

# Plasma Guns 2.0: Disinfection Redefined through Project ACTIVE

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*Surface disinfectants are crucial in keeping us safe, especially during health crises like COVID-19. In October 2021, **THINK** engaged with the team of Project SANITAS about this matter. Now, SANITAS has evolved into Project ACTIVE, which takes disinfection to the next level through advanced technology that creates disinfectants right where they're needed. This article explores how ACTIVE works, the challenges it faces, and its potential to transform how we stay clean and healthy.*

Amid the chaos of COVID-19, a group of researchers armed themselves with an unconventional weapon – plasma. Not the kind found in our blood, but rather the energised fourth state of matter. Imagine harnessing the power of lightning to annihilate germs on surfaces all around us. Sounds like something out of a sci-fi movie, right? Well, Project ACTIVE managed to bridge reality with science fiction.

But before we dive into this energised adventure, let's rewind a bit and set the stage. Picture a world gripped by a pandemic, where hand sanitisers have become scarce as gold and disinfection is the mantra of the hour. It was in this chaos that Project SANITAS emerged.

The research team was originally developing a means for improved antimicrobial solutions that would make seeds safer for human consumption. However, their focus quickly pivoted when the scarcity of hand sanitisers highlighted the urgent need for alternative disinfectant solutions. Project SANITAS was conceived to provide innovative solutions to combat the dire need for a reliable supply of effective disinfectants.

