SHEPROS®

Safety, Heath & Environment Product Solutions

High Performance Adsorbent for Odors, VOCs, Photochemical Smog and Ionizing Radiation

BIOWAVE FILTRATION MEDIA

SHEPROS Sdn. Bhd.

An Introduction to Indoor Air Quality (IAQ)

What Causes Indoor Air Problems?

Indoor pollution sources that release gases or particles into the air are the primary cause of indoor air quality problems in homes. Inadequate ventilation can increase indoor pollutant levels by not bringing in enough outdoor air to dilute emissions from indoor sources and by not carrying indoor air pollutants out of the home. High temperature and humidity levels can also increase concentrations of some pollutants.

Indoor Air Pollution and Health

Health effects from indoor air pollutants may be experienced soon after exposure or, possibly, years later.

Immediate effects

Immediate effects may show up after a single exposure or repeated exposures. These include irritation of the eyes, nose, and throat, headaches, dizziness, and fatigue. Such immediate effects are usually short-term and treatable. Sometimes the treatment is simply eliminating the person's exposure to the source of the pollution, if it can be identified. Symptoms of some diseases, including asthma, hypersensitivity pneumonitis, and humidifier fever, may also show up soon after exposure to some indoor air pollutants.
The likelihood of immediate reactions to indoor air pollutants depends on several factors. Age and preexisting medical conditions are two important influences. In other cases, whether a person reacts to a pollutant depends on individual sensitivity, which varies tremendously from person to person. Some people can become sensitized to biological pollutants after repeated exposures, and it appears that some people can become sensitized to chemical pollutants as well.

Certain immediate effects are similar to those from colds or other viral diseases, so it is often difficult to determine if the symptoms are a result of exposure to indoor air pollution. For this reason, it is important to pay attention to the time and place symptoms occur. If the symptoms fade or go away when a person is away from home, for example, an effort should be made to identify indoor air sources that may be possible causes. Some effects may be made worse by an inadequate supply of outdoor air or from the heating, cooling, or humidity conditions prevalent in the home.

Long-term effects

Other health effects may show up either years after exposure has occurred or only after long or repeated periods of exposure. These effects, which include some respiratory diseases, heart disease, and cancer, can be severely debilitating or fatal. It is prudent to try to improve the indoor air quality in your home even if symptoms are not noticeable.

While pollutants commonly found in indoor air are responsible for many harmful effects, there is considerable uncertainty about what concentrations or periods of exposure are necessary to produce specific health problems. People also react very differently to exposure to indoor air pollutants. Further research is needed to better understand which health effects occur after exposure to the average pollutant concentrations found in homes and which occurs from the higher concentrations that occur for short periods of time.

Basic Information on Pollutants and Sources of Indoor Air Pollution

Volatile Organic Compounds (VOCs)

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products numbering in the thousands. Examples include: paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, office equipment such as copiers and printers, correction fluids and carbonless copy paper, graphics and craft materials including glues and adhesives, permanent markers, and photographic solutions.

Organic chemicals are widely used as ingredients in household products. Paints, varnishes, and wax all contain organic solvents, as do many cleaning, disinfecting, cosmetic, degreasing, and hobby products. Fuels are made up of organic chemicals. All of these products can release organic compounds while you are using them, and, to some degree, when they are stored.

Household Cleaners *Glues and Adhesives* *Paints*

Odors

An odor is commonly referred to as a smell. It is caused by one or more volatilized chemical compounds, generally at a very low concentration, that humans or other animals perceive by the sense of olfaction. Odors are also commonly called scents, which can refer to both pleasant and unpleasant odors. The terms fragrance and aroma are used primarily by the food and cosmetic industry to describe a pleasant odor, and are sometimes used to refer to perfumes. In contrast, malodor, stench, reek, and stink are used specifically to describe unpleasant odors.



