

## News Release

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January 22, 2020

### **The effect of Plasmacluster ion technology to remove PAHs, the toxic air pollutants that are contained in the Indian atmosphere, was confirmed.**

Verified in Collaboration with Indian Institute of Technology (IIT, Delhi)

Sharp Corporation, working in collaboration with Associate Professor Dr. Sagnik Dey and Associate Professor Dr. Gazala Habib of Indian Institutes of Technology, Delhi has demonstrated that Plasmacluster Ion (PCI) has an efficacy to remove PAHs (Polycyclic Aromatic Hydrocarbons), which are contained as toxic air pollutants in Indian cities.

This project started in 2018 by measuring the composition of particulate matter in air pollutants in New Delhi NCR region of India. As a result, many types of pollutants were identified, including PAHs, which are known to be toxic to the human body.

Using the results as a reference, IIT Delhi and Sharp selected three types of PAHs to test the effectiveness of Plasmacluster against these PAHs. The results showed that 91.1% of Fluoranthene, 62.1% of Chrysene, and 94.6% of Dibenzo(a, h)anthracene were effectively removed by applying Plasmacluster.

Plasmacluster Ion is a revolutionary air purification technology from 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 pollutants such as bacteria, viruses and chemical compounds floating in the air to form hydroxyl (OH) radicals, which have extremely high oxidation ability, and this chemical reaction decomposes the cellular compounds or chemical structures, thereby neutralizing their toxicity. Sharp is using the fact that higher ion concentration results in greater efficacy to decompose air pollutants. SHARP envisaged the potential application of this technology in other environments such as hospital, office, public area etc.

Sharp will continue its initiatives to contribute to society in health domain through further evolution of PCI technology and additional demonstrations of its efficacy with the aim of lessening the burden of various contaminants in our life.

<sup>\*1</sup> Plasmacluster and Plasmacluster Ions are trademarks of Sharp Corporation.

### Comments by Associate Professor Dr. Gazala Habib

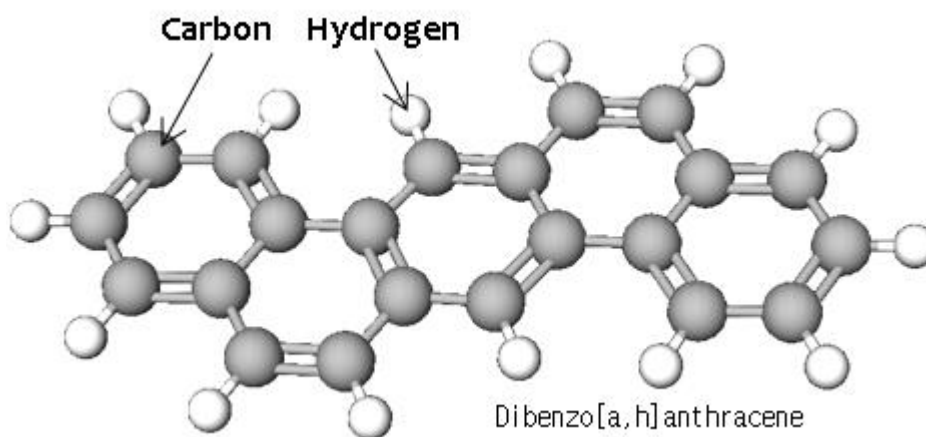
From this test results, it is confirmed that PCI technology is effective in decomposing and reducing the carcinogenic PAHs, which are present in inhalable fraction of particulate matter. It is expected that usage of PCI technology will lead to the improvement of the indoor air environment and contribution to the healthier life of user around the world.

### Comments by Associate Professor Dr. Sagnik Dey

Air pollution is one of the leading health risk factor in India. While it will take time to reduce exposure to air pollution through policy, air purifier has emerged as one of the tools to protect personal exposure. The PCI technology of SHARP is experimentally prove to be successful in eliminating particle bound PAHs from toxic air.

