The Six Air Filtration & Purification Technologies

used by

ULTRA-PURE™

Air Purification Systems

by REAL SPIRIT

an innovative products group

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The Six Air Filtration and Purification Technologies used by Ultra-Pure

1) Negative Ions/Air Ionizers

How Negative Ions Purify the Air

Virtually all particles in the air have a positive charge, while negative ions have a negative charge. In which case, negative ions and particles **magnetically attract** to one another. When there is a high enough concentration of negative ions in the air, they will attract to floating particles in large numbers. This causes the particle to become **too heavy to remain airborne**. As a result, the particle will fall out of the air, preventing it from being inhaled into the respiratory tract where it can trigger breathing and health problems.

The ionized particle will then be collected by normal cleaning activities, such as vacuuming or dusting. If the particle happens to be kicked back up into the air again, it will be ionized, and quickly settled out of the air once again.

In nature, negative ions are generated by processes such as sunlight, lightening, waves from the ocean, and from waterfalls. "Concrete Jungles" minimize the natural production of negative ions by disrupting the delicate electrical balance between the atmosphere and the earth. Ultra-Pure ™ Air Purifiers recreate them with electrode pins ("needlepoint's") to electrically produce negative ions. This method produces a density that is many times higher than the negative ion level found at Niagara Falls, the highest natural producer of negative ions and one of the healthiest environments in the world.

Studies Proving the Effectiveness of Negative Ions

U.S. Dept. of Agriculture

The U.S.D.A. discovered the following in recent studies conducted in a poultry house, which are notoriously polluted:

- Reduced salmonella (bacteria) transmission between chicks by **98%**.
- Reduced airborne salmonella (bacteria) by **95%**.
- Reduced airborne dust & particles by **99% in 60 seconds**.

(Summary of Study from USDA Website)
http://www.ars.usda.gov/is/AR/archive/mar00/salm0300.htm

Good Housekeeping Magazine

In March of 1999, **Good Housekeeping Magazine** had its engineers test an ionizer by using a smoke test, and found that it cleared out the smoke in a tank.

Columbia University
Researchers found people with winter and chronic depression shows that **negative ion generators relieve depression** as much as antidepressants. It was also determined that there are **relatively no side effects**.

European Respiratory Journal
A statistically significant **decrease of carbon monoxide** values was found with an ionizer activated. This was discovered by researchers at Brompton Hospital in London, and published in European Respiratory Journal.

St. James University Hospital
Researchers have found that **hospital-acquired infections** among patients in the Intensive Care Unit were **dramatically reduced** when ionizers were introduced - and have remained so since. The ionizers were found to successfully remove bacteria from air, reducing the transmission of infection.

Effect of Negative Ions on Drivers
A study by Toyota Central R & D Labs, Inc. found that negative ions can improve fatigue and cognition of drivers.

2) HEPA Air Filtration

How HEPA Air Filters Work

HEPA air filters are made from very tiny glass fibers that are made into a tightly woven paper. This creates a filter consisting of a multitude of very small sieves that can capture extremely small particles, including some biological agents. Once trapped, contaminates and particles are not able to flow back into circulation, due to the highly absorbent pores of the HEPA air filter.

HEPA Air Filter Facts & Studies

- HEPA air filters **remove 99.97%** of particles down to 0.3 microns in size, almost 300 times smaller than the width of a human hair.
- The Atomic Energy Commission developed HEPA air filters during the Second World War. They were originally designed to remove radioactive dust from their manufacturing plants.
- HEPA air filters are **recommended by the U.S. Dept. of Homeland Security**.
- HEPA air filters are effective for solid and liquid particles, but not effective for gaseous particles. Ultra-Pure™ Air Purifiers HEPA & ionic air purifiers incorporate other technologies that are effective against gaseous particles, such as ionization and activated carbon filtration.
- **Journal of Hygiene** study found that ionizers increase efficiency of HEPA air filters. The Ultra-Pure offers an ionizer in addition to its HEPA filter.

- A study by **Air & Waste Management Association** found the combination of a HEPA air filter and germicidal UV lamp reduced bacteria by 80% in a 3072 cubic foot chamber. Ultra-Pure's 5-Stage filtration and purification technology includes HEPA filtration as well as UV, Activated Carbon, and Nano TiO_2.

3) Activated Carbon Air Filtration

How Activated Carbon Air Filters Work

Activated carbon air filters consist of a vast system of pores of molecular size. These pores are highly adsorbent, forming a strong chemical bond/attraction to odorous, gaseous, and liquid contaminates.

Research Studies and Facts

Activated carbon air filters are the most effective type of filter against chemicals, gases, cigarette smoke and other odors.

Activated Carbon Air Filter Facts

- Activated carbon air filters trap odors and chemicals in highly absorbent granules (or pores), which look like a hard scrub brush.
- Activated carbon is a charcoal that is treated with oxygen in order to open up millions of tiny pores between the carbon atoms, resulting in a highly adsorbent material.

