



Streamer Technology

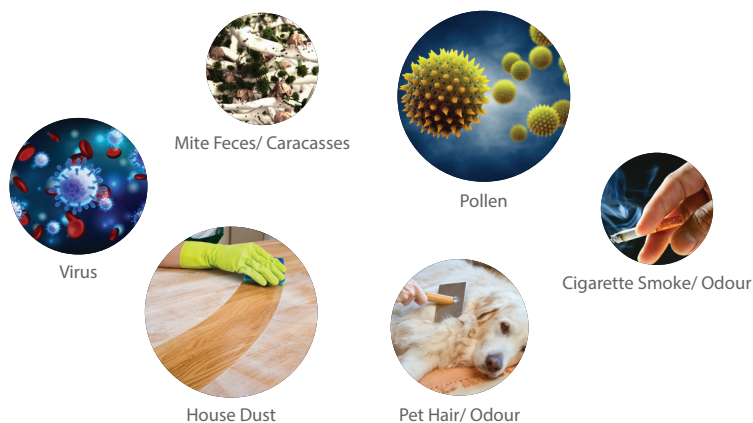


Delivering the purest air for your home or business

What is streamer technology?

The Streamer technology developed by Daikin Industries is an epoch-making air purification technology that has succeeded in stably generating “high-speed electrons”, which had been considered difficult up to that time.

There are various harmful proteins and harmful chemical substances around us.



These are effects in a Streamer test space & not verification results in an actual operation space.

Works on objects caught by the filter

Streamer decomposes and eliminates allergens such as pollen, mould, and mites (droppings and dead mites)^{*1*2}

Pollen, mould, and mites (dead mites) were placed on the electrode of the Streamer Discharge unit and then photographed through an electron microscope after being irradiated with Streamer Discharge for 15 minutes.

*Joint research with Wakayama Medical University>

Decompose and
eliminate pollen

Eliminated more than
99.6%^{*1} in 2 hours!

Decompose &
eliminate mould

Eliminated more than
99.9%^{*2} in 24 hours!

Decompose and
eliminate allergens such
as mite droppings and
dead mites

Eliminated more than
99.61%^{*1} in 24 hours!

Notes:

*1 Testing organization: Wakayama Medical University.

Test conditions: Irradiated allergens with Streamer and checked decomposition of allergen proteins by either the ELISA method, electrophoresis or electron microscopy.

Test result: 99.6% eliminated. (Works on objects caught by the filter)

*2 Measuring method: antibacterial test/mould elimination test

Testing organization: Japan Food Research Laboratories.

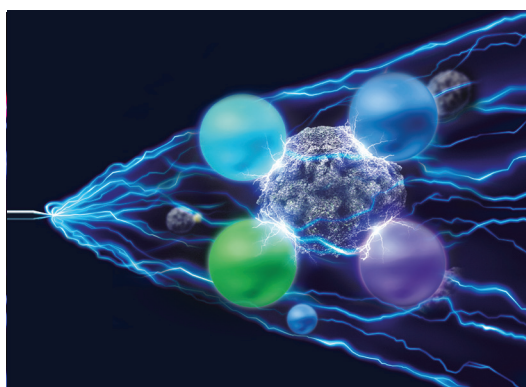
Test number: 204041635-001.

Test result: 99.9% eliminated. (Works on objects caught by the filter)

About the Streamer Discharge

The Streamer discharge is a type of plasma discharge that generates "high-speed electrons", which have high oxidative decomposition power in a three-dimensional and wide range, so the oxidative decomposition power is 1,000 times or more compared to general plasma discharge (glow discharge).

