

PEOAS: Plasma Electrolytic Oxidation Air Sterilizer

ABSTRACT

In our modern era, the quality of the air we breathe has emerged as a critical determinant of public health and environmental well-being. With the advent of global industrialization and urban sprawl, the air is increasingly laden with a myriad of pollutants and infectious agents. The recent outbreak of COVID-19 has further underscored the dire need for effective air sterilization in enclosed spaces, such as outpatient clinics, hospital wards, and public forums. In this context, the Plasma Electrolytic Oxidation Air Sterilizer (PEOAS), henceforth referred to as the Sterilizer, is introduced as a ground-breaking solution. This innovative device is not only capable of purifying air from particulate matter, including PM2.5, PM10, and gaseous contaminants, such as SO₂, NO_x, and VOCs but also boasts the remarkable ability to eradicate viruses as small as 0.1 microns or even smaller. By leveraging advanced technologies, the Sterilizer ensures a safer and healthier indoor environment, fortifying our defences against a spectrum of airborne diseases and pollutants.

The Sterilizer operates on a sophisticated multi-tiered purification system, each layer meticulously orchestrated to target and neutralize a specific category of airborne contaminants. The process begins with the strategic intake of external air into a specialized chamber, setting the stage for a comprehensive purification journey. The air is first refined through a nano-layer derived from Royal Poinciana tree fibres, which not only filters but also freshens the air. Following this, an electrostatic magnetic field generates negative ionizers, crucial in eradicating bacterial and fungal components, thereby mitigating the risk of airborne infections.

Progressing through the system, the air encounters a layer of Titanium dioxide (TiO₂), enhancing the photocatalytic degradation of pollutants and breaking down complex organic compounds. An activated charcoal and carbon layer adeptly intercepts fine particulates, providing relief from pollution-induced respiratory issues. The utilization of ultraviolet rays, in conjunction with an Anti-bacterial layer, ensures that the air is not merely clean, but also sterile and devoid of microbial threats.

A defining feature of the Sterilizer is its unparalleled efficacy in neutralizing viruses as diminutive as 0.1 microns, a capability that distinguishes it from conventional air purifiers. This feature is particularly pivotal in the context of the recent global health crisis, where the transmission of viruses through aerosols has been a significant concern. The integration of copper coordination polymer particles (PCO) adds another layer of purification, reinforcing the system's ability to neutralize a broad spectrum of airborne contaminants. High-efficiency particulate air fibre sheets capture the majority of harmful particles, while a Venturi vent made of copper and brass optimizes airflow, ensuring efficient circulation of purified air.

In conclusion, the Sterilizer is not just an air purification system; it's a testament to the synergy between innovative engineering and an unwavering commitment to public health. Its introduction marks a critical advancement in air purification technology, offering a holistic

solution to the pressing challenges of indoor air quality and setting a new benchmark for clean, breathable air in indoor spaces.

BACKGROUND OF INVENTION

Air, the very essence of life, is a complex amalgam of gases that supports and sustains life on our planet. However, the sanctity of this life-sustaining resource is being incessantly compromised by an array of anthropogenic activities. Industrial emissions, vehicular exhaust, and combustion of fossil fuels contribute significantly to air pollution, releasing a slew of pollutants such as fine particulate matter (PM_{2.5} and PM₁₀), sulphur dioxide (SO₂), nitrogen oxides (NO_x), and volatile organic compounds (VOCs). These pollutants are not confined to the outdoors; they insidiously permeate indoor environments, exacerbating the risk of respiratory diseases, cardiovascular problems, and other health conditions. Furthermore, indoor air often becomes a breeding ground for various microbes, viruses, prions, fungi, and other microorganisms, which can be dispersed through coughing, sneezing, or even normal respiration.

The dire implications of poor air quality are manifold and far-reaching, affecting not only human health but also the broader ecological balance. Recognizing the urgency of the situation, there has been a global impetus to develop innovative solutions that can effectively purify and sterilize indoor air, making it conducive to human health and well-being.

OBJECTIVE OF INVENTION

The primary objective of the Sterilizer is to revolutionize indoor air quality by introducing an advanced air purification system that goes beyond mere filtration. It's meticulously engineered to address the multifaceted challenges posed by indoor air pollution, ensuring comprehensive air sterilization. The Sterilizer is designed to be a bulwark against a spectrum of air pollutants and pathogens. It not only captures and neutralizes particulate matter, gaseous pollutants, and chemical compounds but also exhibits an unparalleled efficacy in eradicating airborne viruses, bacteria, and other microbial entities. One of the standout features of the Sterilizer is its ability to target and neutralize viruses as small as 0.1 microns, a capability that is not typically found in conventional air purifiers. This feature is particularly pivotal in the context of the recent global health crisis, where the transmission of viruses through aerosols has been a significant concern.

