Health is in the air

SANITIZING TECHNOLOGIES AND EQUIPMENT

CSA SYSTEM S-TRAIN
ENGLISH VERSION

JUST BECAUSE YOU DON'T SEE THE PROBLEM, DOESN'T MEAN IT ISN'T THERE.

STE
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STE - Sanitizing Technologies and Equipment is an innovative **start-up** and **spin-off of the University of Urbino Carlo Bo**. We arose from the merging between university researches and experts in aeraulic system and aerobiology fields. We develop, produce and sell the latest generation air and surfaces sanitizers suitable for indoor and professional enviroments and industrial settings.

STRATEGIC PROCESS

Research → Product development → Production → Validation and certification

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Our brand identity

Vision

We aim to contribute to build a better future where the priority is the health. We do that offering **innovative, fast and green sanitization solutions** capable to rise the standard leaving.

Mission

Our mission consists in offering **safety indoor environments**, protecting people and spaces with pioneering systems of sanitization.

As a Biotechnological company and spin-off of the University of Urbino, we merge the **scientific research and innovation technology** to develop effective, eco-friendly and approved outcomes.

Everyday we convert knowledge in concrete products ensuring protection and wellness to those who live, work and share the same indoor environments.

Values

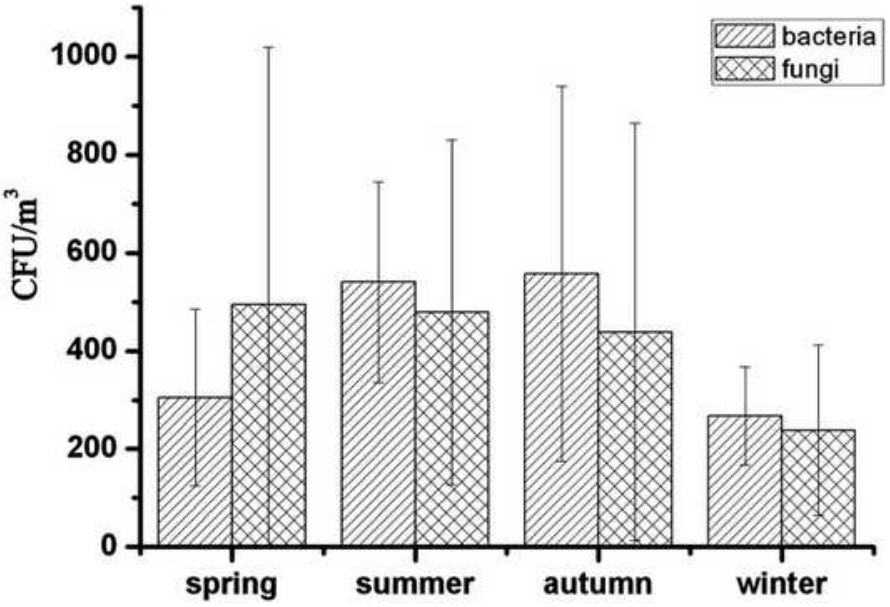
We are a biotech company inspired by ***Life Science***, infact we believe in the balance between nature and science to improve the quality of people's life.
Our sanitization products care the people's health in a green way, we are convinced that the true innovation combines the effectiviness and accountability.
Every choice, from materials to technologies, is guiged by **ecosustainability** and the less impact on the environment.
Creating healthy product in a green way means building a **safety planet for tomorrow**.

Advantages

With the union between the accademic research and the ***Made in Italy* style** we are able to create advanced and reliable solutions. The design and the innovation of our products are two of our main **competitive advantages**. These items reflect high quality, utility and esthetic.
Each product is the result of the match between scientific knowledge and creativity, infact we pay attenction to technical aspects and aesthetic details, that means **certainty**, **innovation** and **italian design**.

Pollution in trains

In this type of transport, the air is mainly recycled, with a low percentage of renewal with external air, thus encouraging the **accumulation of pollutants inside the carriages, in the HVAC systems and in the ducts**.



The average respirable fractions for **bacteria and fungi detected in railway carriages are much higher than in other indoor environments**, on average greater than 62.8% and 81.4%*.

