

MULTI-STAGE AIR PURIFICATION SYSTEM WITH HEMISPHERICAL DISCHARGE

IITM Technology Available for Licensing

Problem Statement

- Indoor air pollutants contain unwanted particulates, gaseous contaminants and microbes, which are emitted by indoor sources, generated as secondary by-products of chemical reactions or infiltrated from outdoors.
- Air-conditioning systems with filters remove only particulate pollutants. Moreover, if these filters are not maintained properly then microbial growth can emit microbial Volatile Organic Compounds (VOCs).
- Adsorption and photo-catalysis have been used to treat gaseous pollutants. However, pollutant removal efficiency of photocatalytic TiO_2 and activated carbon coated filters is reduced due to UV induced byproducts and unstable coating that blows away in the treated air.
- There is a need for a self-maintenance adsorption enhanced conductive photocatalytic air purifier with 360 degree discharge that removes various pollutants while not not release harmful byproducts.

Intellectual Property

- IITM IDF Ref. 2006
- IN 366201- Patent Granted

TRL (Technology Readiness Level)

TRL 5- Technology Validated in Relevant environment

Technology Category/ Market

Category-Environmental Engineering

Industry Classification:

- NIC (2008)-28195- Manufacture of filtering and purifying machinery or apparatus for liquids and gases; 28192- Manufacture of air-conditioning machines, including motor vehicles air-conditioners
- NAICS (2022)- 333413- Industrial and Commercial Fan and Blower and Air Purification Equipment Manufacturing; 335220- Major Household Appliance Manufacturing; 333415- Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing

Applications- Air purifiers and Air conditioners

Market Drivers-

- The Air Purifier Market size is estimated at USD 16.83 billion in 2024, and is expected to reach USD 23.60 billion by 2029, growing at a CAGR of 7% during the forecast period.

Research Lab

Prof. SM Shiva Nagendra,

Dept. of Civil Engineering, IITM

Technology Transfer Office
TTO - IPM Cell

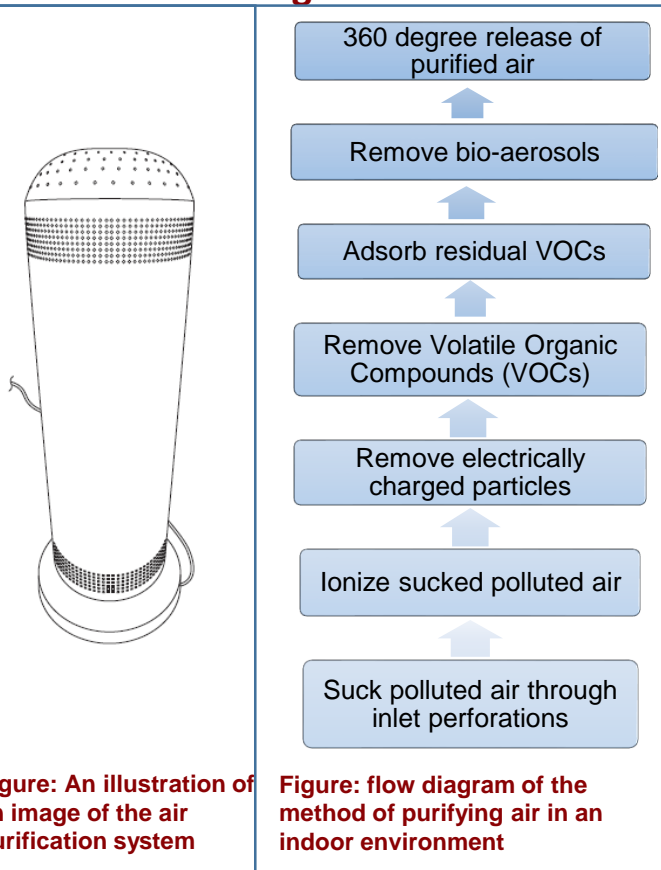


Figure: An illustration of an image of the air purification system

Figure: flow diagram of the method of purifying air in an indoor environment

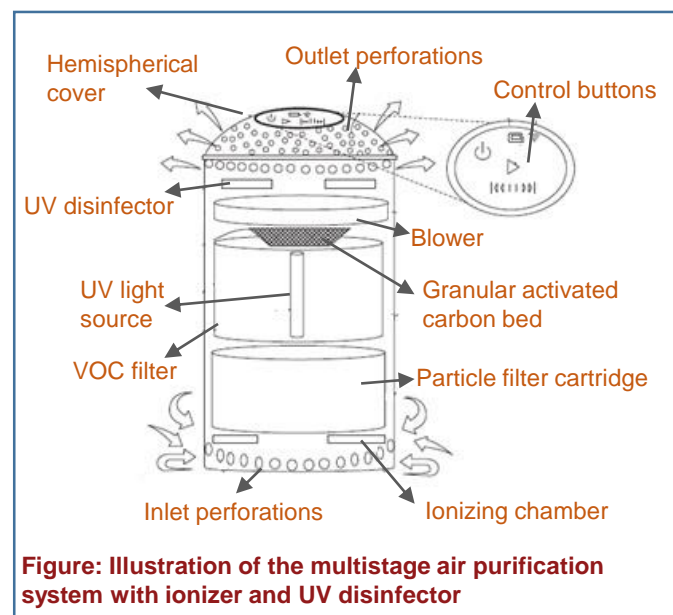


Figure: Illustration of the multistage air purification system with ionizer and UV disinfecter