### About PAHs

Polycyclic aromatic hydrocarbons (PAHs) are a group of organic compounds having two or more merged aromatic rings. There are more than 100 chemicals in PAHs and they are one of the major toxic air pollutants in India as well as other hydrocarbons. PAHs are produced by various anthropogenic activities with incomplete combustion of fuels such as diesel engine. Some of PAHs are carcinogenic and mutagenic and some are related with chronic human health problems. The 3 PAHs tested this time are confirmed to be included in ambient air in Delhi, and Chrysene and Dibenzo[a,h]anthracene are known to be carcinogenic.

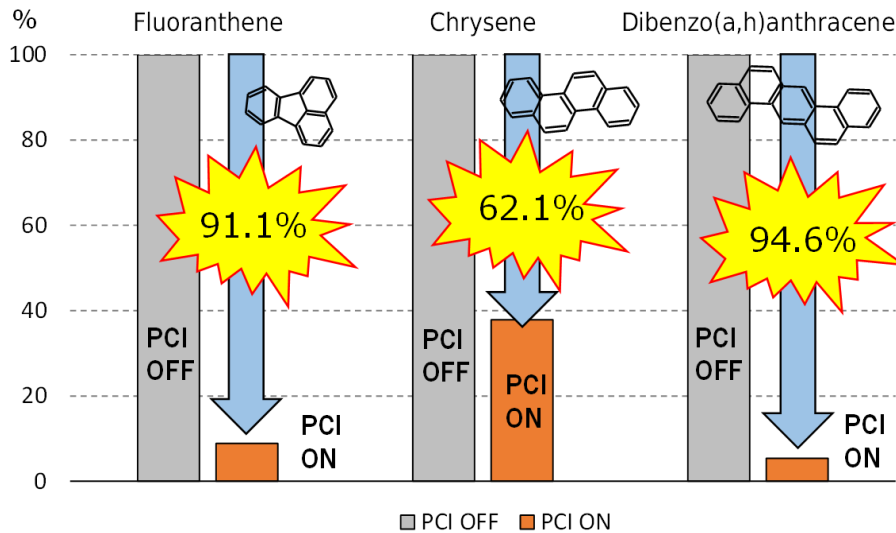


Example of PAHs structure: (Dibenzo [a, h] anthracene)

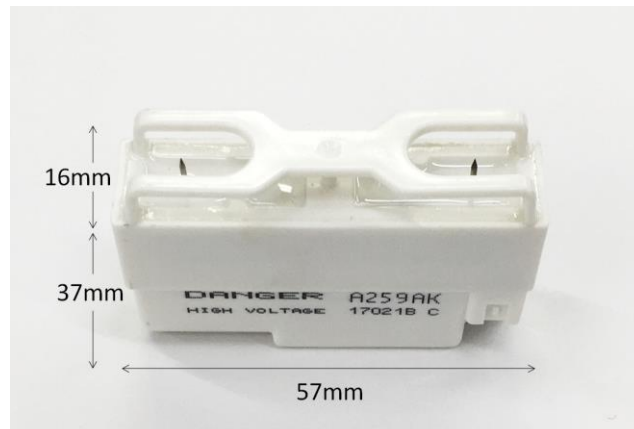
## Test method of Plasmacluster's effectiveness against air pollutant "PAHs"

A very thin layer of around sub-nm range of 3 types of PAHs were formed inside each glass-petri dishes separately. Each samples were inserted in 4 L box for 1 sample. There were 2 types of boxes, one with a Plasmacluster Ion (PCI) generator (PCI ON) and another without Plasmacluster (PCI OFF). Inside of the PCI ON box, ion concentration of approximately 1,000,000 ions/cm<sup>3</sup> were maintained during the test, to which the sample were exposed to. After the PCI exposure, samples were collected and the remaining PAHs were measured by GC-MS (Gas Chromatography Mass Spectroscopy analysis).