During the exam it stood out that the external temperatures effect on the quantity of microorganisms present in the indoor air of the carriage, reaching hight speaks during summer and autumn.

* "*Size and seasonal distributions of airborne bioaerosols in commuting trains*" Ya-Fen Wang, et al.

Pollution in trains

The accumulation of thin dust can achieaves considerable values: an increase of athmospheric matter can increase the onset of respiratiry track infections, also it can cause allergic reactions in weak people and it **can increase the tisk of respiratory diseases**. The presence of athmospheric matter in transport microenvironments are always very high: according to AIRC, for each increment of 5 µg/m³ of PM2.5, the relative risk of getting lung cancer increases by 18%, while it grows by 22% with every increase of 10 µg/m³ of PM 10*.

Inside the train, the presence of **volatile organic compounds** as formaldehyde, toluene and acetone, can engrave on the quality of the air and on the health of passengers and on-board staff. The **long expose** to these substances can conduct to respiratory tract irritation, headaches, fatigue, and in some cases, chronic effects on the respiratory system and nervous system.
The main sources of VOC on board include internal coatings, paints, adhesives, plastic materials and cleaning products.
In close and poorly ventilated environments, these compounds can **accumulate** contributing to a worsening of microclimatic conditions and overall passenger comfort.

For a real time monitoring of the ammounting of these contaminants, it is necessary to **track the status of the air quality** inside of the train carriage. The right supervision allows to operate in a better way to ensure the best wellness to passengers and personnel on board.

CSA System Technology

Our patented technology **Continuous Sanitization Air (CSA) System** provides the continuous purification and sanitization of the air through **only one device**, even in presence of people.

The **CSA SYSTEM** devices apply in an innovative way the purification and sanitization of air standars, synergistically integrating mechanical filtration technologies, ionization and irradation of air through ultraviolet LED sources. The license includes the modulation of sanitization effctiviness through the monitoring of the air quality.
Thanks to the leatest elements, our technology is able to achieve high level of microbial inactivation and reduction of athmosoheric particulates, volatile organic compounds, smells and allergens while maintaining **minimal energy consumption**.

The new technology **CSA SYSTEM** is eco-friendly, infact during its operation it doesn't use chimical substances and the elements can be disposed in a sustenable way and the use of LED UV-C allows an energy saving.
Overall our technology has a low impact on the environment, infact it is in line with the econological transition.

All devices with **CSA SYSTEM Technology** were tested on *Escherichia coli*, *Bacillus subtilis* and *Cladosporium sphaerospermum*.

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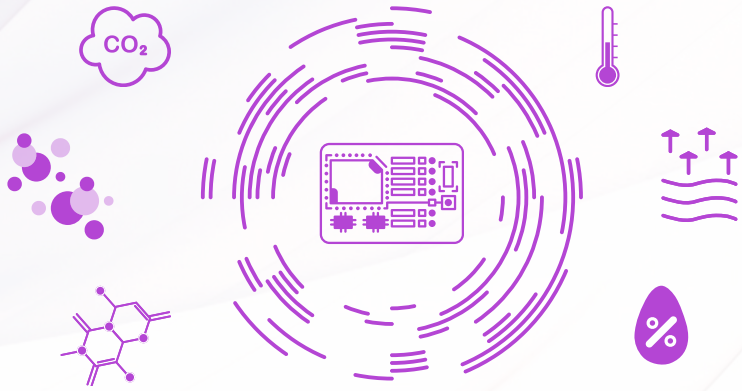
Real-Time monitoring

In our devices there is a **sensor platform** for the continuous monitoring of the **air quality parameters**, such as the pression, the air flow rate, temperature, relative dump, atmospheric particulate matter (PM_{10}, $PM_{2.5}$, PM_1) e gaseous pollutants (VOC, CO_2) and radioactive pollutant (Radon).

Through these sensors, the user can see the quality air data in **real time** on different devices. The information from other tools installed in separate spaces can be **tracked at the same time** using only one screen.



