



Photocatalytic Oxidation

Best-in-Class Technology

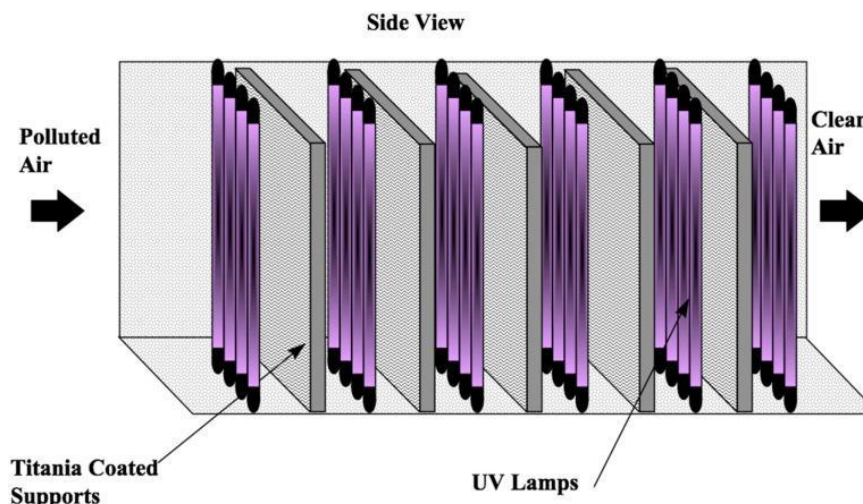
Safe, Effective, Proven, Certified, Economical

The EPA acknowledges we spend 90% of our time indoors where we receive 70%+ of our chemical and pathogenic exposures. Generally we pay little attention until we actually smell something, see dust floating in the air, feel eye or throat irritation, start sneezing and coughing; all signs of contamination...large and small particulates, VOC's, viruses and bacteria, etc.

Air Filtration vs. Decontamination Technology Is Very Different

+ **Passive Air Filtration** machines have been around for decades. They're considered "passive" because they simply use filters to trap large particulate matter like dust (< 10 microns in diameter). Small particulate matter, viruses (< 2.5 microns) can float right through these filters, so there's no protection against inhaling into the lungs ... this is the essence of the Covid respiratory disease crisis.^{1,2}

+ **Active Air Decontamination** technology is very different. This tech uses filters to trap large particulate matter as above, but it's considered "active" because this equipment engages a Photocatalytic Oxidation tech, which uses chemistry not chemicals, to neutralize then deactivate viral and bacterial pathogens including Covid, flu, staph, MSRA, mold spores, etc. ... 24/7/365, 100% safe to humans, animals, and plants; proven, supported by science. Filtration alone, does not and cannot do what PCO does. Below visualizes the contaminated to clean air flow:



The takeaway from above is that it is necessary to deploy ventilation, filtration AND air decontamination equipment in a layered approach to provide the best indoor air quality possible. *Nothing is a silver bullet. Ventilation is necessary. MERV and HEPA filters do a great job (HEPA are better) at filtering large particulate matter but are ineffective against VOC's which are gases and against pathogens which are too small to be trapped in their aerosol form. Advanced PCO deals with these filter deficiencies.*

TransAct offers a complete range of active air filtration/decontamination equipment that filter and decontaminate indoor air. Using little more electricity than an 80W light bulb, the technology saves energy dollars while it deactivates pathogens, removes odors, VOC's and allergens resulting in a healthy, clean-air environment.

How Photocatalytic Oxidation Works.

A fan actively draws indoor air through a carbon filter, HEPA filter, no filter, an ionizer; specific machines are configured differently. Limitedly cleaned air then is propelled forward coming into contact with a *Photocatalytic Catalytic Oxidative* cell that is coated with Titanium Dioxide (a safe, naturally occurring mineral). A specially designed ultraviolet light “activates” this TiO_2 coating, and a chemical chain reaction results that yields four powerful oxidizers formed from the hydrogen and oxygen naturally present in the air.³

- Hydroxyl Radicals ($^{\circ}\text{OH}$) Super Oxides (O_2^-)
- Hydroxyls (OH^-) Hydrogen Peroxide (H_2O_2)

These “friendly oxidizers”⁴ do all the heavy lifting to neutralize and decontaminate the air inside the machine enabling clean air to exist the machine and begin replacing contaminated air in a room with decontaminated air from the machine; in time filling the room with clean air

Hydroxyl Radicals

In the PCO process electrons are released that react with molecules of water in the air (humidity), breaking them into the agile Hydroxyl Radicals ($^{\circ}\text{OH}$). These radicals have one unpaired electron providing reactivity second only to fluorine, so they are incredibly strong and efficient at killing pathogens. Hydroxyl Radicals are produced in the billions per second and are created through what chemists call a chain reaction or cascading effect. When they come into contact with pathogens, they completely denature the nuclei and kill the bacteria, viruses, fungi and VOCs the contact by severing their molecular bonds, turning them chemically into harmless substances such as carbon dioxide and water vapor. Through the process known as oxidation, Hydroxyl radicals also act as deodorizers extracting (not masking) odors in the air from smoke, pets, cooking, etc.

Hydroxyls

Hydroxyl Radicals ($^{\circ}\text{OH}$) are electrically neutral; where Hydroxyls (OH^-) carry a negative charge. This loss of an electron occurs when ultraviolet light activates the Titanium Dioxide

(TiO₂) coating in PCO process thus stripping a hydrogen (H) atom from a water molecule in the air thereby forming a hydroxyl (OH⁻). Hydroxyls break down VOC's and other contaminants converting them into harmless carbon dioxide and water vapor. The hydroxyls produced are the same as those produced naturally in outdoor air in the earth's atmosphere by the reaction of UV rays and water vapor.

Super Oxides

Super Oxides are an oxide containing the anion O₂⁻. They are created when free hydrogen atoms (H) combine with ozone (O₃) to form the powerful oxidizers, oxygen (O₂) and hydroxyls (OH⁻). Super Oxides are powerful and can kill bacteria, viruses, mold and other contaminants. Super Oxides have been utilized for decades in food processing plants and hospitals to control environmental contamination and disinfect safely.

Hydrogen Peroxide

H₂O₂, stronger than chlorine, is one of the most powerful oxidizers known and is considered the safest oxidizer available, out ranked only by oxygen itself. H₂O₂ molecules, through catalysis, convert to Hydroxyl Radicals and neutralize pollutants in places other technologies and filtration systems can't reach. Because these molecules have both positive and negative charges they are drawn to contaminants by electrostatic attraction. Contaminants are safely broken down, eliminated, and returned to the ambient air as oxygen (O₂) and water (H₂O) vapor.

¹ Almost never discussed by passive filtration providers is where do the trapped particulate matter, etc. go; how are they disposed of? If fact they go nowhere, they stay in the machine clogging up the filter, eventually making filtration ineffective which is why filters need to be changed regularly which is not an insignificant ongoing cost.

² Viruses, once trapped by any filter, can stay alive on the filter's surface for several hours or even days. While the virus will eventually die, if alive when the filter is changed, it will very likely be released back into the air.

³ An oxidizer is a substance with the ability to accept one or more electrons from another substance.

⁴ These oxidizers in chemistry are called "friendly" because they are all oxygen-based, and when they react, they revert back to water, hydrogen and oxygen.