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Improving Air Quality Quotient with Tech

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Air quality affects all living organisms in diverse ways. Airborne pathogenic microbes are associated with many infectious diseases such as tuberculosis, severe acute respiratory syndrome (SARS), avian flu, anthrax, and SARS-CoV-2. In particular, the COVID-19 pandemic has demonstrated the real need for mechanisms to control the spread of airborne respiratory pathogens. Thus, preventing the spread of disease from pathogens has come to the forefront of the public consciousness. And this has brought an increasing demand for novel technologies to prioritise clean air by both big and small players.



Over the years, there have been a number of novel filters introduced to try and prevent the spread of air-borne pathogens and pollutants through heating, ventilation and air conditioning (HVAC) systems. For example, in aerospace cabins HVAC systems are designed to be used with high-efficiency particulate air (HEPA) filters. HEPA are extremely efficacious at screening out airborne viruses and bacteria due to their small particulate size. However, a significantly higher level of energy is required to push air through HEPA filters compared to basic HVAC filters.

While these air filtration systems can effectively remove pathogenic microorganisms from the indoor air environment, the organisms are not destroyed and can remain viable, or even proliferate, within the air filtration system and on the filter media. Therefore, the filter itself can behave as a source for contamination of the air environment with airborne pathogenic microorganisms.

Due to the risk of filters acting as a reservoir for contamination of the indoor air environment, and in response to the COVID-19 pandemic, there has been an increase in demand for novel antimicrobial technologies to prevent transmission.

With advancements in nanotechnology, many researchers across the globe are employing the unique properties of nanomaterials to develop efficient and sensitive detection methods. Nanomaterials have enabled miniaturisation of sensing devices, leading to rapid, portable, and sensitive pathogen diagnostic systems that can detect airborne pathogens in hospitals, air vents, and aeroplanes and anticipate bioterrorism attacks in public spaces.

The incorporation of silver nanoparticles into meshes for filters has also been tested in a range of forms. Studies have reported the development of a nano-fibrous air filter with incorporated silver nanoparticles to impart an antimicrobial effect. The inclusion of silver nanoparticles demonstrates an effect on survival of both gram-positive and gram-negative bacteria on the filters.

Further, carbon nanotube filters have demonstrated a 90 per cent reduction in virus survival downstream of the filter, which is significantly more effective than the silver nanoparticle technology.

"Children who breathe in polluted air are more likely to develop asthma or other breathing conditions that will affect them throughout their lives. Adults and elderly who regularly breathe in polluted air can develop acute infections like pneumonia or chronic diseases like chronic obstructive pulmonary disease (COPD) or chronic bronchitis. All of these ailments have been on the rise over the last decade as air has become dirtier. Thus, many industry leaders in the life sciences sector are focusing on treating the cause of these diseases by highlighting the importance of clean air", says **Amarpreet Rai, Co-Founder & Director of Operations and Development, Sanrai Med India**

Recent studies have revealed that far-UVC light from lamps installed in the ceiling could be a highly effective passive technology for reducing person-to-person transmission of airborne-mediated diseases such as COVID-19 and influenza indoors, and lowering the risk of the next pandemic.

A direct approach to limit airborne pathogenic transmissions is to inactivate them within a short time of their production. Germicidal ultraviolet light, typically at 254 nm, is effective in this context but, when used directly, can be a health hazard to skin and eyes. By contrast, far-UVC light (207–222 nm) efficiently kills pathogens potentially without harm to exposed human tissues.

Sharing her thoughts on the new technologies being developed to tackle air-borne pathogenesis and pollution, **Dr Rajvi Mehta, Microbiologist and Scientific consultant, Trivector Biomed** says, "The pandemic has made people realise the

importance of air quality and search for effective means for air purification. Many new technologies which were available even before the pandemic are now getting more exposure. However, at the same time, many products are coming into the market making tall claims and mis-leading vulnerable customers. With the launch of far-UVC light disinfection devices which can be safely used around human beings, it is certainly going to have a paradigm shift in the practices of infection control and our company would certainly play a major role in it by offering the latest technologies at affordable costs.”

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