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Market Opportunity: Air Sanitation

Executive Summary

Safely killing/inactivating viruses and bacteria is difficult if people are breathing treated air. Ozone and hydrogen peroxide are effective but cannot be used in occupied spaces. Photocatalytic Oxidizers (PCOs) and Ultraviolet Germicidal Irradiation (UVGI)can generate hazardous and potentially carcinogenic intermediate molecules during the process of treating pollutants. Despite favored used of ionizers in China, they similarly create ozone unintentionally and have a dubious history because no controlled studies have ever proven a benefit.Enhanced activated carbon and chemical filtration medias work, but entail media replacement costs. The ideal product would likely synergistically combine several of these technologies to offset the negatives while maintaining the positives.

Explanation of the Science

Ozone (0_3) does an outstanding job sterilizing air and disinfecting surfaces. However, it must be used in unoccupied areas because ozne causes inflammation of the throat and lungs.. to the OSHA Permissible Exposure Limit (PEL) for ozone is 100 ppb over 8 hours. CARB limits devices from producing more than 50 ppb. Ozone stunts plant growth and breaks down rubber.

Hydrogen Peroxide Vapor (H_20_2) is used in both liquid and vapor states as a sterilizing agent with broad spectrum efficacy against viruses, bacteria, yeasts, and spores. Higher concentrations (7% to 30%) improve performance but also increase operator health risks. OSHA limits hydrogen peroxide exposure to 1.0 ppm over 8 hours. Hydrogen peroxide also readily decomposes to water vapor and oxygen under standard conditions, preventing its airborne lifetime for sanitation.

Ultraviolet Germicidal Irradiation (UVGI) uses short wave ultraviolet C light (UVC) to kill or inactivate microorganisms by disrupting nucleic acids. The degree of inactivation is directly related to the UVC dose. Furthermore, UVC light is not very penetrating, and is easily blocked by surfaces and particles in surrounding environments. Subsequently, studies suggest UVC disinfection works well when it can irradiate surfaces for at least 10 seconds at a distance of 6 inches. UV lights generally need to be replaced every 2 years. Upper room disinfection strategies used in hospitals could be applied to offices, schools, and homes.

Photocatalytic Oxidizers (PCO shine UV light onto a catalytic surface (usually titanium dioxide, TiO2). A surface reaction occurs that creates hydroxyl radicals and super-oxide ions. Any volatile organic compounds (VOCs) or bioaerosols that impact the catalyst surface will be oxidized. UV wavelengths are not restricted to UVC when used with PCO materials. The major drawback of PCO technologies is the creation of intermediate molecules (like formaldehyde) that are created in an intermediate step of breaking down long-chain organic molecules to CO2 and H20. The PCO catalyst surface would need to be long enough for airflow to take 6 seconds to travel the full distance to ensure no intermediates are released. Some manufacturers put carbon media downstream of the PCO to capture intermediates to prevent the potential release from the PCO device.

Ions are generated (usually by corona discharge/plasma) to help clear the air of airborne particles such as pollen, mold spores, bacteria, viruses, dust, pet dander and cigarette smoke. Reactive anions perform this function by statically attaching themselves to positively charged particles in large numbers As a result, these particles become too heavy to remain airborne. The particles are then attracted to any nearby grounded conductors, either deliberate plates within an air cleaner, or simply the nearest walls and ceilings. Note that companies promoting ionized air for air cleaning or health reasons make a lot of claims, but none have been confirmed in controlled studies. This is the technology that put the Sharper Image into bankruptcy. Furthermore, reactive oxygen species (ROSs) that can be generated by ionizing devices can foster respiratory health issues over long exposure times.

Chlorine Dioxide Gas, (ClO_2), is widely used for the treatment of drinking water. The molecule is an effective oxidizing agent and can disinfect surfaces and air. High concentrations can be explosive. Chlorine dioxide remains a dissolved gas in water; this mixture is used to disinfect agricultural products, kill bacteria on surfaces and in water, and as a deodorant powered by the off-gassing of ClO2 from the water. Transportation of ClO2 is not allowed and must be created at the point of use.

Enhanced Carbon Permanganate Media (like Purafil's Purashield) offers antimicrobial performance in addition to VOC adsorption. The treated media uses oxidation to kill the viruses and bacteria. The media needs to be replaced periodically due to saturation with pollutants. Because treated media is contained within various delivery systems, often including final filters, treatment chemical release into the airspace, personnel, and the surrounding environment is effectively mitigated. The inherent safety of filtration media is a major and unique difference from the other air treatment methods overviewed in this document.

HEPA Filtration – HEPA filters remove at least 99.97% of particles 0.3 µm (microns) in diameter. Particles around the 0.3 µm size are the most difficult to filter and are considered the most penetrating particle size. Particles larger or smaller than 0.3 µm are filtered with even higher efficiency. HEPA filters catch, but do not kill, bacteria and viruses. The used filters should be treated as a biohazard. HEPA filtration should be a part of an air sanitation solution.

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PLEASE CONTACT ONE OF OUR EXPERTS TO HELP YOU IMPROVE YOUR INDOOR AIR HYGIENE

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