

# EFFICIENT, HIGH VELOCITY AIR PURIFICATION WITH A SOFT X-RAY ENHANCED ELECTROSTATIC PRECIPITATOR

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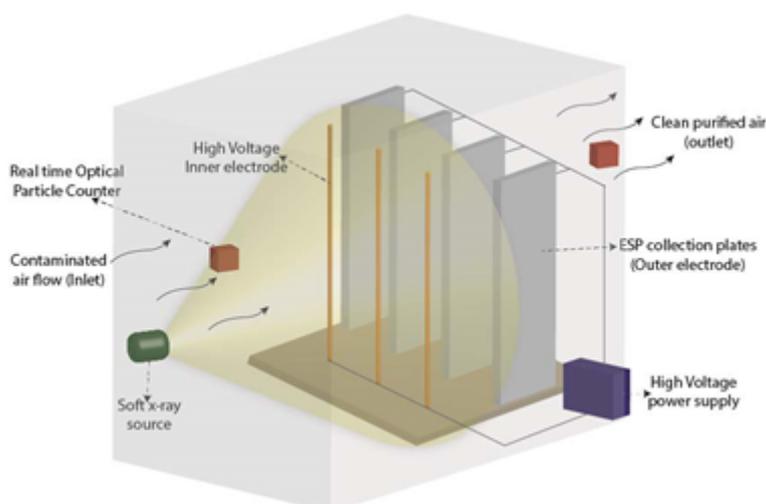
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Engineers in Prof. Pratim Biswas' laboratory have developed an electrostatic precipitator device that removes ultrafine pollutants and inactivates pathogens from the air at high efficiency and low cost. This gas cleaning system has the potential to replace HEPA filters for air filtering applications in hospitals and other buildings with stringent air quality requirements.

Electrostatic precipitators (ESPs) purify the air by ionizing the pollutant particles and then capturing them for removal, but ESPs are typically inefficient for high speed, large volume gases. This technology combines a variety of features (soft X-ray irradiation, electrode geometry and photocatalyst materials) that together provide a high efficiency, low-cost air purification device.

The system is designed to remove a range of ultrafine contaminants (dust, pollutants, microorganisms, volatile organic compounds) at high velocity while providing real-time performance monitoring with an optical particle counter. Particle capture with this ESP is comparable to HEPA filters at flow velocities up to 2000 fpm, and this efficiency is maintained with a pressure drop  $<0.2$ ". Furthermore, the device can be integrated into existing air handling units or filtration devices with end-user applications in residences, aircraft cabins, clean rooms or hospitals.



*Schematic of Soft X-Ray Enhanced Air Filtration with Performance Monitoring*

## Stage of Research

The inventors have demonstrated that soft X-ray enhanced air filtration can work over multiple scales for high efficiency particle removal from gas streams such as industrial exhausts and air ducts (indoor).

The device is very efficient at capturing and inactivating bioagents such as bacteria and viruses.

## Publications

- Kettleson, E. M., Schriewer, J. M., Buller, R. M. L., & Biswas, P. (2013). [Soft-X-ray-enhanced electrostatic precipitation for protection against inhalable allergens, ultrafine particles, and microbial infections](#). *Appl. Environ. Microbiol.*, 79(4), 1333-1341.

## Applications

- **Air filtration/purification** – soft-X-ray irradiation could be incorporated into existing air filtration devices

## Key Advantages

- **High filtration efficiencies:** comparable to HEPA filters at flow velocities up to 2000 fpm
- **Real-time performance monitoring**
- **Reduced operational costs:**
  - maintains efficiency with pressure drop <0.2” (10x lower than HEPA filters), reducing energy needs incurred with pressure drop
  - no cost for replacement filters

## Patent

- [Systems and methods for gas cleaning using electrostatic precipitation and photoionization](#) (PCT Publication No. WO2017143255A1)

## Related Technology

- [Charging and capture of particles in coronas irradiated by in-situ X-rays](#) (U.S. Patent No. 6,861,036, WUSTL Technology T-003094)

**Related Web Links** – [Biswas Aerosol and Air Quality Research Laboratory](#)