Activated Carbon is effective at removing the following types of chemicals:

Acetaldehyde	Cyclohexanol	Hydrogen fluoride	Paint & redecorating odors
Acetic Acid	Cyclohexanol	Hydrogen iodide	Palmitic Acid
Acetic anhydride	Cyclohexene	Hydrogen selenide	Paradichlorbenzine
Acetone	Decane	Hydrogen sulfide	Pantane
	Dibromoethane	Incensen	Pentanone
Acrolem	Dichlorobenzene	Indole	Pentylene
Acrylic Acid	Dichlorodifluoromethane	Iodine	Pentyne
Acrylonitrile	Dichloroethane	Iodoform	Perchloroethylene
Alcoholic Beverages	Dichloroethylene	Irritants	Perfumes, cosmetics
Amines	Dichloroethyl	Isophorone	Phenol
Ammonia	Dichloromonofluormethane	Isoprene	Phosgene
Ameyl acetate	Dichloronitroethane	Isopropyl acetate	Pitch

Amyl alcohol	Dichloroprpane	Isopropyl alcohol	Poison gases
Amyl ether	Dichlorotetrafluoroethane	Isopropyl ether	Pollen
Aniline	Diesel fumes	Kerosene	Poultry odors
Asphalt fumes	Diethylamine	Kitchen odors	Propane
Automobile Exhaust	Diethyl ketone	Lactic acid	Propionaldehyde
Benzene	Dimethylaniline	Dimethylsulfate	Propionic acid
Body odors	Dimethylsulfate	Menthol	Propyl acetate
Borane	Dioxane	Mercaptans	Propyl alcohol
Bromine	Diproyl ketone	Methil acetate	Propyl chloride
Burned Flesh	Ether	Menthyl acrylate	Propyl ether
Burned Food	Ethyl acetate	Methyl alcohol	Propyl mercaptan
Butadiene	Ethyl acrylate	Methyl bromide	Methyl bromide
Butane	Ethyl alcohol	Methyl butyl ketone	Propylene
Butanone	Ethyl amine	Methyl cellosolve	Propyne
Butyl acetate	Ethyl benzene	Methyl cellosolve acetate	Putrefying substances
Butyl alcohol	Ethyl bromide	Methyl chloride	Putrescine
Butyl cellosolve	Ethyl chloride	Methyl chloroform	Pyridine
Butyl chloride	Ethyl ether	Methyl ether	Resins
Butyl ether	Ethyl formate	Methyl ethyl ketone	Rubber
Butylene	Ethyl mercaptan	Methyl formate	Sauerkraut
Butyne	Ethyl silicate	Methyl isobutyl ketone	Sewer odors
Butyraldehyde	Ethylene chlorhydrin	Methyl mercaptan	Skalote
Butyric acid	Ethylene dichloride	Methylcyclohexane	Slaughtering odors
Camphor	Ethylene oxide	Methylcyclohexanol	Smog
Caprylic acid	Essential oils	Methylcyclohexaone	Sour milks
Carbolic acid	Eucalyptole	Methylene chloride	Stoddard solvent
Carbon disulfide	Fertilizer	Monochlorobenzene	Styrene monomer
Carbon dioxide	Film processing odors	Monofluorotri cloromethane	Sulfur dioxide
Carbon tetrachloride	Fish odors	Naphtha	Sulfur trioxide
Cellosolve	Floral scents	Naphthziene	Sulfuric acid
Cellosolve acetate	Fluorotrichloromethane	Nitric acid	Tetrachloroethane
Cheese	Formaldehyde	Nitro benzenes	Tetrachloroethylene
Chlorine	Formic acid	Nitroethane	Tobacco smoke odor
Chlorobenzene	Gangrene	Nitrogen dioxide	Toilet odors
Chlorobutadiene	Garlic	Nitroglycerine	Toluene
Chloroform	Gasoline	Nitromethane	Toluidine
Chloronitropropane	Heptane	Nitropropane	Trichlorethylene
Chloropicrin	Heptylene	Nitrotoluene	Trichloroethane
Citrus and other fruits	Hexane	Nonane	Turpentine
Cleaning compounds	Hexylene	Octalene	Urea
Coal smoke	Hexyne	Octane	Uric acid
Creosote	Organic Chemicals	Onions	Valeric acid
Cresol	Hydrogen bromide	Varnish fumes	Valericaldehyde
Crotonaldehyde	Hydrogen chloride	Ozone	Xylene
Cychlohexane	Hydrogen cyanide	Packing house odors	

4) UV Light Air Purification

How UV Light Purification Works

Ultraviolet light possesses just the right amount of energy to break organic molecular bonds. As microorganisms pass by the UV rays radiated from the ultraviolet lamp, this bond breakage translates into cellular or genetic damage for microorganisms, such as germs, viruses, bacteria, fungi (like molds), etc. This resulted in the destruction of the microorganisms. The same damage occurs to humans, but is limited to the skin and eyes. UV air purifiers, such as the Ultra-Pure™ Air Purifiers, shield direct ultraviolet light from escaping the inside of the unit, sterilizing only the air that passes through the air cleaner.

