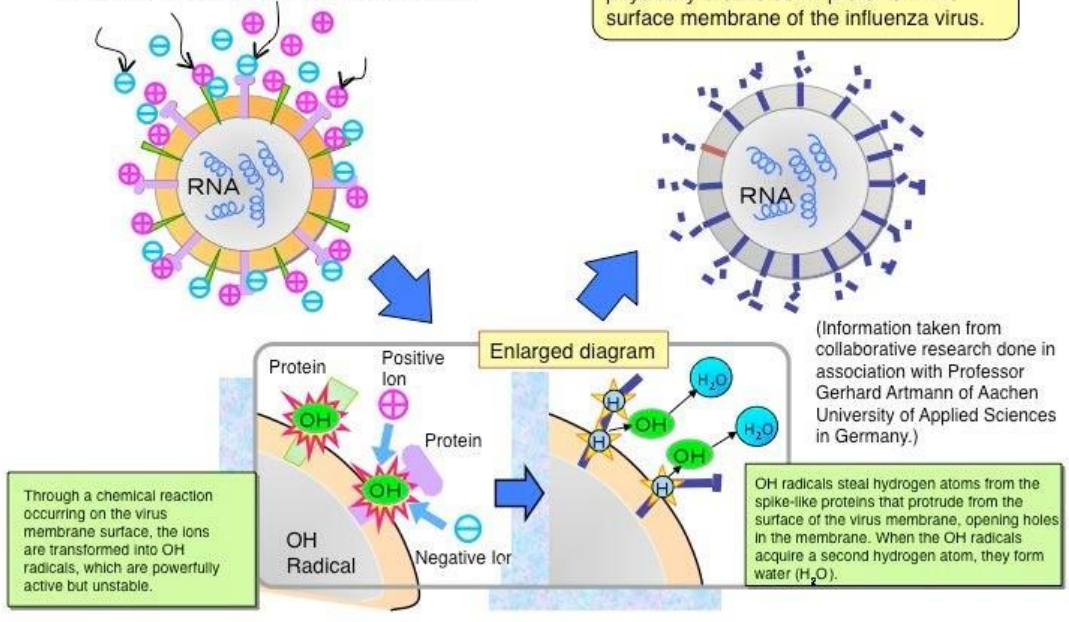


The airborne water molecules cluster around ions like bunches of grapes, making each ion a stable cluster ion.

Working Mechanism to Inhibit Infection by Airborne Viruses

Positive and negative ions surround the surface membrane of the airborne virus.

A chemical reaction takes place that physically breaks down proteins in the surface membrane of the influenza virus.



(Information taken from collaborative research done in association with Professor Gerhard Artmann of Aachen University of Applied Sciences in Germany.)

Comparison of Oxidation

Positive and negative ions bond on the surface of airborne viruses and bacteria and react chemically to form OH radicals, which have high oxidation power (standard oxidation potential 2.81 V). These reduce the contagiousness of airborne viruses and the activity of bacteria.

Active Substances	Chemical Formula	Standard Oxidation Potential (V)
Hydroxyl radicals	OH	2.81
Oxygen atom	O	2.42
Ozone	O_3	2.07
Hydrogen peroxide	H_2O_2	1.78
Hydroperoxyl radical	OOH	1.7
Oxygen molecule	O_2	1.23

Source: *Fundamentals and Applications of Ozone*

25 Research Institutes That Provided Data for Sharp's Academic Marketing

Target	Testing and Verification Organization	Country
Efficacy proven in clinical trials	Graduate School of Medicine, University of Tokyo / Public Health Research Foundation	Japan
	Faculty of Science and Engineering, Chuo University / Clinical Research Support Center, University Hospital, University of Tokyo	Japan
	Animal Clinical Research Foundation	Japan
	Soiken Inc.	Japan
	School of Bioscience and Biotechnology, Tokyo University of Technology	Japan
	HARG Treatment Center, National Trust Co., Ltd.	Japan
Viruses	Kitasato Research Center of Environmental Sciences	Japan
	Seoul National University	Korea
	Shanghai Municipal Center for Disease Control and Prevention	China
	Kitasato Institute Medical Center Hospital	Japan
	Retroscreen Virology, Ltd.	UK
	Shokukanken Inc.	Japan
	Hanoi College of Technology, Vietnam National University	Vietnam
	Institut Pasteur, Ho Chi Minh City	Vietnam
Allergens	Graduate School of Advanced Sciences of Matter, Hiroshima University	Japan
	Department of Biochemistry and Molecular Pathology, Graduate School of Medicine, Osaka City University	Japan
	Ishikawa Health Service Association	Japan
	University of Lübeck	Germany

Fungi	Professor Gerhard Artmann, Aachen University of Applied Sciences	Germany
	Japan Food Research Laboratories	Japan
	Shokukanken Inc.	Japan
	Shanghai Municipal Center for Disease Control and Prevention	China
Bacteria	Ishikawa Health Service Association	Japan
	Shanghai Municipal Center for Disease Control and Prevention	China
	Kitasato Research Center of Environmental Sciences	Japan
	Kitasato Institute Medical Center Hospital	Japan
	Dr. Melvin W. First, Professor Emeritus, Harvard School of Public Health	US
	Animal Clinical Research Foundation	Japan
	University of Lübeck	Germany
	Professor Gerhard Artmann, Aachen University of Applied Sciences	Germany
	Japan Food Research Laboratories	Japan
	Shokukanken Inc.	Japan
Odors, pet smells	Boken Quality Evaluation Institute	Japan
Skin beautifying effects	School of Bioscience and Biotechnology, Tokyo University of Technology	Japan
Hair beautifying effects	Saticine Medical Co., Ltd.	Japan
	C.T.C Japan Ltd.	Japan
Working mechanism of inhibitory effects on viruses, fungi, and bacteria	Professor Gerhard Artmann, Aachen University of Applied Sciences	Germany
Working mechanism of inhibitory effects on allergens	Graduate School of Advanced Sciences of Matter, Hiroshima University	Japan
Working mechanism of skin moisturizing (water molecule coating) effect	Research Institute of Electrical Communication, Tohoku University	Japan