Contribution ID: **109** Type: **Poster**

Advancing Air Purification in indoor HVAC system: A 90-Day Comparative Study of Cold Plasma Ionization Electrical Filter (IEF) and conventional bag filter system in filtration performance, energy efficiency, and pressure drop in a medical facility

1.Abstract
Indoor air purification and disinfection in medical facilities represent multi-billion dollar markets. [1] Compared to conventional HEPA and activated carbon filters, electrostatic filtration with low-temperature plasma technology offers several unique advantages. The plasma field charges fine particles and captures them using an oppositely charged electrode [2]. Simultaneously, high-energy radicals generated by the plasma field effectively eliminate bacteria and germs. Collected pollutants adhere to the electrodes, which are washable, eliminating the need for disposable filters. This not only reduces operational costs but also minimizes secondary pollution. Additionally, the technology's open structure enhances airflow, ensuring a consistent CADR while simultaneously reducing energy consumption by up to 20%, which significantly lowers the carbon footprint.

We will explore the principles of cold-temperature plasma technologies in air filtration and showcase prototypes of the IEF designed based on these principles. To demonstrate the benefits of cold plasma ionic electrical filtration (IEF) technology—particularly its advantages in air filtration and HVAC performance—we developed an in-house system to compare its energy consumption and pressure drop against an H11 HEPA filter under identical ducting and airflow conditions. The system features an air switch that allows airflow to be directed through either the HEPA filter or the IEF module. By continuously monitoring pressure drop and power consumption for both setups, we have shown that at an airflow rate of 3 m/s, the TPA filtration system exhibits only about one-third of the pressure drop of the HEPA system under the same configuration.

To validate our findings in real-world applications, we also collected in-situ data on filtration efficiency, pressure drop, and power consumption of an IEF filter compared to a F9 bag filter used as standard. Over a 90-day period, we continuously monitored and recorded performance data, which demonstrated highly promising results for the IEF filter in terms of stability and energy savings. These insights offer valuable guidelines for practical implementation in real-world applications.

Primary author: Dr ZHANG, Yan

Co-authors: Dr GALMOZZI, Ferruccio; Dr MOLERI, Mario; GAO, X.H.; LIU, Y.G.

Presenter: Dr ZHANG, Yan