CSA SYSTEM S-TRAIN

The **CSA SYSTEM S-TRAIN** is the perfect solution to incorporate into the heating, ventilation, and air conditioning (**HVAC**) systems of trains, trams, or subways to maintain high levels of health for passengers and staff on board. In this type of public transport, air is primarily recycled, with a low exchange rate with outside air, thus promoting the accumulation of pollutants inside the train carriage, in its HVAC, or in its ducts. The **CSA SYSTEM S-TRAIN** sanitizes and purifies the interior air, keeping pollutant levels low and healthy during the journey.

The **CSA SYSTEM S-TRAIN** can be installed easily inside existing HVAC units, without structural modifications, thanks to its modular and **compact** design. The system can be customized according to the air volume and specific train needs.

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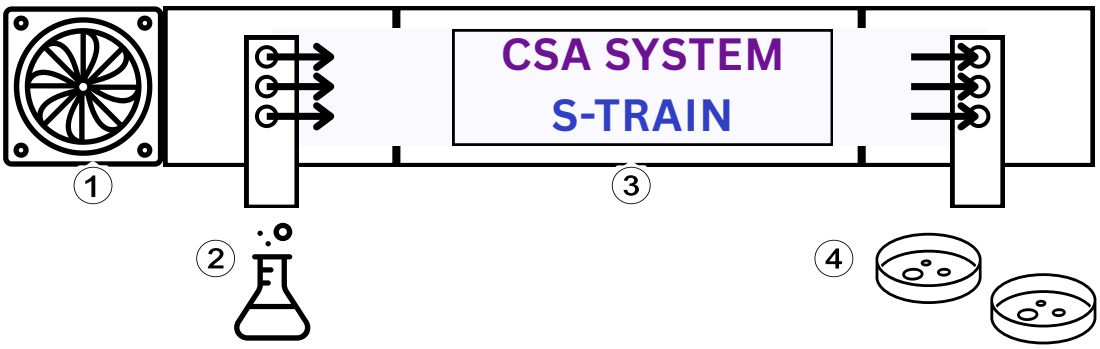
Features

	CSA SYSTEM S-TRAIN
Category	Air purifier and sanitaizer and monitoring
Materials	Light alloy
Power consumption (W)	min 300 (customized)
Operating temperature (°C)	-24 - 60 °C
Vdc Voltage	24 - 72 - 110
Led UVC	Yes
Type of input filter	G4 self-sanitizing
Installation	HVAC conduct
Dimension	Customized according to HVAC space or air channels
Weight (kg)	Customized

Test rig validation

CSA SYSTEM S-Train has been subjected by STE and the University of Urbino Carlo Bo to numerous efficacy tests, conducted in a dedicated test rig and built according to the **BS ISO 15714:2019 standard** – "*Method of evaluating the UV dose to airborne microorganisms transiting in-duct ultraviolet germicidal irradiation devices*".



1. Fan
2. Microbiotic solution to be sprayed
3. CSA SYSTEM S-TRAIN (ON/OFF)
4. Microbiotic aerosol to be sampled

The test rig, specifically designed to reproduce the real operating conditions of railway HVAC systems, allows for **precise verification of the sanitization performance of devices** subjected to different air flows.
Its configuration permits to conduct various types of microbiological tests thus to perform and validate the effectiveness of treatments in different application scenarios.

Efficacy results

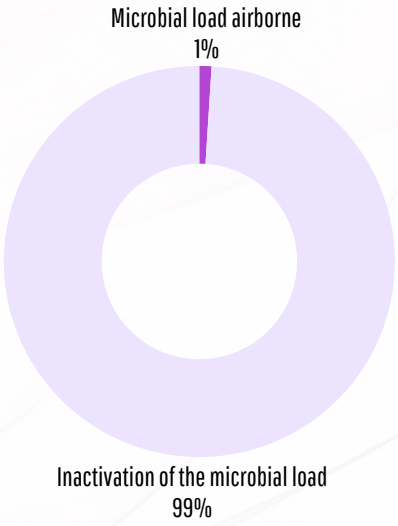
The effectiveness of the **CSA SYSTEM S-TRAIN** has been verified through laboratory tests conducted in collaboration with researchers from the University of Urbino Carlo Bo.