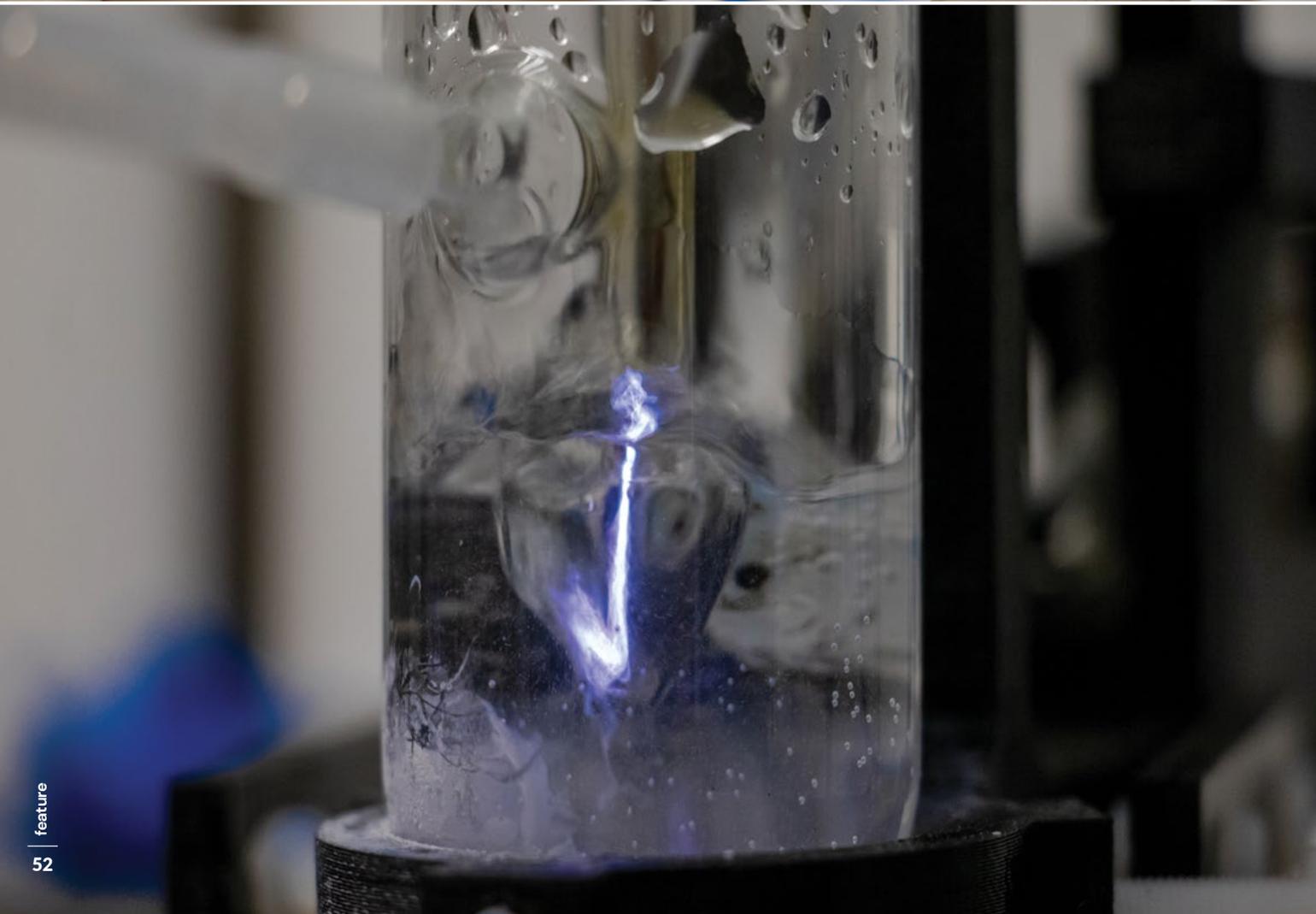
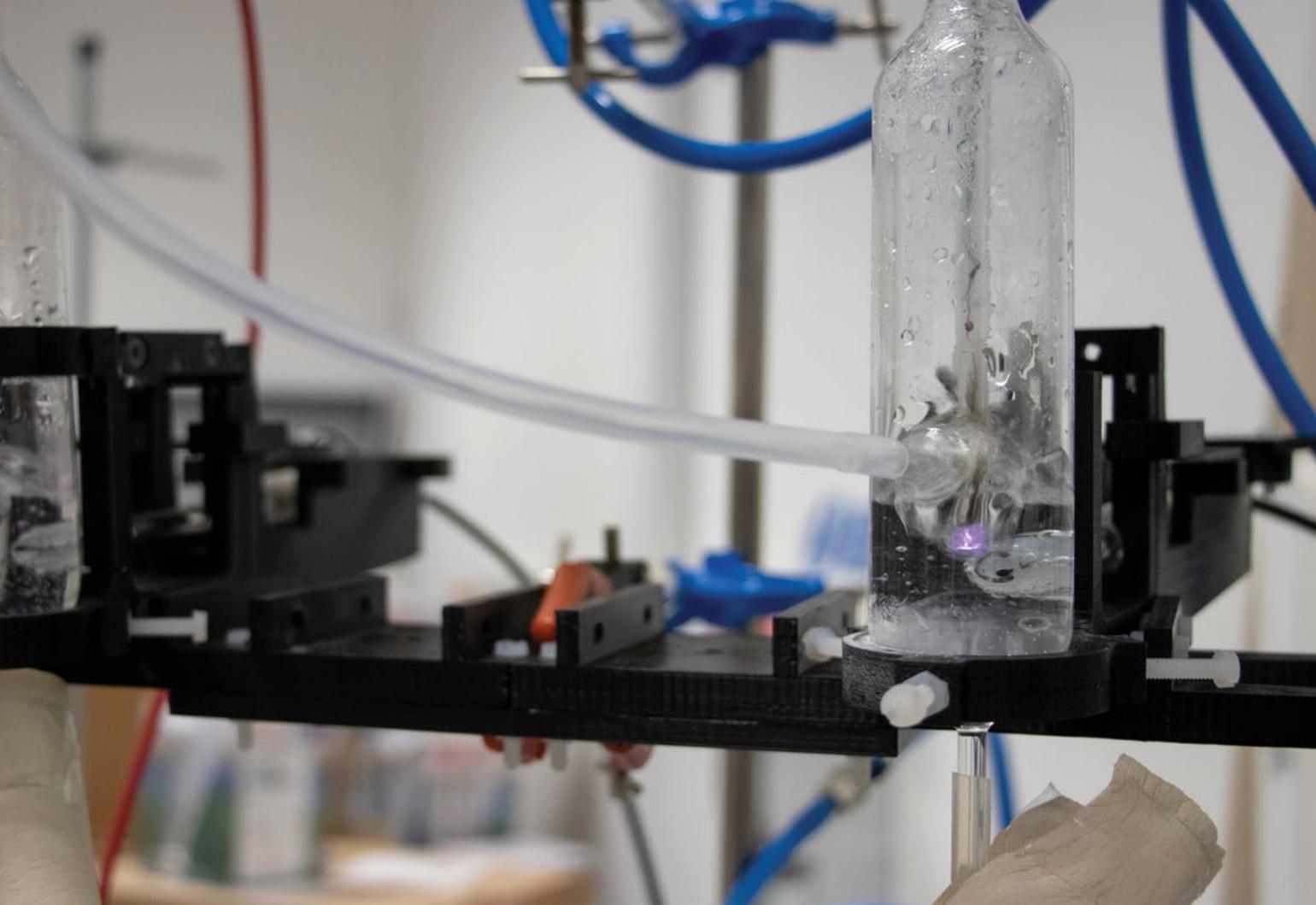
Fast-forward to the present, and SANITAS has metamorphosed into Project ACTIVE, a dynamic evolution of its predecessor. Building upon SANITAS's foundational research and technological advancements, ACTIVE seeks to further refine and optimise non-thermal plasma-based

disinfection technology for a wide range of applications. But what is non-thermal plasma-based technology?

## EXPLORING THE TECHNOLOGY: NON-THERMAL PLASMA DISINFECTION

At the heart of Project ACTIVE lies the utilisation of non-thermal plasma for disinfection purposes. Imagine if you could turn air into a special kind of glowing, high-energy gas, sort of like the light in a neon sign. Put simply, that is what plasma is! It's a supercharged form of gas that can do some really cool things.

