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FOR IMMEDIATE RELEASE

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Plasmacluster Ions™ Deactivate*¹ Airborne Mite Allergens, a Main Cause of Asthma and Atopic Disorders—Proof for First Time Ever*²

A New Benefit of “Plasmacluster Ion™ Technology*³” Beyond Inactivation of Airborne Fungi and Influenza Viruses

Verification Research Conducted Jointly with the Graduate School of Advanced Sciences of Matter at Hiroshima University

Sharp Corporation, in cooperation with the Department of Molecular Biotechnology of the Graduate School of Advanced Sciences of Matter at Hiroshima University, has verified for the first time in the world that Sharp’s proprietary Plasmacluster Ion™ technology deactivates airborne mite allergens (consisting of the dead bodies and feces of mites), a cause of allergy-related disorders, and are effective in controlling symptoms even when the allergens are inhaled. It is estimated that one in every three people in Japan suffer from some form of allergy (source: research by Ministry of Health, Labor and Welfare). The results of these tests indicate that the incidence of allergy-related disorders (bronchial asthma, atopic dermatitis, allergic rhinitis, etc.) can be reduced.

Plasmacluster Ion™ technology is Sharp’s proprietary air purification technology, which uses a plasma discharge to generate large numbers of positive and negative ions from airborne water and oxygen molecules, and then releases the ions in large quantities back into the air. By taking advantage of the properties of positive and negative ions to form clusters around microparticles and react

chemically with them, airborne fungi, influenza viruses, etc., are rendered inactive. Sharp developed this air purification technology in 2000 and verified for the first time that airborne fungi, influenza viruses, etc., are inactivated (become incapable of reproducing). The company has utilized the technology in numerous products.

Beginning in April 2002, we set our sights on airborne mite allergens thought to be the main cause of bronchial asthma and atopic disorders. In cooperation with Professor Kazuhisa Ono and Associate Professor Seiko Shigeta of the Department of Molecular Biotechnology of the Graduate School of Advanced Sciences of Matter at Hiroshima University, we conducted tests to evaluate the ability of Plasmacluster Ions™ to deactivate mite allergens. The results indicate that applying positive and negative ions to airborne mite allergens (particulate matter from the dead bodies and feces of mites floating in the air) in a concentration of 10,000 ions/cm³ deactivates 91% of the allergens within approximately 15 minutes by a chemical reaction with the ions (even when the ion concentration is only 3,000 ions/cm³, 74% are deactivated in approximately 15 minutes). Thus, it is clear that these Plasmacluster Ions™ act to effectively control the action of allergens (see page 3 for the verification method).

Overview of Plasmacluster Ion™ Technology

Positive (H⁺) ions and negative (O₂⁻) ions generated by a plasma discharge have the property of forming clusters around microparticles. They surround harmful substances such as airborne fungi, viruses and allergens. At this point, a chemical reaction occurs, and the collision of two H⁺ ions and an O₂⁻ ion creates highly reactive OH⁻ groups called hydroxyl radicals. A hydroxyl radical is unstable and to stabilize itself, it will rob one hydrogen (H) from any airborne particle it encounters, forming water (H₂O) vapor in the process, which is returned to the air. These positive and negative ions are the same ions found in abundance in nature, such as in the forest, and are completely harmless to humans. In addition, these ions are surrounded by water molecules in the air and are carried on air currents to reach every corner of the room. They do not immediately disappear, and because a continuous stream of ions is generated as long as the unit is in operation, their number and effectiveness are not diminished. These Plasmacluster Ions™ are also effective in decomposing musty odors produced by fungi, the nitrogen monoxide (NO) contained in tobacco smoke^{*4}, and chemical constituents of offensive odors (acetic acid, styrene, etc.).

Compared to passive air cleaning systems that filter out contaminants by using the power of a fan to pull air through a filter, air cleaning systems that utilize Plasmacluster Ion™ technology are significantly more effective in cleaning the air in the interior of an entire room, including stagnant air which is not able to go through a filter. Plus, Plasmacluster Ion™ generating units are continuously effective, as they do not become clogged with dirt like a filter and do not require changing or cleaning filters. They are environmentally conscious devices that use water molecules in the air and save electricity costs (approx. 0.5W power consumption, annual electricity cost of approx. 100 yen [\$0.86]).

