CIRCUL-AIRE

Introduction to Multi-Mix®

INTRODUCTION

Until now, there have been four general techniques for controlling odor and gas contaminants: masking, combustion, ventilation and removal. All of these methods are in contrast to the chemical destruction of odors by Multi-Mix® chemical media.

Multi-Mix® is a solid oxidizing system for the elimination of odors and gas-phase contaminants. The product is composed of activated alumina (Al_2O_3) impregnated with potassium permanganate ($KMnO_4$). It is produced in pellet form, purple in color. The pellets are inorganic, nontoxic and nonflammable (listed as UL Class 1). They can be applied in two principal ways:

1. Dynamic systems consisting of filters or modules placed in the airstreams of airconditioning and ventilation systems, central heating systems, range hoods or portable air purification room units.

2. For static conditions, small filters or packets can be placed in localized odor areas (closets, florists, vaults, refrigerators) where normal diffusion and convection currents carry odor molecules across the pellets.

Media pellets utilize two of the oldest proven methods of gas contaminant control: sorption and oxidation. The removal of the contaminants begins by both adsorbing and absorbing molecules. Then, with the potassium permanganate as an oxidizing agent, Multi-Mix® proceeds to chemically destroy the collected contaminants. This chemical oxidation is termed controlled oxidation because of its containment in the pellet form. Also, it does not involve high temperatures or burning, unlike combustible oxidation methods. In this way, the system is unique.

Controlled chemical oxidation accounts for the system's **destruction of odors** adding, in effect, a new dimension to odor control.

A wide range of individual chemical contaminants have been found to be subject to such molecular breakdown. Representative chemicals reactive with the chemical media are listed on page 3.

OXIDATION OF ODORS

The combination of activated alumina and potassium permanganate is the key to the effectiveness of Multi-Mix®. Simply, the chemical oxidation of odors with MM-1000 takes place in the following manner:

The alumina adsorbs and absorbs both moisture and chemical contaminants. The adsorbed contaminants collect on the outer surface and interfaces of the pellets; the absorbed contaminants penetrate into the heart of the pellets. Moisture dissolves the permanganate, which in turn, oxidizes both the adsorbed and absorbed chemical contaminants.

The permanganate goes through several oxidation stages before its life is completely expended, resulting finally in the formation of brown manganese dioxide. As the permanganate on the outer surface of a pellet is reduced by the intermediate oxidation reaction, the pellet's external color begins to change. The pellet will progress through a range of brown colors, from light to dark and from surface to core - as the chemical oxidation capacity is finally exhausted.

Analysis of the media when the pellets first turn brown shows that approximately 80% of its effective life remains.

REPRESENTATIVE CHEMICALS REACTIVE WITH MULTI-MIX®

ALCOHOLS	Ethyl Alcohol Isopropyl Alcohol Methyl Alcohol	Liquor Rubbing alcohol Antifreeze
ALDEHYDES	Acetaldehyde Butyraldehyde Formaldehyde	Sharp, acrid odor
ALKALOIDS	Indole Nicotine Skatole	Putrefaction of proteins Tobacco smoke Putrefaction of proteins-feces
AMINES	Ammonia Cadaverine Putrescine Trimethylamine	Bacterial decomposition of proteins Fish odor
AROMATICS	Ethyle Benzene Toluene Xylene	Paint solvent odor Gasoline odor
ESTERS	Amyl Acetate Dioctyl Pthalate Ethyl Acetate	Banana odor Plasticizer Nail polish remover
ETHERS	Butyl Ether Ethyl Ether Propyl Ether	Organic solvent Anesthetic Organic solvent
KETONES	Acetone Dipropyl Ketone Methyl Ethyl Ketone	Organic solvent
MERCAPTANS	Butyl Mercaptan Ethyl Mercaptan Methyl Mercaptan	Stench (skunk odor) Stench (similar to Butyl Mercaptan) Odorant in natural gas
OLEFINES	Acetylene Butylene Ethylene	Industrial gas, odorless
ORGANIC ACIDS	Acetic Acid Butyric Acid Caprylic Acid Isovaleric Acid Propionic Acid	Vinegar Odor of rancid butter Decomposition of animal fats and oils Decomposition of animal fats and oils Sharp odor (similar to vinegar)
OXIDES	Carbon Monoxide Nitrogen Dioxide Nitrogen Oxide Sulfur Dioxide	Toxic, odorless gas Toxic, irritating gas
PHENOLS	Chlorophenol Cresol Phenol	Germicide Prime ingredient of Creosote Germicide
SULFIDES	Allyl Disulfide Carbon Disulfide Hydrogen Sulfide	Garlic oil Organic solvent (odor similar to Hydrogen Sulfide) Rotten eggs