Cigarette Smoke | Body Odor | Cooking Odor

Photochemical Smog

Photochemical smog (or just smog for short) is a term used to describe air pollution that is a result of the interaction of sunlight with certain chemicals in the atmosphere. It is the chemical reaction of sunlight, nitrogen oxides and volatile organic compounds in the atmosphere, which leaves airborne particles and ground-level ozone. One of the primary components of photochemical smog is ozone. While ozone in the stratosphere protects earth from harmful UV radiation, ozone on the ground is hazardous to human health. Ground-level ozone is formed when vehicle emissions containing nitrogen oxides (primarily from vehicle exhaust) and volatile organic compounds (from paints, solvents, and fuel evaporation) interact in the presence of sunlight. Therefore, some of the sunniest cities are also some of the most polluted.

This noxious mixture of air pollutants can include the following:

Aldehydes - *Example: formaldehyde and acetaldehyde*

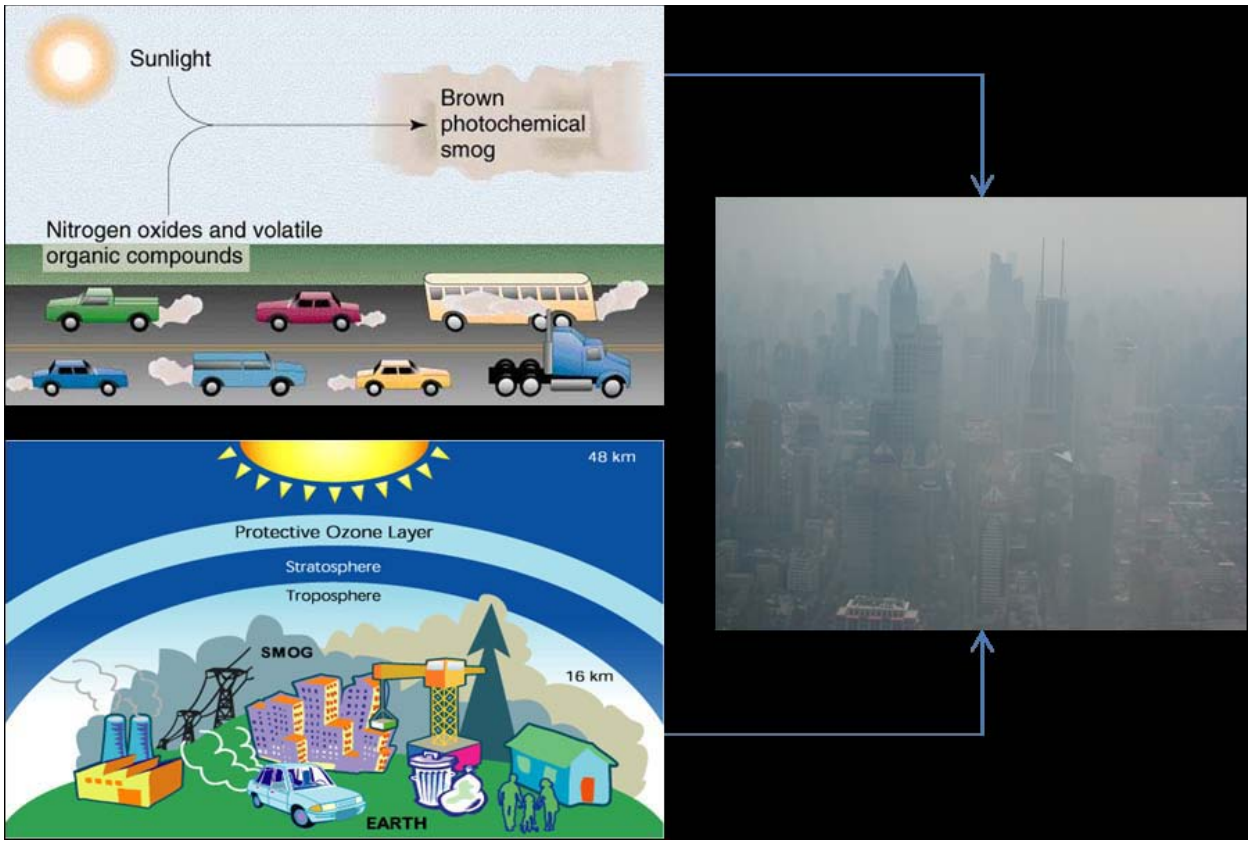
Nitrogen oxides - *Example: nitrogen dioxide*