CONTACT US

Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
<https://ipm.icsr.in/ipm/>

Email: smipm-icsr@icsrpiis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

MULTI-STAGE AIR PURIFICATION SYSTEM WITH HEMISPHERICAL DISCHARGE

IITM Technology Available for Licensing

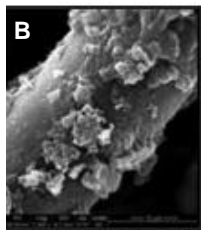
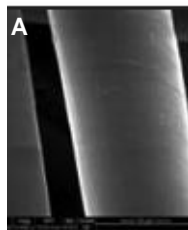


Figure: SEM image of Photocatalytic filter (A) before and (B) after coating the hydrolyzed polyester substrate with polyelectrolyte (CPANI) followed by dipping in a solution of activated carbon/PSS and then a suspension of TiO_2P25

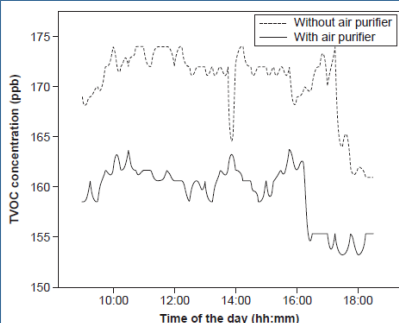


Figure: PM1 concentration when measured on three alternative days with and without air purifier

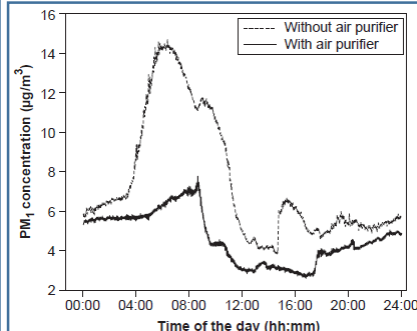


Figure: TVOC concentration when measured on three alternative days with and without air purifier

Technology

- 1 The system includes a particle filter cartridge, a photocatalytic oxidation (PCO) filter cartridge coated with composite photocatalysts with porous materials to absorb VOCs using UV light and a granular activated carbon filter to adsorb the residual VOCs.
- 2 An ionizer chamber and a UV disinfectant are included near the inlet and outlet respectively
- 3 The composite photocatalyst comprises a combination of polyelectrolyte solution (CPANI), an activated carbon (AC) solution (AC/Polystyrene Sodium Sulfonate (PSS)), and a suspension of TiO_2 (TiO_2P25)
- 4 the hemispherical top dome provides a uniform distribution of purified air in all three dimensions

Key Features / Value Proposition

- The particle filter cartridge in combination with the ionizers used in the air system are effective in removing particles below $2.5 \mu m$ size with more than 70% removal efficiency.
- The air purification system was installed, tested and validated in an office environment. The photocatalyst coating was stable compared to such coatings in conventional purifiers getting blown away on use.
- The band gap energy diagram of the photocatalytic filter used in the system (CPAT) in comparison with two other filters (pure TiO_2 and composite CSAT filter) show that the filter operates well even when illuminated with a visible light LED.
- The purification system effectively removes particulate pollutants, microbes and VOCs. Whereas, conventional HEPA filters are able to remove only particulate matter.

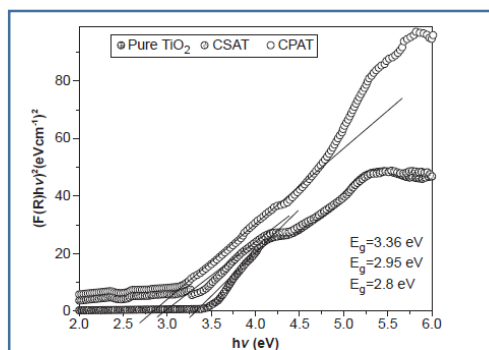


Figure: Band gap energy diagram of the photocatalytic filter used in the system (CPAT) in comparison with two other filters (pure TiO_2 and composite CSAT filter).

CONTACT US

Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
<https://ipm.icsr.in/ipm/>

Email: smipm-icsr@icsrpiis.iitm.ac.in
sm-marketing@imail.iitm.ac.in

Phone: +91-44-2257 9756/ 9719