- *1: Prevent an allergic reaction from occurring by preventing the allergen (antigen) from combining with the IgE antibody.
- *2: Current as of September 3, 2003, using Plasmacluster Ion™ technology.
- *3: Plasmacluster and Plasmacluster Ion are registered trademarks of Sharp Corporation.
- *4: Cannot remove certain harmful substances (such as carbon monoxide) contained in tobacco smoke.

Mite Allergen Deactivation Verification Method

1. Proof of principle

Two identically shaped cylindrical containers, one with a Plasmacluster Ion™ generator installed inside, were prepared. We sprayed mite allergens into both containers and then took out the mite allergens from both and applied them to the antiserums of allergy patients to compare the allergic reactivity difference.

The results showed that, when the Plasmacluster Ion™ concentration in the air was 100,000 ions/cm³, the allergic reaction of the antiserums in all 18 patients was reduced (figure 1). We were thus able to verify the efficacy of Plasmacluster Ions™ on deactivating the allergens.

We conducted a test using the ELISA (enzyme linked immunosorbent assay) method to see the allergic reactivity of the antiserums from 18 mite allergy patients. In all 18 antiserums, Plasmacluster Ions™ deactivated the mite allergens, thus resulting in less allergic reactions.

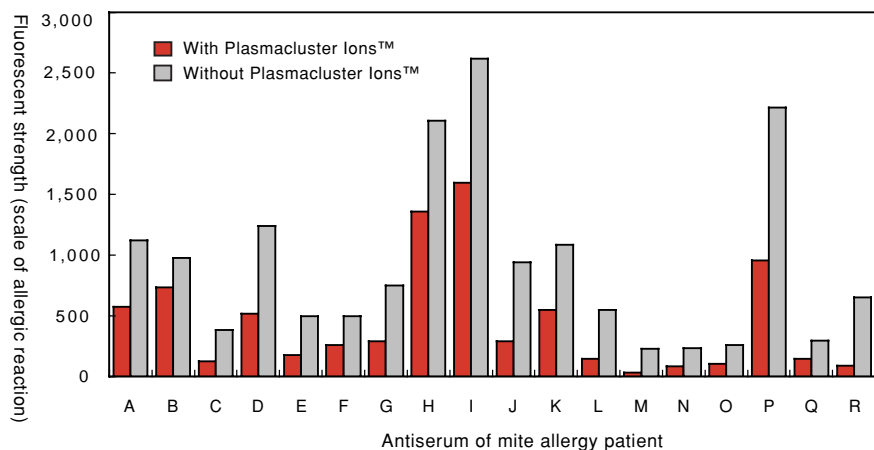


Figure 1

2. Trial test on actual allergens

We next conducted a test of the efficacy of Plasmacluster Ions™ on deactivating mite allergens by using the actual mite dust (not refined mite allergens for experimental purposes, but the actual dead bodies and feces of mites floating in the air).

The results showed that, when the Plasmacluster Ion™ concentration in the air was 10,000 ions/cm³, 91% of the airborne allergens were deactivated within approximately 15 minutes (figure 2). Even at an ion concentration of only 3,000 ions/cm³, 74% of the airborne allergens are deactivated in approximately 15 minutes (figure 3). It was thus verified that Plasmacluster Ions™ are effective in deactivating actual mite allergens floating in the air.