Peroxyacyl nitrates - *Powerful respiratory and eye irritants*

Tropospheric ozone - *Greenhouse gas and initiates the chemical removal of methane and other hydrocarbons from the atmosphere.*

Volatile organic compounds - *Organic chemicals that have a high vapor pressure at ordinary, room-temperature conditions*

All of these chemicals are usually highly reactive and oxidizing. Photochemical smog is therefore considered to be a problem of modern industrialization. It is present in all modern cities, but it is more common in cities with sunny, warm, dry climates and a large number of motor vehicles. Because it travels with the wind, it can affect sparsely populated areas as well.



Photochemical Smog Formation

Ionizing Radiation

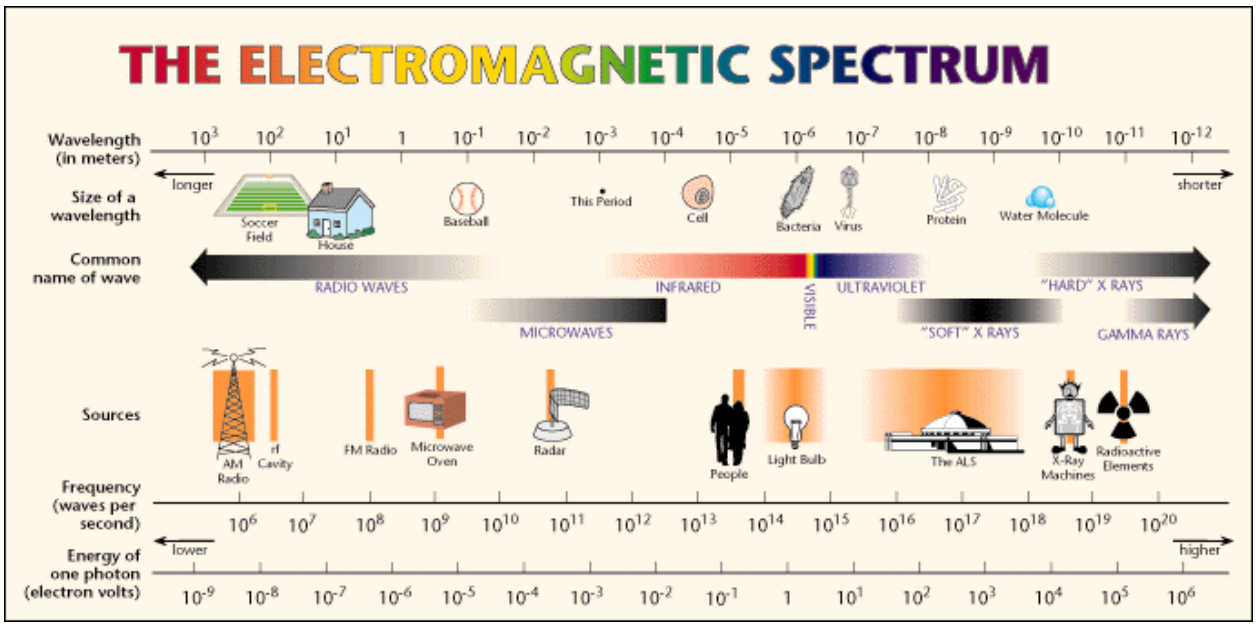
Higher frequency ultraviolet radiation begins to have enough energy to break chemical bonds. X-ray and gamma ray radiation, which are at the upper end of magnetic radiation have very high frequency --in the range of 100 billion Hertz--and very short wavelengths--1 million millionth of a meter. Radiation in this range has extremely high energy. It has enough energy to strip off electrons or, in the case of very high-energy radiation, break up the nucleus of atoms.