Research Studies and Facts

No other air purification is more effective at neutralizing microorganisms than ultraviolet light radiation.

UV Light Air Purifier Facts & Studies

- The **Centers of Disease Control** (CDC) recommends the use of ultraviolet light with simultaneous use of HEPA air filters, both of which are offered in the Ultra-Pure™ Air Purifiers.
- **The U.S. government** now specifies that UV light should be used in air handling units to **improve indoor air quality in government buildings**, by controlling airborne and surface microbial growth.
- The **Air Institute of Respiratory Education** suggests UV lights be used in buildings for indoor air quality purposes, and states that may be the **final line of defense against those diseases** that have developed resistance to drugs, such as tuberculosis and others.
- According to the **Aerobiological Engineering Dept. at Penn State University**, the ultraviolet component of sunlight is the main reason microbes die in the outdoor air. The die-off rate in the outdoors varies from one pathogen to another, but can be anywhere from a few seconds to a few minutes for a **90-99% killing of viruses or contagious bacteria**.
- The **Centers of Disease Control** (CDC) **recommends UV lights** in homeless shelters to prevent the spread of disease, particularly TB (tuberculosis).
- A study by **Air & Waste Management Association** found the combination of a HEPA air filter and germicidal UV lamp reduced bacteria by 80% in a 3072 cubic foot chamber.

5) Ozone Air Purification

How Ozone Purifies the Air

Ozone oxidizes airborne pollutants, and then reverts back to oxygen, transforming polluted air to pure and refreshened air.

Here is how the process works:

1. Oxygen molecules (O^1 and O^2) are converted to ozone (O^3) by either a high-voltage electrical charge (such as from lightning), or by ultraviolet light (such as from the sun rays).
2. One oxygen atom (O^1) splits off from the ozone molecule, and reacts with other particles when it comes within range of a particle and/or pollutant. Ozone is highly reactive, so it never fails to initiate this reaction with other particles.
3. As the 2nd most powerful oxidant in existence, the single oxygen atom proceeds to "oxidize" the particle it reacts with. This means it burns the particle, which changes its physical properties. As a result, the particle will no longer be toxic, and will no longer be able to reproduce if it is biological. In other words, the particle becomes completely harmless.
4. When the single oxygen (O^1) molecule oxidizes the particle, it too is destroyed. This leaves behind the O^2 it split away from, or pure and clean oxygen.
5. This then becomes activitaed oxygen

Effectiveness of Ozone

Effectiveness at Low Levels

In testing performed by two scientists by the name of Elford and Van den Ende, it was found that ozone effectively destroyed bacteria at 0.04 ppm. Ultra-Pure™ Air Purifiers produce an ozone concentration of 0.02 ppm to 0.04 ppm.

Effectiveness against Mold

A 1999 study conducted at the University of Minnesota found that both ozonated air and water inactivate mold, rendering the mold cells harmless.

Safety of Ozone

Ozone is completely safe and effective when occurring within FDA and OSHA standards of **0.05 ppm** (parts per million). In **healthy and clean outdoor environments**, ozone occurs **between 0.02 ppm and 0.05 ppm**. Ozone has not been found to be harmful to the lungs until occurring at concentrations of 0.1 to 0.2 ppm. However, it is very difficult (if not impossible) to adjust most ozone air purifiers to produce anywhere close to this amount of ozone. The Ultra-Pure™ Air Purifiers ozone output is limited to 0.04 ppm, a full 20% below the FDA and OSHA maximums.

Research Studies and Facts

Studies shown that ozone is safe and effective if used properly, and many have found it to be the best way to reduce or eliminate odors. The ozone output in the Ultra-Pure™ Air Purifiers is programmable. You can adjust the output, or **turn it completely off** if not needed or desired.

Ozone Air Purification Research

ASHRAE *(American Society of Heating, Refrigeration, and Air Conditioning)*: "Ozone controls surface mold on packages and walls, and reduces scale development and decay. The presence of ozone . . .. significantly reduces the occurrence of mold."

Refrigeration Service Engineers Society *(RSES)*: "Ozone is one of the purest and most powerful oxidants and germicides known."

6) Photo-Catalysis TiO_2 Air Purification

How Photo-Catalyst TiO_2 Purifies the Air

Photo catalysis's uses light, which reacts with a catalyst resulting in oxidation. This is found to be effective in destroying mold, mildew, bacteria, other fungi, dust mites, and many odors. This technology is produced with an Ozone/UV lamp set in a variety of combinations.

The Ultra-Pure™ Air Purifiers UV lamp is in direct visual contact with metallic targets. Titanium Dioxide (TiO2) is commonly used because it will react with UV alone. New research is establishing that when used in combination with other metals such as Zinc and Copper its effectiveness is multiplied many times. When this type of photo catalysis is combined with the natural humidity in indoor air it creates hydroxyl radicals and super oxide ions that are effective in combating fungi. This method is also a pro-active approach that goes to the source for treatment. This technology generally requires the lamp and targets to be replaced