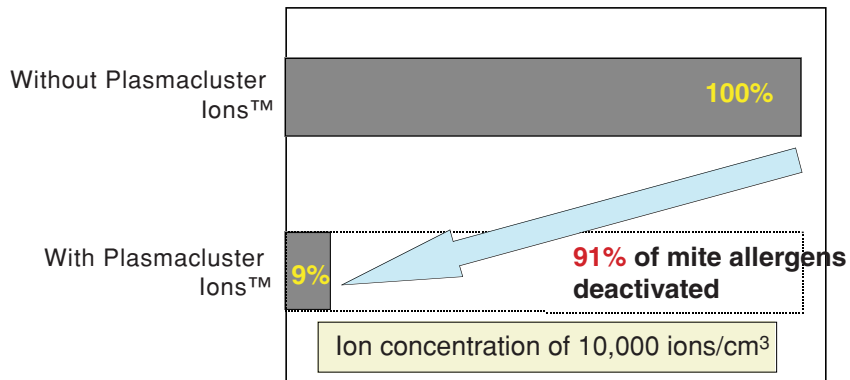


Figure 2

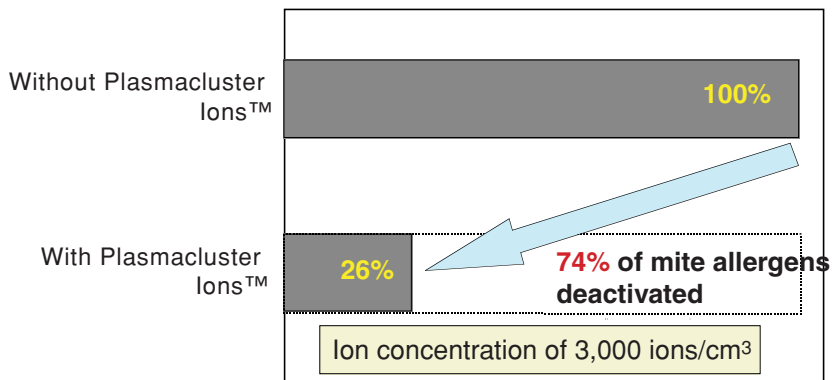
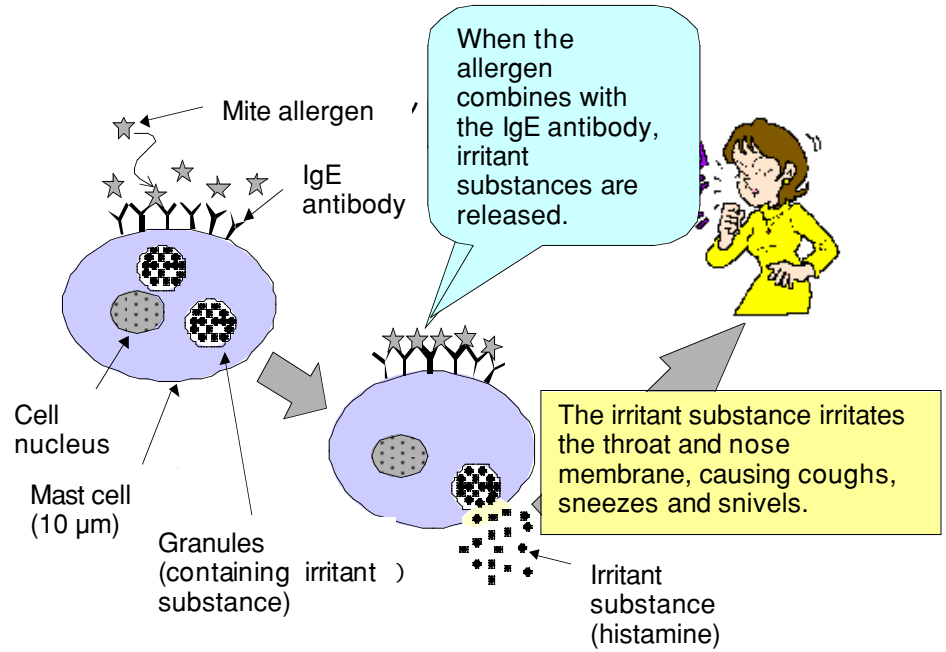