Ionization is the process in which a charged portion of a molecule (usually an electron) is given enough energy to break away from the atom. This process results in the formation of two charged particles or ions: the molecule with a net positive charge, and the free electron with a negative charge.

Each ionization releases approximately 33 electron volts (eV) of energy. Material surrounding the atom absorbs the energy. Compared to other types of radiation that may be absorbed, ionizing radiation deposits a large amount of energy into a small area. In fact, the 33 eV from one ionization is more than enough energy to disrupt the chemical bond between two carbon atoms. All ionizing radiation is capable, directly or indirectly, of removing electrons from most molecules.

There are three main kinds of ionizing radiation:

- alpha particles, which include two protons and two neutrons
- beta particles, which are essentially electrons
- gamma rays and x-rays, which are pure energy (photons).



Types and Sources of Radiation

BIOWAVE Filtration Media

Removal of VOCs, Odors, Photochemical Smogs and Ionizing Radiation Particles

DESCRIPTION

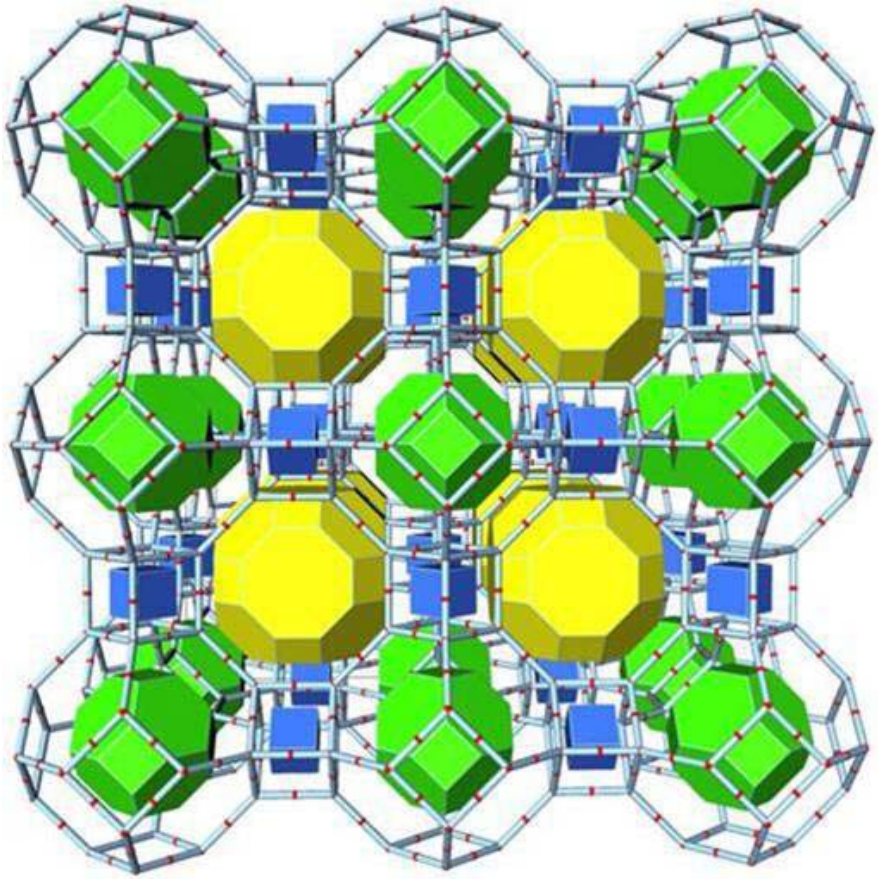
Normal air filtration systems are not highly efficient in removing VOCs, odors, smoke and ionizing radiation contaminants. These pollutants are becoming the major pollution in indoor air quality and adversely affecting human health and well-being.