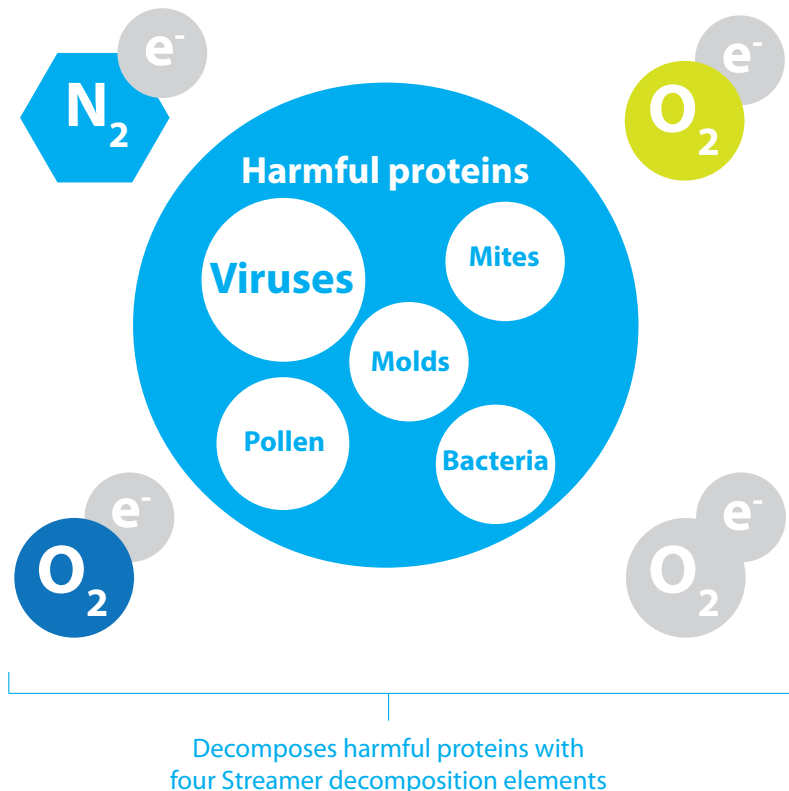
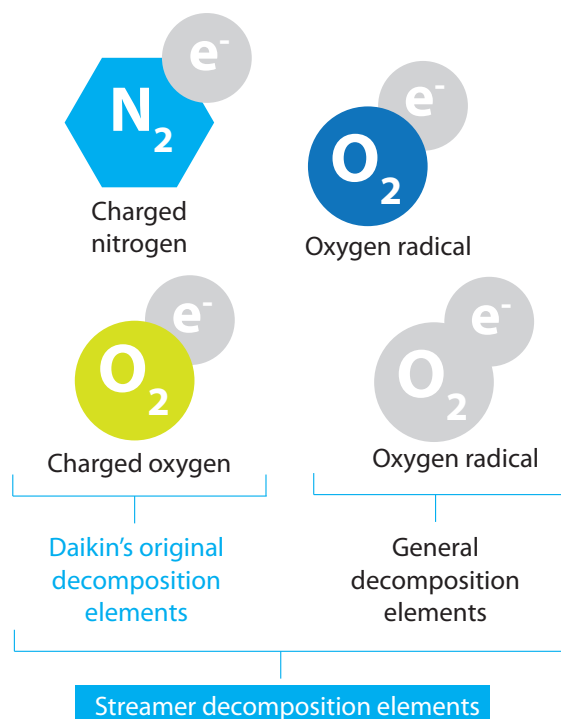
With this technology, high-speed electrons that combine with air components have a strong oxidative decomposition power, so they continuously act on odors, bacteria, and indoor pollutants such as formaldehyde. So far, we have demonstrated in collaboration with universities and public research institutes that it acts on harmful substances such as influenza virus, norovirus, toxins and bacteria that cause food poisoning.



Streamer Discharge

Comparable to about 16 times the energy of the sun

*Comparison based on oxidative decomposition power. Charged nitrogen has an oxidative decomposition power of 10eV (electron Volt), and the oxidative decomposition power of the sun is equivalent to 0.5eV.





Streamer Technology against SARS-COV-2

Daikin in collaboration with a group of research professors from the Department of Microbiology in the Faculty of Veterinary Medicine from the Okayama University of Science, led by Professor Shigeru Morikawa, has demonstrated that the Streamer technology has inactivating effects against the novel Coronavirus (SARS-COV-2).

*This result was obtained by using a Streamer discharge device for testing in lab conditions.
The effects of products equipped with Streamer technology or results in actual use environments may differ.