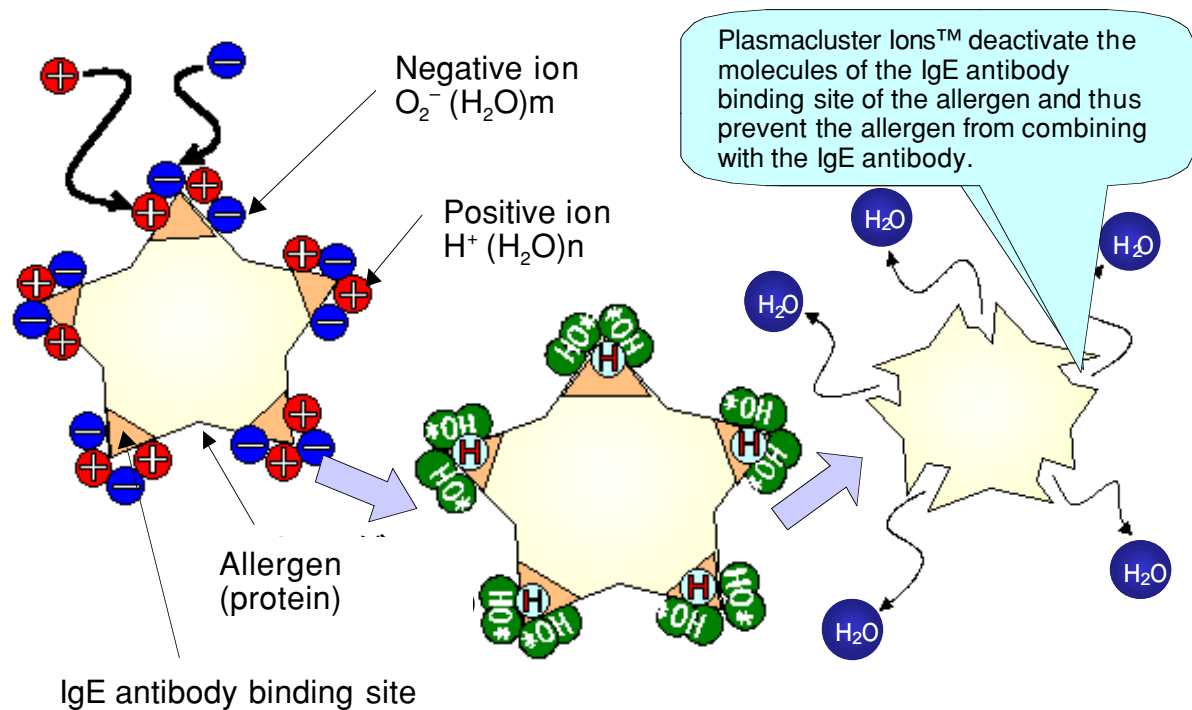
Figure 3

How allergies occur

When an allergen enters the human body, the body creates IgE antibodies, which combine with mast cells. The combined IgE antibodies and newly entering allergens form a link, which causes the mast cell to release irritant substances such as histamine. The histamine irritates organs like the throat and nose membrane, causing the person to become afflicted with allergic symptoms such as coughs, sneezes and snivels.



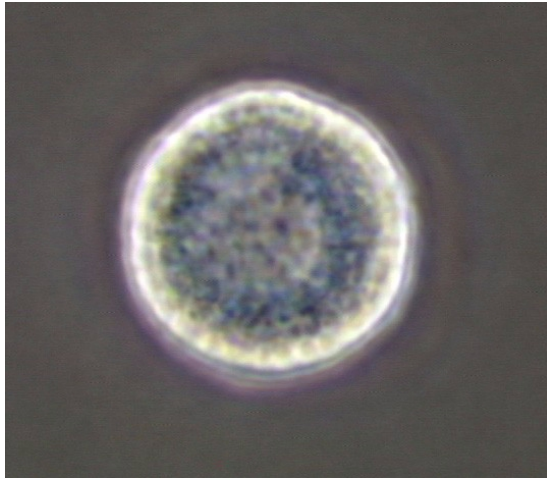
How Plasmacluster Ions™ deactivate allergens