SHEPROS with vast experience in air purification technologies, has developed a novel revolutionary molecular sieve adsorbent called BIOWAVE Filtration Media. BIOWAVE Filtration Media is crystalline solids structures made of silicon, aluminum and oxygen that form a framework with cavities and channels inside where cations, water and/or small molecules may reside. BIOWAVE's porous crystalline structure provides nano-pores or "cages" which have high affinity to adsorb air pollutants. The application of this technology in HVAC products and air purifiers is very efficient for the removal of volatile organic compounds (VOCs) odors, photochemical smogs and ionizing radiation particles.

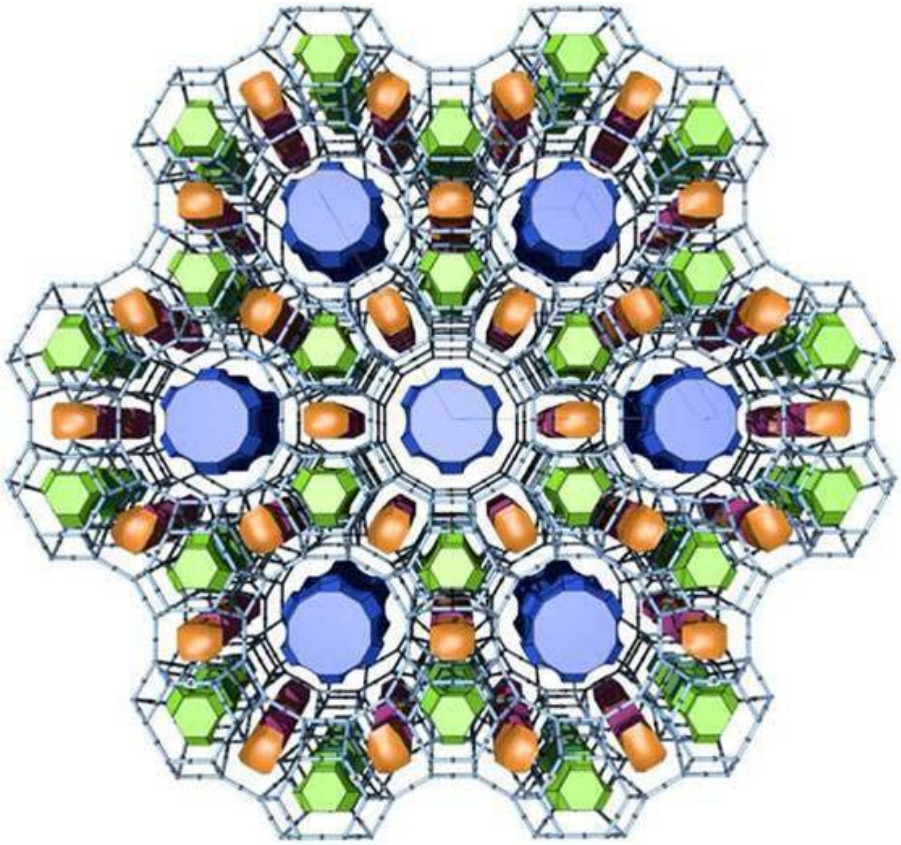
Biowave Media

FEATURES

BIOWAVE Filtration Media is a crystalline aluminosilicates with open 3D framework structures built of SiO_4 and AlO_4 tetrahedra linked to each other by sharing all the oxygen atoms to form regular intra-crystalline cavities and channels of molecular dimensions. A defining feature of the BIOWAVE Filtration Media is that its frameworks are made up of 4-coordinated atoms forming tetrahedra. These tetrahedra are linked together by their corners and make a rich variety of beautiful structures. The framework structure may contain linked cages, cavities or channels, which are big enough to allow small molecules to enter. The system of large voids explains the consistent low specific density of these compounds. In BIOWAVE Filtration Media used for various applications, the voids are interconnected and form long wide channels of various sizes depending on the compound. These channels allow the easy drift of the resident ions and molecules into and out of the structure. The aluminosilicate framework is negatively charged and attracts the positive cations that reside in cages to compensate negative charge of the framework.



