

Title of Project

English: Chaotized Plasma for actively combating airborne COVID19

Chinese: 用於主動對抗懸浮於空氣傳播的新冠病毒的混沌等離子體

Abstract of Research Comprehensible to a non-specialist

We propose a safe technology of Chaotized Plasma to disinfect suspended viruses because plasma air ionization was proven to reduce Coronavirus Surrogate MS2 Bacteriophage by 99% in Independent Spanish Testing and many other places.

UK Health and Safety Executive said, “Do not rely on recirculation units which just move COVID virus around”. Omicron viruses were found in the air purifiers at Silka Seaview Hotel on 18/1/2022 and at Hakka Cuisine in the Lion Rock Shopping Centre on 31/1/2022 and people were infected just under the air purifiers. Just air exchanges as mandated by the Hong Kong Government in designated places are not scientific as viruses are still active and infecting the air purifiers. Existing disinfection technologies, e.g. nano-coating, silver ions, spirit, and UVC(Ultraviolet-C light) are for landed viruses only. However, over 90% of COVID infection is through the air. The European Commission has published its decision to classify nano-coating as a category 2 carcinogen.

Evidence from the HK Airport Toilets and Moon Palace Restaurant shows that Omicron is not a landed virus and is transmitted mainly through the air. On 2/1/2022, the Health Protection Centre inspected the Moon Palace Restaurant in Festival Walk and collected over 80 environmental samples with no landed viruses found. On 4/2/2022, 5 people were infected in Caritas Hospital but the ventilation was good. Therefore, good ventilation may not be able to avoid infection. The main cause of the disease is airborne. Air disinfection is necessary.

The PI used chaotized bleach water in 2003 to disable viruses from patients coughing at an airspeed of 22m/s (funded by the Research Grant Council) and then chaotized ozone water in 2020 for negative pressure isolation rooms (funded by ITF). The former devices were installed in the Prince of Wales Hospital and the latter in Pok Oi Hospital and Society for the Blind Care Homes successfully. Now, instead of vapor, we use chaotized plasma, the first time in the world. Plasma is produced by elevating the usual 220V voltage to 5000V and discharging between positive and negative poles. For example, O₂ is split into O⁺ and O⁻ ions, both will neutralize back to O₂ releasing tiny energy to disable microbe’s reproduction. However, ions and viruses are extremely small (nanometres) that they have little chance to meet in a finite space. Chaotic mixing of ions and virus is created inside the invented use of Chaosors so that, in a trial run using Eilat coronavirus, 99% efficacy of disinfection within 0.1 seconds can be achieved. It was found also that the efficacy is reduced to less than 10% when plasma was not chaotized. Plasma can also decompose big air molecules like formaldehyde and H₂S. Therefore, chaotized plasma can deodorize.

The project’s deliverables include (1) chaotic simulation of viruses and plasma ions by computational fluid dynamics; (2) hardware: air disinfection devices for use in institutions; (3) Indoor Air Quality monitoring devices in smart and healthy city applications; (4) student learning materials in engineering, biophysics, and microbe disinfection; (5) patents, seminar and conference presentations and paper publications. New knowledge for teaching and learning in hygiene practices and air disinfection will be created in the post-COVID19 healthy-smart city.

The device will be installed at the inlet of an Air Handling Unit to clean air almost costless.

It will also be tested in a model elevator. The piston effect of the lift car movement provides the airflow and cleans the adjacent air at merely 0.04% additional energy cost by chaotized plasma. The PI will use four of his invention patents in this project. Extensive public engagement activities are arranged for wide application and commercialization.