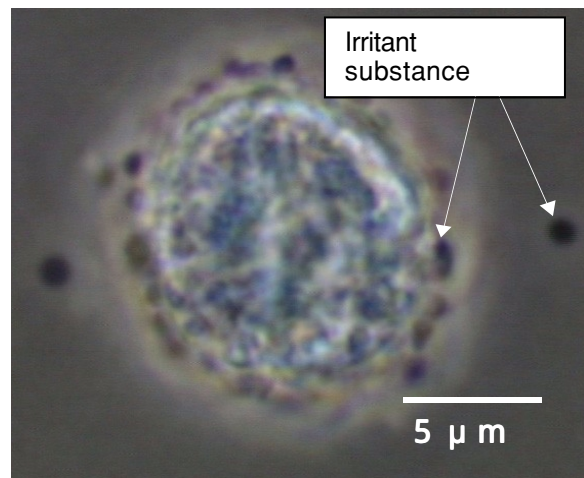
Plasmacluster Ions™ surround the airborne allergen and change into highly reactive hydroxyl radicals (OH). The hydroxyls then deactivate the molecules of the IgE antibody binding site of the allergen. No allergic symptoms occur even if allergens enter the body.

Effect of mite allergen deactivation

Photos of a sensitized mast cell and its reaction to mite allergens



With Plasmacluster Ions™
No allergic reaction, no release of irritant substance



Without Plasmacluster Ions™
Allergic reaction present; irritant substance that causes coughs, sneezes and snivels is released

Mast cell: A cell in mucosal surfaces and tissue that produces irritant substances such as histamine. A mast cell has a diameter of 10 to 30 μm . IgE antibodies adhere to its cell surface. When allergens combine with the IgE antibodies, the mast cell releases irritant substances such as histamine that cause an allergic reaction.

IgE antibody: Immunoglobulin E antibody. Binds to alien substances (antigens) and causes allergic reaction.

Allergen (antigen): An alien substance such as mite dust, pollen and fungi, that causes an allergic reaction.

Note: "Sensitized" refers to a state in which allergens enter the body, which produces the IgE antibodies that combine with mast cells.

At present, allergy sufferers combat mite allergens by using physical means such as diligent cleaning with active ventilation, eliminating carpeting, which is a breeding ground for mites, etc., and medical means such as controlling allergy-related symptoms by taking antihistamines, steroids, etc. It is Sharp's intention to adapt its Plasmacluster Ion™ technology under the concept of "protecting the air in every space we live in with Plasmacluster Ions™ for use in home appliances and other new fields as a revolutionary allergy-fighting technology that will inactivate not only airborne mold fungi and influenza viruses, but also aggressively deactivate airborne mite allergens—a world first."

Sharp's Plasmacluster Ion™ technology was developed in 2000 and its ability to inactivate airborne mold fungi was validated by the Ishikawa Health Service Association. In September 2002, working jointly with the Kitasato Research Center of Environmental Sciences, the fact that it inactivates airborne influenza viruses was verified and became a topic of much discussion in the media and among consumers. Internationally, its efficacy was confirmed by public-sector research organizations around the world, including the Shanghai Municipal Center for Disease Control and Prevention (China) and the Lübeck University Clinic (Germany).

Working closely with universities and independent research organizations around the world, Sharp is strengthening its efforts to develop scientific data to confirm the efficacy of Plasmacluster Ion™ technology. We are promoting this "academic style of marketing" to discover and commercialize even more efficacies of Plasmacluster Ions™.

Efficacy of Plasmacluster Ion™ Technology on Various Pathogens

Target Material	Type	Testing & Verification Organization
Allergens	Mite allergen (dust from dead mite bodies and feces)	Graduate School of Advanced Sciences of Matter, Hiroshima University
Virus	Influenza virus (common cold, the "flu")	Kitasato Research Center of Environmental Sciences
	Coxsackie virus (summer colds)	
Bacteria	MRSA (methicillin-resistant Staphylococcus aureus)	Kitasato Research Center of Environmental Sciences
	Coliform bacteria (E. coli)	Ishikawa Health Service Association
Fungi	Cladosporium (black mold, mildew)	Ishikawa Health Service Association

Profile of the Department of Molecular Biotechnology of the Graduate School of Advanced Sciences of Matter at Hiroshima University

The Graduate School of Advanced Sciences of Matter was established with the objectives of engaging in wide-ranging, visionary research; providing a comprehensive, interdisciplinary education; and, training highly professional engineers and creative, young researchers to give them the capability to approach the essence of problems from new viewpoints. The Department of Molecular Biotechnology conducts developmental research with the goal of isolating new molecular groups related to the homeostatic mechanism of living organisms (immune response regulators, etc.), advancing the understanding of their operational mechanisms, and finding practical applications for polymer drugs of these molecular groups (drugs for the treatment of allergies, etc.).