MULTI-MIX® MM-1000

E	**EXCELLENT**	**F**	**FAIR**
G	**GOOD**	**P**	**POOR**

(Refer to Circul-Aire technicians if "F" or "P" designations are shown. May not be highly recommended.)

COMPOUNDS	CODE
Acetaldeyde	G
Acetic Acid	G
Acetone	E
Acetylene	G
Acrolein	E
Allyl Chloride	F
Ammonia	P
Amyl Acetate	F
Arsine	G
Benzene	P
Butadiene	G
Butane	P
Butane Diamine	G
Butene-2	F
Butylamine	F
Butyl Mercaptan	G
Butyric Acid	G
Caproic Acid	G
Caprylic Acid	G
Carbon Monoxide	F
Carbon Tetrachloride	P
Chlorine	F
Chloroform	P
Chloropicrin	F
3-Chloroprene	G
Diethylamine	G
Dimethylamine	G
Ethanol	G
Ethyl Acrylate	F
Ethylene	G
Formaldehyde	E
Hydrogen	P
Hydrogen Sulfide	E

COMPOUNDS	CODE
Indole	G
Iodoform	G
Isopropanol	G
Isovaleric Acid	G
Methane	P
Methanol	G
Methyl Acrylate	F
Methyl Chloroform	G
Methylethyl Ketone	E
Methylmercaptan	E
Monomethyl Amine	G
Nicotine	G
Nicotinic Acid	G
Nitric Oxide	G
Nitro Benzene	P
Nitrogen Dioxide	G
N-Methyl Pyrolidine	G
Ozone	P
Peroxy Acetyl Nitrate (PAN)	G
Phenol	E
Phosgene	F
Propane	P
Pyridine	F
Skatole	G
Styrene	G
Sulfur Dioxide	E
Toluene	F
Triarylphosphate	F
Trichloro-ethylene	G
Triethylamine	F
Trimethylamine	F
Xylene	F

ACTIVATED CARBONS

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COMPOUNDS	CODE	COMPOUNDS	CODE
Acetaldehyde	F	Decane	E
Acetic Acid	E	Dibromoethane	E
Acetic Anhydride	E	Dichlorobenzene	E
Acetone	G	Dichlorodifluromethane	E
Acalylane	P	Dichloroethane	E
Acrolam	G	Dichloromonofluoromethane	E
Acrylic Acid	E	Dichloronitroathene	E
Acrylonrole	E	Dichloropropane	E
Alcholic Beverages	E	Dichlorotetrafluoroethane	E
Amines	F	Dichlorothyelether	E
Ammonia	F	Diesel Fumes	E
Amyl Acetate	E	Diethylamine	G
Amyl Alcohol	E	Diethyl Ketone	E
Amyl Ether	E	Dimethylaniline	E
Aniline	E	Dimethysulfate	E
Asphalt Fumes	E	Dioxane	E
Automobile Exhaust	G	Dipropyl Ketone	E
Benzene	E	Ethane	P
Body Odors	E	Ether	G
Borane	G	Ethyl Acetate	E
Bromine	E	Ethyl Acrylate	E
Burned Flesh	E	Ethyl Alcohol	E
Burned Food	E	Ethylamines	G
Butadiene	G	Ethyl Benzene	E
Butane	F	Ethyl Bromide	E
Butanone	E	Ethyl Chloride	G
Butyl Acetate	E	Ethylene	P
Butyl Alcohol	E	Ethylene Chlorhydrin	E
Butyl Cellosolve	E	Ethylene Oxide	G
Butyl Chloride	E	Ethyl Ether	G
Butyl Ether	E	Ethyl Formate	G
Butylene	F	Ethyl Mercaptane	G
Butyne	F	Ethyl Silicate	E
Butyraldehyde	G	Essential Oils	E
Butyric Acid	E	Eucalyptol	E
Camphor	E	Fertilizer	E
Caprylic Acid	E	Fill Processing Odors	G
Carbolic Acid	E	Fish Odors	E
Carbon Dioxide	P	Floral Scents	E
Carbon Disulfide	E	Fluorotrichloromethane	G
Carbon Monoxide	P	Formaldehyde	F
Carbon Tetrachloride	E	Formic Acid	G
Cellosolve	E		
Cellosolve Acetate	E	Gangrene	E
Cheese	E	Garlic	E
Chlorine	G	Gasoline	E
Chlorobutadiene	E		
Chloroform	E	Heptane	E
Chloronitropropane	E	Heptylene	E
Chloropicrin	E	Hexane	G
Citrus & Other Fruits	E	Hexylene	G
Cleaning Compounds	E	Hexyne	G
Coal Smoke	G	Hydrogen	P
Creosote	E	Hydrogen Bromide	G
Cresols	E	Hydrogen Chloride	F
Crotonaldehyde	E	Hydrogen Cyanide	G
Cyclohexane	E	Hydrogen Fluoride	F
Cyclohexanol	E	Hydrogen Iodide	G
Cyclohexanone	E	Hydrogen Selenide	F
Cyclohexene	E	Hydrogen Sulfide	G