Testing Organization

Professor Shigeru Morikawa's led research group at the Department of Microbiology in the Faculty of Veterinary Medicine from the Okayama University of Science



Supervisor

Professor

Shigeru Morikawa

Department of Microbiology, Faculty of Veterinary Medicine, Okayama University of Science.

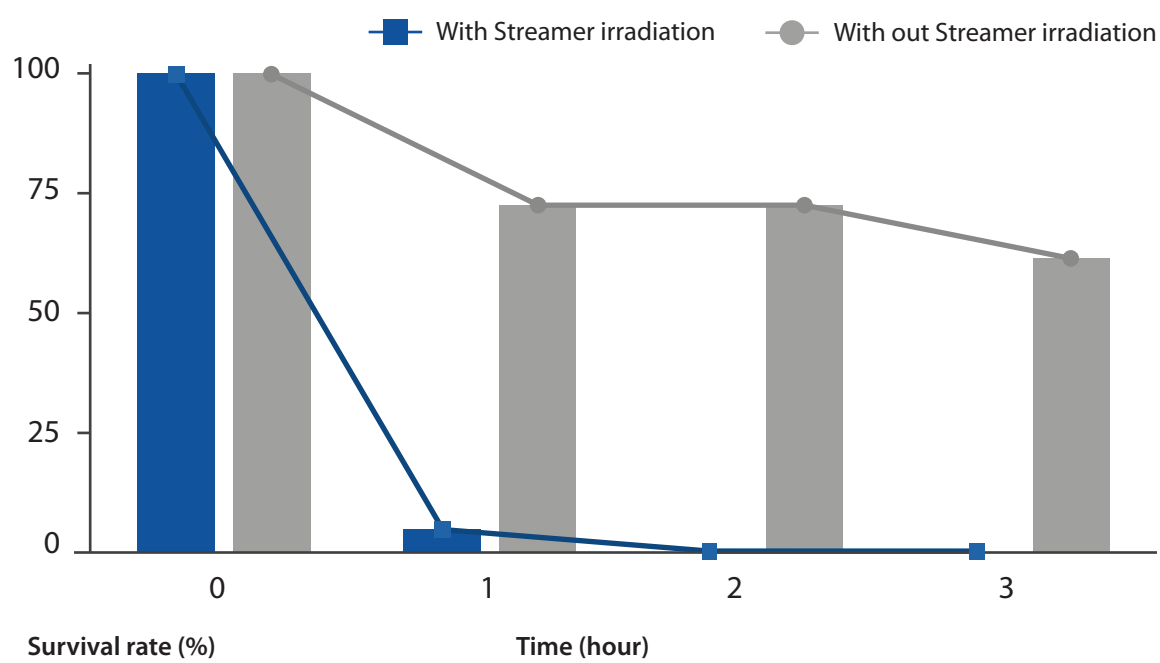
Former Director of SARS Countermeasures office, National Institute of Infectious (NIID)



Test Method

Two acrylic boxes of about 31L were mounted inside a safety cabinet. One box was equipped with a Streamer discharge device and the other box was not. A see-saw rocking motion shaker was placed in each box, and a six-well plate was placed on top of the motion shaker. Virus solution measuring 0.5 ml was put into each well of the plates, and Streamer irradiation was performed while agitating the solution using the motion shaker (approximately 12 times per minute). Virus solution was collected from two wells every hour for three hours, and viral load was measured. The viral load of SARS-CoV2- was quantied by the TCID50 method using Vero E6 / TMPRSS2 cells.

Experimental Result



Streamer Irradiation Time	1 hour	2 hour	3 hour
Novel coronavirus (SARS-CoV-2) inactivation	93.6%	99.7%	99.9%

Source: "Study report on the inactivation eect of plasma ion generator (Daikin Streamer) on SARS-CoV-2" written by Shigeru Morikawa, Department of Veterinary Medicine, Microbiology Course, Okayama University of Science.

As a result of the test, SARS-CoV-2 was inactivated by 93.7% after 1 hour of Streamer irradiation. After 2 hours, it was inactivated by more than 99.8%, reaching more than 99.9% after 3 hours of Streamer irradiation.

