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News Release

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Plasmacluster Technology[1] Proven to Decrease Risk of Tuberculosis Infection in Tuberculosis Hospital for the First Time[2]

Sharp, in cooperation with WHO Global Health Workforce Alliance[3] National Center of Tuberculosis and Lung Disease in Tbilisi, Georgia, has effectively proven the decreased risk of Tuberculosis transmission among hospital healthcare workers and prevention of acquired drug resistance (ADR)[4] among patients using Plasmacluster technology (100,000 ions/cm^3) for the first time in history.

Tuberculosis is an infection caused by bacteria *Mycobacterium Tuberculosis*. Over 9.6 million people worldwide were infected with Tuberculosis[5] in 2015 and 1.5 million of those died from the disease[5]. This makes it one of the most fatal stand-alone infection in the world.

By releasing Plasmacluster positive ions (H^+ $(H_2O)_m$) and negative ions (O_2^- $(H_2O)_n$) in the air at the same time, Plasmacluster ions form highly oxidized OH radicals that break down the surface protein of airborne microbes leading to their complete eradication. In cooperation with Chest Disease Institute Dr. Charoen of Thailand, Plasmacluster technology was used to effectively suppress attached Tuberculosis bacteria. Those findings were released in September 2009[6]. This time, Plasmacluster ion test devices emitting an average ion concentration of 100,000 ions/cm^3 were set up at Tuberculosis hospital. Through this test, the decreased risk of Tuberculosis infection for healthcare workers, and positive impact in preventing the development of acquired drug resistance for Tuberculosis patients were confirmed.

Sharp has been involved with academic marketing[7] to verify the effectiveness of Plasmacluster technology in cooperation with global testing organizations since 2000. The effectiveness of controlling hazardous substances such as new types of the influenza virus, drug-resistant bacteria, mite allergens, and also reducing the risk of tracheal inflammation in childhood asthma patients[8] has been proven in our 28 tests that took place so far[9]. The safety of Plasmacluster technology has also been confirmed[10] through these trials. Sharp aims to continue such types of studies to explore even more benefits that the Plasmacluster technology can support the society with.

It should also be noted that the details of this clinical study are scheduled to be presented by the research group at the 21st Congress of Asian Pacific Society of Respirology to be held on November 12-15, 2016.

Comment from the National Center of Tuberculosis and Lung Disease in Tbilisi, Georgia

Until now, there have been limited data globally from high TB burden settings on how Infection Control means such as ventilation, UV, etc. contribute to the prevention of Tuberculosis transmission within hospitals. With the current research on Plasmacluster technology, we have been able to accomplish this task and developed capacity that can be used to pioneer future scientific experiments in the field. We believe Plasmacluster technology has a good chance to play an important role as one of the measures to prevent the spread of Tuberculosis bacteria in specialized Tuberculosis hospitals.

1 Plasmacluster is a trademark of Sharp Corporation.
2 Test applicable to healthcare providers and tuberculosis patients using engineering control in tuberculosis hospitals. Sep 8, 2016, Sharp research.
3 WHO HP: http://www.who.int/workforcealliance/members_partners/member_list/tbgeo/en/
4 Acquired drug resistance (ADR) is defined as patients that develop resistance to antituberculosis drugs.
5 World Health Organization. Tuberculosis fact sheet number 104. Reviewed March 2016.
6 Released on Sep 22, 2009
7 A marketing method that advances commercialization by researching the effectiveness of technology by analyzing scientific data with leading academic institutions.
8 Released on Sep 18, 2014
9 As of Sep 8, 2016
10 Based on tests conducted at LSI Medience Corp. (inhalation toxicity test, skin/eye irritation and corrosion test, teratogenic test, 2D reproductive toxicity test)

■ Plasmacluster ion devices Installation Conditions at Tuberculosis Hospital

All experiments using 140 Plasmacluster ion devices were conducted on a designated floor inside the Tuberculosis Hospital where the ion concentration was kept at an average of 100,000/cm^3.

Photo: Plasmacluster ion device experimental installation in the hospital room

Photo: Plasmacluster ion device experimental installation in the hospital corridor

■ Results of Reduced Risk of Tuberculosis Infection for Healthcare Workers

88 healthcare workers were tested for Tuberculosis bacteria using QuantiFERON®-TB Gold In-Tube (QFT)[11]. 32 of the healthcare workers who did not carry the bacteria were tested again after 6-8 months using QFT test.

Healthcare workers in the 100,000/cm^3 Plasmacluster ion device setting decreased their risk of getting latent Tuberculosis infection by 75% compared with those who were not in the Plasmacluster ion device setting.