FIELD OF INVENTIONS

The Sterilizer represents a harmonious fusion of mechanical ingenuity and nanotechnology. It is a testament to human innovation in the field of air purification, setting new standards in the quality of indoor air. The invention transcends the conventional paradigms of air purification, incorporating a series of sophisticated processes that work in concert to deliver air that is not just clean, but sterile and wholesome.

BRIEF SUMMARY OF THE INVENTION

The PEOAS is a comprehensive air purification system designed to tackle a wide array of indoor air pollutants. The device consists of multiple purification and sterilization layers, each serving a distinct function in the purification process. From the intake of outside air to the final delivery of purified air, the system ensures meticulous filtration, sterilization, and improvement of indoor air quality. The integration of advanced materials, such as Royal Poinciana tree fabric, Titanium dioxide (TiO₂), activated charcoal, and copper coordination polymer particles, underscores the device's commitment to leveraging cutting-edge technology for air purification.

DETAILED DESCRIPTION OF THE INVENTION

The Sterilizer is an epitome of technological sophistication, featuring a multi-tiered purification system that meticulously cleanses and sterilizes indoor air. Each layer within the system is designed with a specific purpose, ensuring that every aspect of air purification is addressed comprehensively. The detailed operation of the PEOAS system unfolds over several stages, each a critical cog in the machine of air purification:

Process 1 - Intake of Outside Air

The system begins by taking in air from the outside environment. This is the first step in the purification process where raw, unfiltered air enters the chamber for treatment.

Process 2 - Purification through Pre-Filter

The initial stage of filtration involves a pre-filter that captures larger particulate matter such as dust, pollen, and hair. This early interception is crucial for protecting the more refined filters downstream and ensuring their longevity and efficiency.

Process 3 - Purification through Fine-Filter (Aluminium Mesh)

Following preliminary filtration, the air is further refined through a fine aluminium mesh filter. This stage targets smaller particles not captured by the pre-filter, enhancing the overall particulate removal efficiency of the system.

Process 4 - Electrostatic Precipitator

Next, the air is subjected to an electrostatic precipitator that employs an electric charge to attract and trap extremely fine particulate matter. This technology is particularly effective in removing smoke and microscopic pollutants, significantly improving air quality.

Process 5 - Royal Poinciana Layer

The incoming air is then passed through a nano-layer made from the fabric of Royal Poinciana tree. This layer possesses natural air purification properties, contributing to the removal of additional contaminants and enhancing air freshness.

Process 6 - Activated Carbon Layer

After initial purification, the air is subjected to an electrostatic magnetic field. This process generates negative ions, which are known to attach to and neutralize airborne particles like bacteria and fungi, effectively removing them from the air.

Process 7 - Titanium Dioxide Layer

Next, the air passes through an outer layer of Titanium dioxide (TiO₂). It acts as a photo catalyst when exposed to UV radiation, breaking down contaminants at a molecular level.

Process 8 - Ionizer Layer

The air is then filtered through layers of activated charcoal and carbon. These materials are highly porous and have a large surface area, making them effective at trapping pollutants like PM 2.5 and PM 10.0, which are particulate matter with diameters of 2.5 and 10 micrometres, respectively.

Process 9 - Cold Plasma Layer

The cold plasma layer employs plasma technology to deactivate a wide range of pathogens, including bacteria, viruses, and mould spores, without the need for high temperatures. This energy-efficient method ensures the air is not only clean but also safe for indoor environments.

Process 10 - Ultraviolet Filtration

Along with the antibacterial layer, the air is exposed to ultraviolet rays. UV light has the ability to dismantle and inactivate bacterial and fungal elements, adding another level of purification.

Process 11 - Venturi Vent

Air then passes through a venturi vent made of copper and brass. The venturi effect creates a lower pressure zone that helps to propel the air with greater force through the system.

Process 12 - Centrifugal Fan

A centrifugal fan is used to pull air from the outside to the inside of the system and then thrust it back out. This ensures a continuous flow of air through the purifier.

Process 13 - Digital Measurement of Air Parameters

This process involves sensors and digital systems to monitor the quality of air, such as measuring levels of various pollutants, to ensure the system is functioning correctly and effectively improving air quality.

The Sterilizer is not just an air purifier; it's a beacon of hope in our collective quest for a healthier, cleaner indoor environment. Its ability to neutralize viruses as small as 0.1 microns positions it as a crucial tool in the global fight against airborne diseases. The comprehensive purification processes, coupled with the advanced materials and technologies employed, make the Sterilizer an unparalleled invention in the realm of air purification.

The Plasma Electrolytic Oxidation Air Sterilizer is a testament to human ingenuity and innovation, promising a future where clean, breathable air is not just an aspiration but a reality. Its introduction marks a significant milestone in our ongoing endeavour to improve indoor air quality, safeguarding public health and ensuring the well-being of future generations.