ACTIVATED CARBONS

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COMPOUNDS	CODE
Incense	E
Indole	E
Iodine	E
Iodoform	E
Irritants	E
Isophorone	E
Isoprene	G
Isopropyl Acetate	E
Isopropyl Alcohol	E
Isopropyl Ether	E
Kerosene	E
Kitchen Odors	E
Lactic Acid	E
Menthol	E
Mercaptans	E
Methane	P
Methyl Acetates	G
Methyl Acrylate	E
Methyl Alcohol	G
Methyl Bromide	G
Methyl Butyl Ketone	E
Methyl Cellosolve	E
Methyl Cellosolve Acetate	E
Methyl Chloride	G
Methyl Chloroform	E
Methylcyclohexane	E
Methylcyclohexanol	E
Methylcyclohexanone	E
Methylene Chloride	E
Methyl Ether	G
Methylethyl Ketone	E
Methyl Formate	G
Methyl Isobutyl Ketone	E
Methylmercaptan	E
Monochlorobenzene	P
Monofluorotri-Chloromethane	E
Naphtha	E
Naphthalene	E
Nitric Acid	G
Nitrobenzene	E
Nitroethane	E
Nitrogen Dioxide	F
Nitroglycerine	E
Nitromethane	E
Nitropropane	E
Nitrotoluene	E
Nonane	E
Octalene	E
Octane	E
Onions	E
Organic Chemicals	E
Ozone	E
Packing House Odors	E
Paint & Redecorating Odors	E
Palmitic Acid	E
Paradichlozbenzene	E
Pentane	G

COMPOUNDS	CODE
Pentanone	E
Pentylene	G
Pentyne	G
Perchloroethylene	E
Perfumes & Cosmetics	E
Phenol	E
Phosgene	G
Pitch	E
Poison Gases	G
Pollen	G
Popcorn & Candy	E
Poultry Odors	E
Propane	F
Propionaldehyde	G
Propionic Acid	E
Propyl Acetate	E
Propyl Alcohol	E
Propyl Choride	E
Propyl Ether	E
Propyl Mercaptan	E
Propylene	F
Propyne	F
Putrefying Substances	B
Putrescine	E
Pyridine	E
Resins	E
Rubber	E
Sauerkraut	E
Sewer Odors	E
Skatole	E
Slaughtering Odors	G
Smog	E
Sour Milk	E
Stoddard Solvent	E
Styrene Monomer	E
Sulfur Dioxide	F
Sulfur Trioxide	G
Sulfuric Acid	E
Tetrachloroethane	E
Tetrachloroethylene	E
Tobacco Smoke Odor	E
Toilet Odors	E
Toluene	E
Toluidine	E
Trichlorethylene	E
Trichloroethane	E
Turpentine	E
Urea	F
Uric Acid	E
Valeric Acid	E
Valeric aldehyde	E
Varnish Fumes	E
Xylene	E