Healthcare Provider QFT Results

Use of Plasmacluster Ions	QFT Negative (number of people)	QFT Positive (number of people)	Total (number of people)	Odds
Yes	10	1	11	0.10
No	15	6	21	0.40
Total (number of people)	25	7	32	

■ Prevention of Acquired Drug Resistance in Tuberculosis Hospital Patients

155 Tuberculosis culture positive patients in the Drug Sensitive department received the Drug Susceptibility Testing (DST)[12]. After a 3-month period, 49 patients who remained culture positive received DST again.

Those who were in the 100,000/cm^3 Plasmacluster ion device setting showed 78% of prevention in acquired drug resistance compared to those who were not in the Plasmacluster ion device setting.

Acquired drug resistance among Tuberculosis Patient based on DST result

Use of Plasmacluster Ions	ADR NO (number of people)	ADR YES (number of people)	Total (number of people)	Risk
Yes	25	1	26	0.038
No	19	4	23	0.174
Total (number of people)	44	5	49	

11 QuantiFERON®-TB Gold In-Tube is a test for detection Latent Tuberculosis Infection (LTBI) using a blood sample. It came into use in 2007.

12 Drug Susceptibility Testing is a test used to determine which medicine to administer to patients who carry the tuberculosis bacteria.

■**Cooperating Researchers**

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Professor
Director of the National Center for Tuberculosis and Lung Diseases

Nestani Tukvadze, MD
Director of Clinical Research at the National Center for Tuberculosis and Lung Diseases
WHO TA on Infection Control and Biosafety

Nino Lomtadze, M.D., MSc, PhD Candidate
Head of TB Surveillance and Strategic Planning Department at the National Center for Tuberculosis and Lung Diseases

■ **Introduction of National Center of Tuberculosis and Lung Diseases**

National Center of Tuberculosis and Lung Diseases (NCTLD) is a non-profit organization that was founded in 2001. It is a head facility for TB control in Georgia, which creates implements and administers the National Tuberculosis Program. The program aim is to decrease spreading of Tuberculosis in Georgia. The main functions of the Center are:

1. Administration of National Tuberculosis Program, partnership with local and foreign (international) Governmental and Non-Governmental organizations;

2. Provision of high quality TB diagnosis;

3. Treatment of TB patients; and

4. Prevention of Tuberculosis.

The Center was created after reorganization, based on the Institute of Tuberculosis and Lung diseases, the city TB Hospital, and the Georgian Railway TB-Stationary. Today, the center is presented by administrative, diagnostic and treatment branches.

Logo Mark of NCTLD

(Reference *WHO HP* *http://www.who.int/workforcealliance/members_partners/member_list/tbgeo/en/*)

Photo; The appearance of the hospital

■ **Key Facts on Tuberculosis**

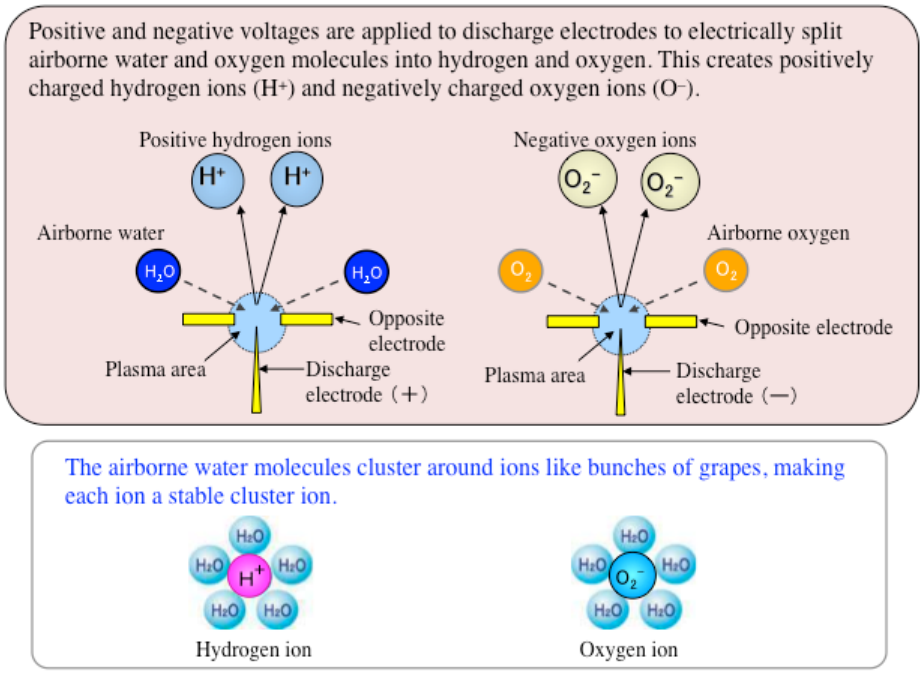
- Tuberculosis (TB) is one of the most fatal stand-alone infection in the world.
- In 2014, 9.6 million people were infected with Tuberculosis and 1.5 million died from the disease.
- Over 95% of Tuberculosis deaths occur in low- and middle-income countries, and it is among the top 5 causes of death for women aged 15 to 44.
- In 2014, an estimated 1 million children were infected with Tuberculosis and 140,000 children died of Tuberculosis.
- Tuberculosis is a leading killer of HIV-positive people: in 2015, 1 in 3HIV deaths was due to Tuberculosis.
- Globally in 2014, an estimated 480,000 people developed multidrug-resistant Tuberculosis (MDR-TB).
- The Millennium Development Goal target of halting and reversing the Tuberculosis epidemic by 2015 has been met globally. Tuberculosis incidence has fallen by an average of 1.5% per year since 2000 and is now 18% lower than the level of 2000.
- The Tuberculosis death rate dropped 47% between 1990 and 2015.
- An estimated 43 million lives were saved through Tuberculosis diagnosis and treatment between 2000 and 2014.
- Ending the Tuberculosis epidemic by 2030 is among the health targets of the newly adopted Sustainable Development Goals.