The results showed that PAHs concentration decreased significantly when they were exposed to Plasmacluster ions for 10 days with ion concentration of approximately 1,000,000 ions/cm<sup>3</sup> in the test boxes. The efficacy was 91.1% on Fluoranthene, 62.1% on Chrysene and 94.6% on Dibenzo(a,h)anthracene.



Removal Efficacy of Plasmacluster to PAHs



Plasmacluster ion generator

# SHARP

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## **Profile of Reserchers of IIT Delhi**

Dr. Sagnik Dey: Associate Professor of Civil engineering, IIT, Delhi.

Dr. Gazala Habib : Associate Professor of Civil Engineering, IIT Delhi

Dr. Bipasha Ghosh : Post doctoral Fellow

Dr. Himanshu Lal: Post Doctoral Fellow

Nasir Baig : Project Scientist

## **About the IIT Delhi**

Established in August 1961, The Indian Institute of Technology Delhi is a public engineering institution located in New Delhi, India.

The institute was decreed in Institutes of National Importance under the Institutes of Technology Amendment Act, 1963.

In 2018 it was awarded the Institute of Eminence status.

Internationally, IIT Delhi was ranked 182 in the QS World University Rankings. The same rankings ranked it 40 in Asia in 2019 and 18 among BRICS nations in 2019.

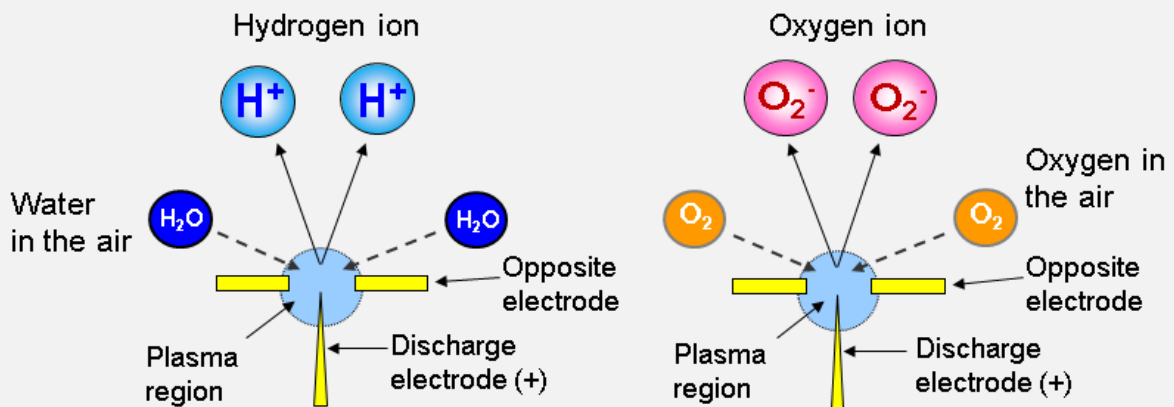


Outlook of Indian Institute of Technology Delhi

## Overview of Plasmacluster Ion Technology

### Plasmacluster Ion Generation

By applying positive and negative voltages to the electrodes, water molecules and oxygen molecules in the air are decomposed by the plasma and ionized. In this way, positive hydrogen ions ( $H^+$ ) and negative oxygen ions ( $O_2^-$ ) are generated and released into the air.



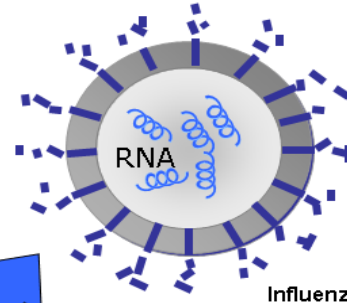
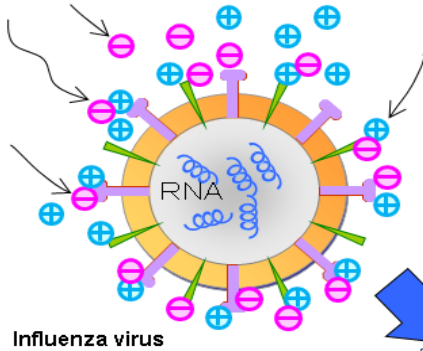
Water molecules in the air cluster around the ions like a bunch of grapes. Each ion forms part of a stable "bunch of grapes" or ion cluster.