APPLICATIONS

APPLICATIONS	CONTAMINANTS
Airline Terminals	ETS, fumes, food odors
Air Raid Shelters	Multiple organics & inorganics
Animal Rooms	Urine, excreta, pet odors
Art Studios	Multiple organics & inorganics
Athletic Clubs	Body odors, Valeric Acid
Auditoriums	Multiple organics & inorganics
Autopsy Rooms	Formaldehyde
Banks (customer area)	Formaldehyde, multiple organics & inorganics
Banks (vault area)	Formaldehyde
Banquet Rooms	ETS, body odors, food odors
Barber Shops	ETS
Bars	ETS, body odors, perfume
Beauty Salons	Multiple organics & inorganics
Bingo Halls	ETS
Book Stacks	Multiple hydrocarbons
Brasseries	ETS, food odors, body odors
Bus Terminals	ETS
Cafeterias	ETS, kitchen fumes
Casinos	ETS
Chemical Storage Areas	Multiple organics & inorganics
Clinics	Multiple organics & inorganics
Cocktail Lounges	ETS, food odors
Conference Rooms	ETS, body odors, furn off gasing
Darkrooms	Multiple organics & inorganics
Decal Application Areas	Multiple organics & inorganics
Dentists' Offices	Multiple organics & inorganics
Dining Rooms	Food odors, ETS
Doctors' Offices	Multiple organics & inorganics
Drafting Areas (w/o BPM)	Multiple organics
Drafting Areas (w/ BPM)	Ammonia, mutiple organics
Dry Cleaners (dust area)	Multiple organics & inorganics
Embalming Rooms	Formaldehyde, multiple organics
Factories (office area)	ETS, furniture
Fertilizer Plants (office)	Ammonia, ETS
Fish Markets	Tri-Methyl Amine
Florists	Floral scents
Fruit & Vegetable Storage Areas	Ethylene, multiple organics
Funeral Homes	ETS, body odors, furniture
Garbage Disposal Areas	Multiple organics & inorganics, acidic compounds
Geriatrics	Body odors, urine, excreta
Greenhouses	Ethylene, multiple organics
Grocery Stores	Multiple organics & inorganics
Hospitals	Multiple organics & inorganics, body odors
Hospitals (autopsy)	Formaldehyde
Hotels (smoking, renovation)	ETS, particulates, paint
Institutions (psychiatry)	ETS, body odors, urine
Intensive Care Units	Multiple organics & inorganics

Media formulations can be mixed to provide a single bed configuration.

APPLICATIONS

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Kitchen Exhausts	Odorous fumes
Labs (research)	Multiple organics & inorganics from solvent, etc.
Libraries	Multiple hydrocarbons
Locker Rooms	Body odors, Valeric Acid
Lounges	ETS
Lunch Rooms	Multiple odors, ETS, food
Meat Markets	Multiple organics & inorganics
Morgues	Formaldehyde
Motels	Furnishings, ETS
Museums	Multiple contaminants
Night Clubs	ETS, body odors, perfume
Nurseries	Multiple organics & inorganics
Office Buildings	ETS, paint fumes, furniture
Paint Shops	Tiluene, Xylene, multiple organics
Painted Rooms	Paint fumes
Penal Institutions	ETS, body odors
Pet Shops	Urine, animal odors
Pharmacies	Multiple contaminants
Photo Stores (one-hour)	Multiple hydrocarbons
Photographic Studios	Multiple hydrocarbons
Physiotherapy	Multiple (oils & waxes)
Printing Plants	Hydrocarbons & ammonia
Projection Booths	Hydrocarbons, ETS, food odors
Psychiatric Wards	ETS, body odors
Public Toilets	Urine, excreta, body odors
Radio Studios	ETS
Recreation Halls	Multiple contaminants
Rendering Plants	Multiple organics
Restaurants	Food odors, ETS
Segregated Smoking Rooms	ETS, body odors, perfume
Storage Rooms	Multiple organics & inorganics
Stores	Multiple organics & inorganics
Television Studios	ETS, food odors, perfume
Theaters	ETS, food odors
Veterinary Hospitals	Animal odors, urine
Waiting Rooms	ETS

Media formulations can be mixed to provide a single bed configuration.

CIRCUL-AIRE

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Printed in Canada
2.5-0403