（Reference　*WHO. Fact sheet N°104. Media Centre. Reviewed March 2016 Tuberculosis*
http://www.who.int/mediacentre/factsheets/fs104/en/index.html）

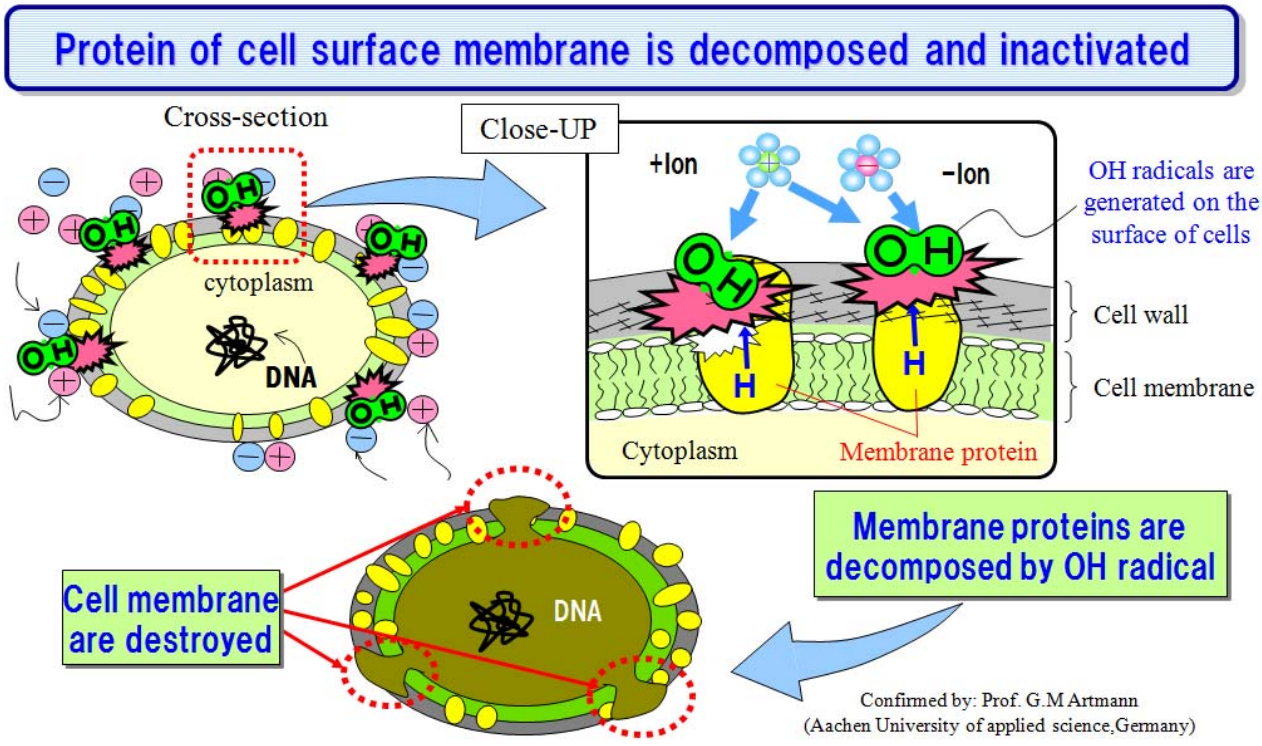
About Plasmacluster Technology

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



Bactericidal mechanism by PCI



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*

28 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
	National Center of Tuberculosis and Lung Diseases	Georgia
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
	University of Indonesia	Indonesia
	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
Fungi	Ishikawa Health Service Association	Japan
	University of Lübeck	Germany
	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

	Chest Disease Institute	Thailand
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