A representation of the BIOWAVE Filtration Media as an assembly of framework's micro- and nano-pores or "cages". Center of a cage is the center of a void in the framework. Voids are connected with adjacend ones through the large "windows" which are faces of cages.



Poring representation of the structure of the BIOWAVE Filtration Media. Blue cages or pores are channels in the structure running along direction of the crystallographic **c** *axis.*

BIOWAVE Filtration Media has several properties, which explain their superior performance in a wide range of applications:

Increased surface area

The material is designed with large surface area to enhance filtration performance. Aided by strong ionic forces (electrostatic fields) caused by the presence of cations such as sodium, calcium and potassium, and by the enormous internal surface area up to 1000 m^2 / g, molecular sieves will absorb a considerable amount of pollutants. If the pollutants to be adsorbed are polar compounds, they can be adsorbed with high loading even at very low concentrations of the pollutants.

Enhanced adsorption

Adsorption is the physical process of binding a thin film of gas molecules to a large surface area. BIOWAVE Filtration Media exhibits high rapid reaction and adsorption kinetics. Therefore, BIOWAVE Filtration Media filters are very effective when short contact time, high air flow speeds or small bed depths are required.

Flexible material

The material's flexibility offers superior handling in filter and product manufacture. It can come in powder or pellet form and makes lamination or bonding to other materials possible.

Chemical air purifiers (gas phase purifiers)

It can be used as an adsorbent to capture molecular sized pollutants, odors and non-particulates such as cooking gas, out gassed paint and building material vapors, and vehicle exhaust gas. Gas molecules are 0.001 micron and smaller and cannot be removed by even the best HEPA filter alone.

Chemisorption

Chemisorption is a sub-class of adsorption, driven by a chemical reaction occurring at the exposed surface. A new chemical species is generated at the adsorbent surface (e.g. corrosion, metallic oxidation). The strong interaction between the adsorbate and the substrate surface creates new types of electronic bonds - ionic or covalent, depending on the reactive chemical species involved.

BIOWAVE Filtration Media uses chemisorption to remove low molecular weight gasses, including formaldehyde, hydrogen sulfide, carbon monoxide and ammonia where activated carbon doesn't perform efficiently.

Environmental advantages

- Regenerable (high thermal stability)
- Non toxic and non-corrosive
- No waste or disposal problems

PROPERTIES

Typical Analysis

SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O	MnO	P
66.32%	13.95%	1.95%	0.41%	0.04%	0.03%	5.40%	3.74%	0.03%	0.17%

Specification

Color	Diameter	Pores Volume	Pores Diameter	pH	Thermal Stability
Brown	1 to 5 mm	Up to 40%	0.29 – 0.70 nm	6 - 8	250 - 500°C

APPLICATIONS

SHEPROS has developed and scaled up special custom made filtration products which are tailor made to customer's specifications. Any inquiry for special BIOWAVE Filtration Medias can be manufacture according to technical specifications and catalytic performance requirements.

SHEPROS is in the position to adopt various important product parameters according to customer's individual requirements, such as

- Particle size
- Crystal size
- Crystal morphology
- Surface activity
- Choice of different binders

SHEPROS complies with industrial-accepted standards for maintaining customer confidentiality, which is the basis for a long term reliable partnership. This has already been proved by SHEPROS in the past through successfully managed technology scale up projects.

Suggested Applications

- Air purification
- Used as catalysts in the petrochemical industry in fluid catalytic cracking and hydrocracking.
- Providing precise and specific separation of gases including the removal of H_2O, CO_2 and SO_2 from low-grade natural gas streams. Other separations include noble gases, N_2, O_2, freon and formaldehyde.
- Used in nuclear industry for advanced reprocessing methods, where their micro-porous ability to capture some ions while allowing others to pass freely, allowing many fission products to be efficiently removed from nuclear waste and permanently trapped.
- Can be used as solar thermal collectors and for adsorption refrigeration.

PACKAGING

25 kgs pail , 50 kgs pail and 200 kgs drum

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