The results showed that, thanks to its patented sanitization technology, the device is able to achieve a **significantly reduction** of the concentration of airborne microorganisms, reaching inactivation rates exceeding **99%** for *Escherichia coli* and *Bacillus subtilis*.

In addition to its germicidal action, the system helps **to mantain high levels of indoor air quality** by removing particulate matter, dust, allergens, and volatile organic compounds (such as formaldehyde), improving the health and comfort of passengers and staff on board.

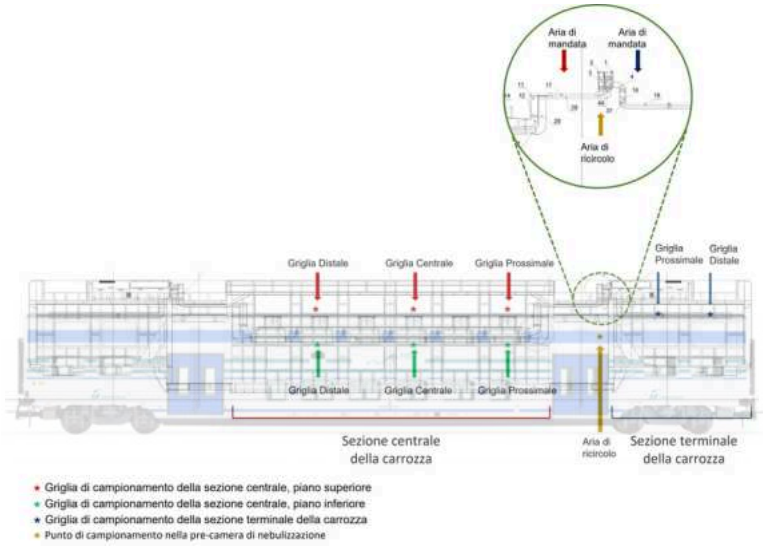
CSA SYSTEM S-TRAIN OFF

CSA SYSTEM S-TRAIN ON



On board train Validation

The tests, conducted by STE in collaboration with the University of Urbino Carlo Bo, were the first to be taken directly on board trains, under **real-world operating conditions**. Before this research, **no scientific data were available on air sanitization systems applied to the rail and tram sector**.
This activity allowed to evaluate the system's effectiveness in the field, making a concrete contribution to the knowledge and the improvement of air quality solutions for public transposts.



The results highlighted the **importance of integrating air sanitization systems into the HVAC systems** of this type of train, where the high recycling air can carry out the **accumulation of contaminants**.
The adoption of dedicated devices, like the **CSA SYSTEM S-TRAIN**, contributes to **protect the health and wellness** of passengers and railway staff, ensuring a safty and healthier environment during all the journey.

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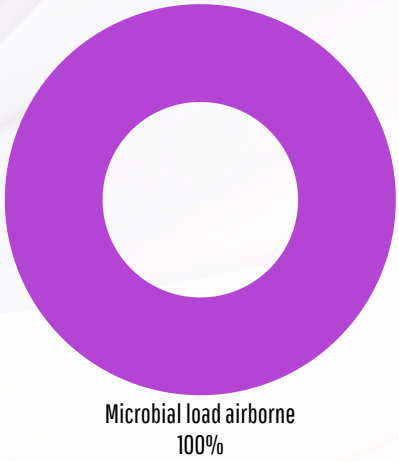
Efficacy results

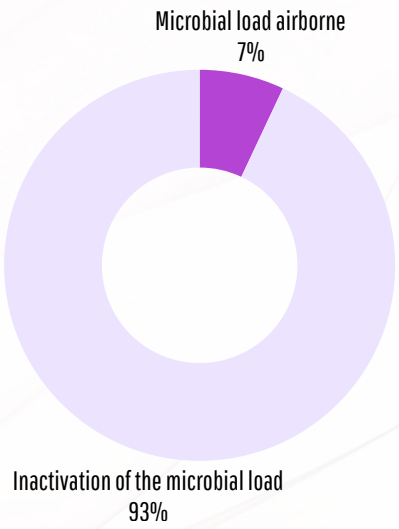
In its environment application, aboard a medium-distance train, the patented **CSA SYSTEM S-TRAIN** technology achieved inactivation rates exceeding **93%**, operating in the presence of microbiological levels far higher than those typically found on rail vehicles.

