

HYDROSIL
INTERNATIONAL LTD.

REMOVAL OF ANIMAL ODORS AT ZOO'S AND VETERINARY OFFICES

The odors caused by fecal material and excretions from animals are best handled by a combination of HS-600 and activated carbon. The odors can be identified as indole and skatole, which are best adsorbed by activated carbon. Other compounds generated are amines and other nitrogen containing compounds. These items are not adsorbed by activated carbon and require the oxidative properties of HS-600. The potassium permanganate media oxidizes these materials and holds the resulting compounds in the pore structure of the HS-600.

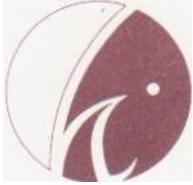
Other compounds found in these spaces for disinfecting the space include aldehydes and/or ketones. These compounds contain a carbonyl group. The type of carbonyl group and size of the compound will determine what type of gas phase filter media should be used to remove the pollutant. Aldehydes are quite easily oxidized whereas ketones are oxidized only with difficulty. Aldehydes are compounds like formaldehyde, acetaldehyde, benzaldehyde and tolualdehyde. All of these compounds are oxidized by HS-600 none noxious chemicals. Standard activated carbon will also do a good job of adsorbing the large aldehydes, (benzaldehyde and tolualdehyde), but the small aldehydes (formaldehyde and acetaldehyde are not adsorbed well. Activated carbon will easily adsorb the large molecular weight ketones. This is the reason a mixture of the two materials is suggested.

The relative humidity found in these spaces is quite big, greater than 60%. When the activated carbon is subjected to this high humidity, its' pore structure becomes filled with water. With increasing humidity, the activated carbon will become less effective in removing pollutants. This is not the case with the potassium permanganate impregnated media, as it requires humid environment.

Based upon these reasons it is best to use a separate pass or mixture of HS-600 and activated carbon.

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REMOVAL OF ODORS AT AIRPORT FACILITIES

Airport facilities are faced with a variety of gaseous pollutants relating to Indoor Air Quality. The majority of the pollutants are unspent or partially spent hydrocarbons. Activated carbon should be used to remove these components from the air. Other pollutants found in the air include the following: ethylene glycol and isopropanol from deicing fluids found on or in the soil about the tarmac, sulfur based additives from the airplane fuel, sulfur oxides and nitrogen oxides emissions from diesel fueled engines and ethylene from liquid propane fueled engines. These pollutants are not removed by activated carbon and require reactive media. We recommend the use of a potassium permanganate impregnated media, HS-600. The potassium permanganate media breaks down the pollutants removing them from the air stream.

As the airports typically only have one set of gas phase filter frames, it is preferable to use a blend of activated carbon and the Hydrosil HS-600. The blended media can work on all of the pollutants found in the air. This will provide the required adsorption properties of activated carbon and the oxidation properties of potassium permanganate. Hydrosil refers to this product as XB-17.

XB-17 is currently being used at a number of airports. These include (to name a few) O'Hare International Airport, Chicago, IL; Dulles International Airport, Washington, D.C.; JFK International Airport, New York, NY; Skyharbor International Airport, Phoenix, AZ.

To determine if the XB-17 media is spent both the activated carbon and HS-600 media require testing. Two methods are accepted for testing activated carbon, 1) analytical testing and 2) breakthrough sensed by occupants of the space. The potassium permanganate can be determined by two methods, 1) analytical testing and 2) by breaking the granule open and looking for the purple color.

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Removal of Propylene Glycol Fumes

Propylene glycol is commonly used as a deicing fluid at airports. This chemical has an odor that can cause problems with Indoor Air Quality (IAQ). Gas phase filtration can remove these fumes. Activated carbon will not adequately adsorb the pollutant. To remove the propylene glycol we must breakdown (oxidize) the pollutant. This can be achieved by using Hydrosil's HS-600 that contains 6% potassium permanganate. The oxidation properties of potassium permanganate in removing propylene glycol will result in the formation of carbon dioxide (CO₂), manganese dioxide (MnO₂), water (H₂O) and potassium hydroxide (KOH). These products of oxidation will remain in the pore structure of the HS-600 media. This is outlined in the following reaction:

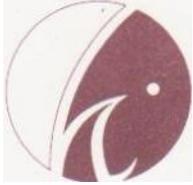


Other gases at an airport include large hydrocarbons from jet aircraft engine exhaust, diesel exhaust, cooking odors from exhaust fans, and other chemicals used at the airport. Because of the variety of chemical odors it is always suggested that both HS-600 and activated carbon be used at airports. For this reason when a separate pass of HS-600 media cannot be used to remove all of the pollutants at the airport. Hydrosil recommends blending activated carbon with HS-600 in a 50/50 blend by volume. This mixture is called XB-17.

If you have any questions concerning the application of a media to your gaseous pollutants please call.

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REMOVAL OF DIESEL EXHAUST ODOR

Diesel exhaust is composed of both particle and gas phase. To remove the particle phase of diesel exhaust, no less than a 60% ASHRAE 52-76 final filter should be used. To remove the gas phase generated we must look at the gases generated. Diesel exhaust is composed of unspent diesel fuel, sulfur-based compounds, nitric acid, and nitrogen dioxide; see enclosed report "Toxicity of Short Term Exposures to Low Levels of Diesel Exhaust Particles and Acids". Activated carbon does a very good job in removing unspent diesel fuel; however, it does not do a good job in removing the other gaseous components. The other gaseous components must be removed through chemical oxidation. We recommend the use of a potassium permanganate impregnated media, HS-600. The potassium permanganate media oxidizes the sulfur-based compounds to elemental sulfur and holds the pollutant in the pore structure of base zeolite. The acidic nitrogen oxides are also removed by this mechanism.

In view of the gases present, a 50/50 volumetric blend of activated carbon with a potassium permanganate impregnate on zeolite is suggested. This will provide the required adsorption properties of activated carbon and the oxidation properties of potassium permanganate. Hydrosil refers to this product as XB-17.

This product is currently being used in many hospitals, airports, zoos and other areas where activated carbon alone will not remove the gaseous pollutants. Estimated pollutant loading of this product is 12#s of pollutant per 100#s of XB-17. The service life of the product is determined by the exposure to gaseous pollutants. To determine when the activated carbon is spent, two methods are accepted, 1) analytical testing and 2) breakthrough sensed by occupants of the space. The potassium permanganate media when exposed to pollutants undergoes a color change from purple to a dark brown. The level of potassium permanganate can be determined in two methods, 1) analytical testing and 2) by breaking the granule open and looking for the purple color.

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