## Influenza Virus Inhibition Mechanism of Plasmacluster

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

Chemical reactions cause the breakdown of surface proteins and inactivate the virus.

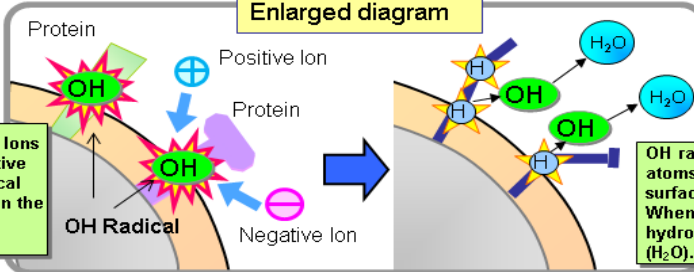


Influenza virus

Influenza virus inactivated

### Enlarged diagram

Positive and Negative Ions are converted to reactive OH radicals by chemical reactions that occur on the virus surface.



OH radicals remove hydrogen atoms from spiked proteins on the surface then inactivate them. When an OH radical acquires a hydrogen atom, it forms water (H<sub>2</sub>O).

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

## Efficacy list of Plasmacluster Ion Confirmed Through Collaborative Research

Efficiency	The research institutions that performed the verifications
Efficacy proven in clinical trials	Graduate School of Medicine, University of Tokyo / Public Health Research Foundation
	Faculty of Science and Engineering, Chuo University / Clinical Research Support Center, University Hospital, University of Tokyo
	Animal Clinical Research Foundation(Japan)
	Soiken Inc.(Japan)
	School of Bioscience and Biotechnology, Tokyo University of Technology
	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
	Hanoi College of Technology, Vietnam National University
	Institut Pasteur, Ho Chi Minh City(Vietnam)
Allergens	Graduate School of Advanced Sciences of Matter, Hiroshima University
	Department of Biochemistry and Molecular Pathology, Graduate School of Medicine, Osaka City University
Fungi (Mold)	Ishikawa Health Service Association(Japan)
	University of Lübeck (Germany)
	Professor Gerhard Artmann, Aachen University of Applied Sciences
	Japan Food Research Laboratories
	Shokukanken Inc. (Japan)
	Shanghai Municipal Center for Disease Control and Prevention
	Biostir Inc.(Japan)
Medical Mycology Research Center, Chiba University	
Bacteria (Microbe)	Ishikawa Health Service Association(Japan)
	Shanghai Municipal Center for Disease Control and Prevention
	Kitasato Research Center of Environmental Sciences(Japan)
	Kitasato Institute Medical Center Hospital
	Dr. Melvin W. First, Professor Emeritus, Harvard School of Public Health
	Animal Clinical Research Foundation(Japan)
	University of Lübeck
	Professor Gerhard Artmann, Aachen University of Applied Sciences
	Japan Food Research Laboratories
	Shokukanken Inc. (Japan)
	Chest Disease Institute(Thailand)
	Biostir Inc.(Japan)

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Odors, pet smells	Boken Quality Evaluation Institute(Japan)
Skin beautifying effects	School of Bioscience and Biotechnology, Tokyo University of Technology
Hair beautifying effects	Saticine Medical Co., Ltd. (Japan)
	C.T.C Japan Ltd.
Working mechanism of inhibitory effects on viruses, fungi, and bacteria	Professor Gerhard Artmann, Aachen University of Applied Sciences
Working mechanism of inhibitory effects on allergens	Graduate School of Advanced Sciences of Matter, Hiroshima University
Working mechanism of skin moisturizing (water molecule coating) effect	Research Institute of Electrical Communication, Tohoku University