Thanks to its design features, the **CSA SYSTEM S-TRAIN** contributes to maintain indoor air quality by acting on both microbiological and chemical-physical contaminants such as PM, volatile organic compounds, and other airborne pollutants.

CSA SYSTEM S-TRAIN OFF



CSA SYSTEM S-TRAIN ON



Services

Environmental Monitoring

We offer services of environment and air quality monitoring. We can do that thanks to sensors for the real time detecting of the main air pollutant and to conduct microbiological analyses through **sampling** in indoor environment following the classic method of harvest and cultivation. These achieved data are transformed into detailed reports, tempestive alert and interactive dashboard. With these tolls we provide to our clients facilities to understand the results and to **carry out the right improvement strategy**.

Engineering, research and development

We realize **customized system and devices for the sanitization** of air, liquid and surfaces, using a structured workflow that emphasizes each phase of the manufacturing process. From the **research** to the technical **engineering**, using the latest 3D modeling tolls and light studies, until the concrete implementation of products, we care every single details to guarantee reliable, functional and workmanlike products. We project all the devices to meet different needs.

Testing

We provide to our clients testing services, according to **BS ISO 15714:2019** standard in our facilities, that means the possibility to carry out dedicated test rig to evaluate the effectiveness of sanitization systems. From those results we elaborate **performance reports and certifications**, thus we supply reliable validations guaranteeing the highest level of **security** and **assurance**.
Our team performs specific analysis in collaboration with qualified operators, following all the lab's good practice and the reference standard.

Scientific assistance and patenting

We offer scientific assistance to support our products, such as **interpretation of the data** and validation of protocols. We join our customers during the **patenting process** with focused consultancy on **intellectual property** and the **protection of innovations**. Thus we guarantee the assurance of the results, and their adequate securing and valorization on the market.

Scientific and technological value

As a spin-off of the University of Urbino, STE projects products and offers services with scientifically valuable solutions. In addiction, o**ur products are are the subject of main scientific publications** on international journals, available on our website.

Read our scientific publications:

- Baldelli, G., Aliano, M.P., Amagliani, G., Magnani, M., Brandi, G., Pennino, C., Schiavano, G.F. Airborne Microorganism Inactivation by a UV-C LED and Ionizer-Based Continuous Sanitation Air (CSA) System in Train Environments. Int J Environ Res Public Health. 2022;19(3):1559.

- Palma, F., Baldelli, G., Amagliani, G., Aliano, M.P., Brandi, G., Schiavano, G.F. Use of an eco-sustainable UV-C LED continuous sanitation air (CSA) system in indoor sport environments. Journal of preventive medicine and hygiene. 2022; Vol.63 N.2S1.

- Palma, F., Baldelli, G., Schiavano, G. F., Amagliani, G., Aliano, M. P., & Brandi, G. Use of Eco-Friendly UV-C LEDs for Indoor Environment Sanitization: A Narrative Review. Atmosphere. 2022; 13(9), 1411.

Granted patents and pending application:

- Microbiological sanitization and air purification system for hvac system of a railway vehicle (WO2021234529A1)

- Microbiological sanitization device for liquids (Question number: 102025000006447)

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Our dedication

Our goal is to make **innovative technology** available to everyone, because it is able to improve the quality of life and the environments where we live and work. Our range of products, that is in continuously evolution, consists into three broad categories, AIR, SURFACES and LIQUIDS. We target to **end consumers** (B2C) and also to **professional sectors**.

We are expanding our commitment to new frontiers. Our next aim is to project pioneers system for **liquids sanitization**.

Every products is designed to be settled in each context of use, supporting people into their daily activities and offering them a tangible wellness experience. With our solutions we want to build **healthier**, efficient and sustainable **environments**. We empower our clients and partners in a path of growing and innovation.

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