*This result was obtained by using a Streamer discharge device for testing in lab conditions. The effect of products equipped with Streamer technology or results in actual use environments may differ.

Demonstration Experiments List

Experiment results of the Streamer technology that have been verified so far



Viruses

Target of experiment	Testing organaization	Test Method	Report date
Norovirus	Kobe University Graduate School	ELISA method	12-Jan-2007
New strain of influenza virus (Type A-H1N1)	Vietnam National Institute of Hygiene and Epidemiology	Dilution method	14-Sep-2009
Highly pathogenic avian influenza virus (Type A-H5N1)			16-Apr-2009
<u>Influenza virus (Type A-H1N1)</u>	Kitasato Research Center for Environmental Science	CPE and TCID50	31-Jul-2009
<u>Influenza virus (Type A-H3N2)</u>	Shanghai City Center for Disease Control and Prevention, etc.		8-Feb-2010
<u>RS virus</u>	Wakayama Medical University	CPE and TCID50	13-Apr-2012
<u>Adenovirus</u>	Kitasato Research Center for Environmental Science		23-Jun-2017
<u>Coxsackievirus</u>			
<u>Enterovirus</u>			
<u>Echovirus</u>			
<u>Measls</u>			
<u>Mouse Norovirus</u>	The University of Tokyo Graduate School		11-Oct-2018
<u>Mouse Hepatitis Virus A59 (MHV-A59)</u>		Plaque method	28-Apr-2020
Novel Coronavirus (SARS-CoV2-)	Okayama University of Science	CPE and TCID50	8-Jul-2020



Bacteria

Target of experiment	Testing organization	Test Method	Report date
Bacteria (Escherichia coli/O157-)	Japan Food Research Laboratories	Pour plate culture method	8-Apr-2004
Bacteria (Staphylococcus aureus)			25-Aug-2004
Toxin (enterotoxin)		ELISA method	8-Mar-2010
Tubercle bacilli (ECG mutant)	Kitasato Research Center for Environmental Science	Plaque method	8-Mar-2010
Bacteria (tubercle bacilli/clinical strain)	The Jikei University School of Medicine	PCR method	15-Feb-2010
Bacteria (vancomycin-resistant enterococci/VRE)	Japan Food Research Laboratories	Pour plate culture method	19-Feb-2010
Bacteria (methicillin-resistant Staphylococcus aureus/MRSA)			
Pseudomonas aeruginosa			12-Apr-2010
<u>Bacillus</u> , <u>Serratia</u> , and <u>Arthrobacter</u>			29-Sep-2010
Bacteria (Escherichia coli/ATCC)			10-Sep-2018
<u>Moraxella bacteria</u>			10-Jun-2019



Molds

Target of experiment	Testing organization	Test Method	Report date
Mold (Black mold)	Japan Food Research Laboratories	Pour plate culture method	28-Sep-2004



Hazardous gases

Target of experiment	Testing organization	Test Method	Report date
Adjuvant suppression effect (DEP)	Wakayama Medical University National Institute for Environmental Studies	ELISA method	1-Nov-2005
Adjuvant suppression effect (DEP)	Tohoku Bunka Gakuen University	Attenuation method	8-Dec-2006



Target of experiment	Testing organization	Test Method	Report date
<u>Molds and mites (feces and carcasses)</u>	Wakayama Medical University	Pour plate culture method	8-Apr-2004
<u>Pollen + exhaust gas + PM2.5</u>	Yamagata University under the supervision of Professor Shirasawa, Tohoku Bunka Gakuen University	IgE antibody test	25-Aug-2004
<u>Mites (feces and carcasses) + cedar pollen</u>		ELISA method	8-Mar-2010
<u>Pollen(16 kinds)</u>	L.S.L. Asaka Research Laboratory under the supervision of Project Professor Kusakabe, graduate school of the University of Tokyo	ELISA method	23-Jan-2020

*This result was obtained by using a Streamer discharge device for testing in lab conditions.
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Indoor Air Quality

We are committed to creating revolutionary technologies to give you the purest air.



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