Project ACTIVE utilises innovative technology to create plasma at lower working ambient temperatures (hence why it's called non-thermal plasma). ▶



Images (left and right) show non-thermal plasma discharges used for the production of plasma activated solutions

Photos by Kristov Scicluna



In this case, the plasma generated is used to energise water molecules and other chemicals to produce reactive oxygen species. With their unbalanced electrical charges, these ionised chemicals can destabilise germs' protective coatings, which deactivates and neutralises them. In fact, Project ACTIVE's non-thermal plasma-based disinfection sets it apart from traditional chemical agents by creating harmless by-products, minimising ecological impact while effectively combating pathogens.

One of the distinguishing features of non-thermal plasma disinfection is its ability to target a broad spectrum of pathogens, including enveloped viruses like SARS-CoV-2. This versatility makes it a promising tool for combating infectious diseases in various settings, from healthcare facilities to food

processing plants. Additionally, non-thermal plasma offers several advantages over traditional chemical disinfectants, including reduced reliance on harmful chemicals and a smaller environmental impact.

### **REGULATORY CHALLENGES AND SAFETY STANDARDS**

It's better than conventional disinfectants, has fewer harmful chemicals, and can be produced from water, so why aren't we using this everywhere? Despite its potential, developing and implementing non-thermal plasma disinfection technology poses significant regulatory challenges. Biocidal products, including disinfectants, are subject to stringent regulations set by governing bodies such as the European Commission. Compliance with these regulations

requires extensive testing and evaluation to ensure the safety, efficacy, and environmental impact of the technology.

Before becoming regulated, Project ACTIVE needs to conduct comprehensive testing to demonstrate its effectiveness against various pathogens, including bacteria, fungi, yeast, and viruses. Additionally, safety assessments must be conducted to evaluate the potential toxicity and irritability of the disinfectant formulation, ensuring it is safe for human use.

### **GREEN TECHNOLOGY WITHIN HEALTHCARE SETTINGS**

In addition to ensuring the safety of the disinfectant for human use, researchers aim to minimise its impact on the environment. Traditional chemical agents often leave residues ▶



**The Project ACTIVE team from left to right: Dr Sholeem Griffin, Prof. Ruben Gatt, and Dr Jefferson De Oliveira Mallia**  
*Photo by Kristov Scicluna*

that can harm the environment. However, Project ACTIVE's non-thermal plasma-based disinfection creates reactive oxygen species from water and other chemicals, which break down into harmless substances, reducing environmental impact.

Furthermore, Project ACTIVE focuses on energy efficiency during plasma generation. Researchers adjust parameters like gas composition and discharge characteristics to minimise resource use without sacrificing disinfection effectiveness. This eco-friendly approach not only cuts operational costs but also reduces the project's carbon footprint, promoting environmental sustainability.

Moreover, Project ACTIVE emphasises developing environmentally friendly disinfectant formulas. Chemists carefully select compounds with biodegradability and low environmental toxicity, ensuring minimal ecological impact throughout the disinfectant's life cycle. Efforts to enhance stability and shelf-life also minimise waste and encourage sustainable usage.

## **DECENTRALISATION FOR ENVIRONMENTAL IMPACT REDUCTION**

Instead of relying on traditional methods that involve making and moving disinfectants over long

distances, Project ACTIVE can install disinfection machines directly where needed, such as in hospitals, kitchens, and public areas. Dr Jefferson De Oliveira Mallia (research support officer at the Faculty of Science) explains: 'At its core, Project ACTIVE seeks to decentralise disinfectant production by introducing on-site manufacturing devices capable of producing certified disinfectants without reliance on traditional supply chains.'

This change reduces the need to transport disinfectants around, which cuts down on pollution from transportation and waste due to packaging and handling. By making disinfectants closer to where they are used, Project ACTIVE reduces waste and helps keep the environment cleaner.

The potential applications of Project ACTIVE extend beyond healthcare and hygiene to various sectors, including food safety, agriculture, and environmental remediation. In the food industry, plasma-based disinfection can be used to decontaminate surfaces, equipment, and packaging materials, reducing the risk of foodborne illnesses and extending shelf life. In agriculture, plasma technology shows promise for treating seeds and controlling plant diseases, offering a sustainable alternative to chemical pesticides.

Environmental applications for the technology developed through Project ACTIVE include air and water purification, soil remediation, and waste treatment. Plasma-generated reactive species can degrade organic pollutants, neutralise harmful pathogens, and remove contaminants from environmental matrices. By harnessing the power of non-thermal plasma, Project ACTIVE aims to contribute to environmental protection and sustainable development, mitigating pollution and promoting ecosystem health.

Looking to the future, Project ACTIVE envisions a world where plasma-based disinfection is widely adopted as a safe, effective, and environmentally friendly solution for protecting public health and enhancing quality of life. Through ongoing research, innovation, and collaboration, Project ACTIVE strives to realise this vision, paving the way for a cleaner, healthier, and more sustainable future for all. [T](#)

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