Research areas of Professor Kazuhisa Ono

- Elucidation of the structure and function of immunoregulatory factors that play important roles in the homeostatic mechanism of living organisms
- Analysis of signal transduction within immune cells

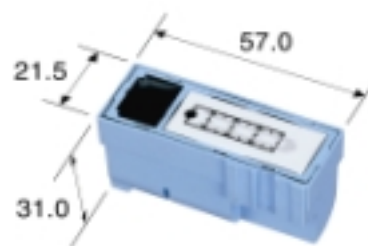
Research areas of Associate Professor Seiko Shigeta

- Analysis of “non-self” defense mechanisms in living organisms, particularly, in animals.
- Development of vaccines effective against allergy-related diseases caused by mites or cedar pollen

[Reference]

Plasmacluster Ion™ Generating Device

Positive and negative ions—tens of thousands per cubic centimeter—are generated from airborne water and oxygen molecules by a plasma discharge (note: cluster ions are the positive and negative ions surrounded by water molecules). These are then sent into the room air by a fan.

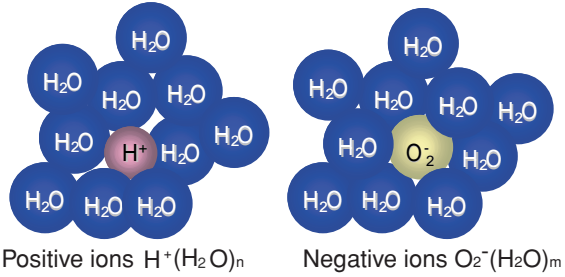


Unit: mm

These positive and negative ions are surrounded by water molecules in the air and are carried to every corner of the room. As long as the Plasmacluster Ion™ product is running, ions continue to be generated in the same numbers.

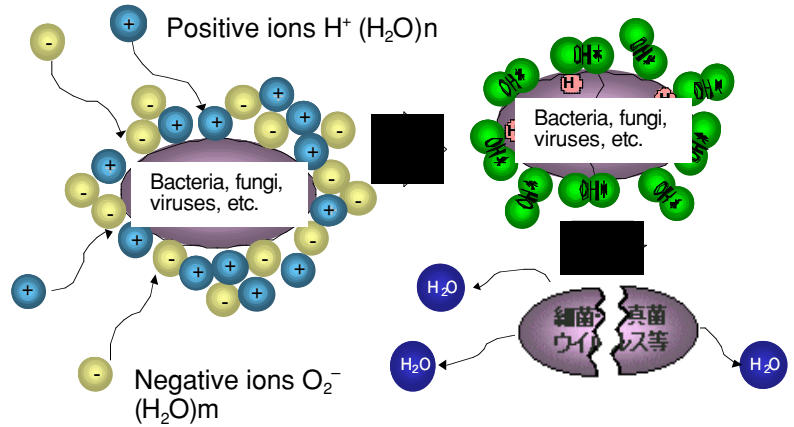
Chemical Composition and Structure of Plasmacluster Ions™

(confirmed using a time-of-flight mass spectrometer)
Positive and negative ions surrounded by water molecules



Mechanism for Inactivating Airborne Fungi

The positive and negative 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. The hydroxyl radical will take a hydrogen molecule from the cell wall of an airborne fungi particle, thus inactivating it.



Mechanism for Inactivating Airborne Influenza Virus

The positive and negative ions surround the hemagglutinin (surface proteins that form on organisms and trigger infections) and change into highly reactive OH groups called hydroxyl radicals. These take a hydrogen molecule from the hemagglutinin and change into water (H_2O). The hemagglutinin molecules are destroyed so the virus cannot infect even if it enters someone's body.

