compounds, either gaseous or particulate, which create odor problems. The use of catalysts to reduce the temperature needed for combustion is comparatively recent in this field. In some instances the heat of combustion may be recovered for utilization. The temperature necessary for destruction of compounds varies with the nature of the contaminant. However, partial combustion may alter the compound to render it innocuous. The temperature required for complete destruction is usually above 1100 F. Catalysts may only require heating to 500 F or may operate without heating if the gas temperature is above 500 F.

Absorbers

These may consist of spray chambers, packed towers, or wet cell washers through which an absorbing agent is recirculated. The gases collected may be converted to insoluble salts or usable acids and other compounds. The performance of these devices depends upon several factors such as the solubility of the gas, its vapor pressure, its rate of reaction with the absorbent, the velocity through the collector, area of the absorbing surface either as spray droplets or wetted media. These are generally designed for the specific purpose intended. They usually are intended to collect over 95 percent of the contaminant. Resistance depends upon the particular design and ranges from 1 to 10 in. of water in most installations. Their resistance during their operating interval is constant unless serious plugging of packing occurs. Spray units are seldom affected by plugging. Packed absorption devices require a precleaner to remove particulates if long trouble-free service is desired. Maintenance of spray nozzles is a function of the degree of atomization used and of conditions encountered, such as purity of spray liquids.

Protection against corrosion and freezing may be necessary and disposal of waste liquids may create secondary problems.

Adsorbers

These units consist of a chamber filled with a granular adsorbent. The adsorbent may be activated charcoal, silica gel, alumina and other treated solids. Activated charcoal is the most common and has the highest retention per unit weight for organic solvents. Performance of adsorbent beds depends upon their thickness, velocity of the gas passing, mesh size (surface area) of adsorbent and temperature of the vapor being removed. They can be designed to obtain almost complete removal of organic vapors and some inorganic gases. They may be reactivated by the use of steam or heat. Resistance depends upon the adsorbent mesh size, depth and velocity. It may range from less than one inch of water to several inches of mercury.

Adsorbent beds are usually limited, because of their cost, to applications where recovery may be economically feasible. Removal of particulate matter by use of precleaners is necessary if significant loadings are involved as the adsorbent voids are readily plugged. They are not suitable for high temperature conditions. Silica gel and alumina exhibit a strong preference for water vapor whereas charcoal does not.

Combustion Devices

This group of industrial air cleaners entails the use of high temperatures or catalysis combined with some elevation in temperature to destroy or decompose organic and some inorganic gases which create obnoxious odors.

The devices are divided into those in which combustion is obtained by use of liquid or gaseous fuels and the secondary air for combustion is provided by the contaminated air. In essence, the simplest form involves passing the contaminated air through the combustion chamber of a boiler or fire box. Special fire boxes or brick checkerwork may also be employed. Catalytic devices consist of noble metal packed into frames in the form of ribbons or screens or may be ceramic granules coated with noble metal catalysts. The frames or packing are placed in a housing over which the gas stream to be decontaminated is passed. The contaminants break down and are reduced to elemental gases of an innocuous nature. Catalysts reduce the amount of heat necessary but may become contaminated by sulfur or other elements.

The performance of a combustion device is dependent upon the retention period of the contaminant in the high temperature zone. Removal or destruction is thus dependent on velocity and surface area of the heat transfer device. If properly designed, obnoxious odors are removed.

The resistance of the direct combustion unit is negligible since it is an integral part of the fuel combustion system. Catalytic devices behave in a manner comparable to packed beds or filters except that they are not plugged by organic particulates but may be affected by inorganic solids.

Maintenance of these types of units is essentially dependent upon the contaminants encountered. The direct combustion system requires little care other than that required by ordinary fuel burning equipment. Catalytic units become contaminated slowly and will require removal for reactivation at certain intervals depending upon the application.

Economic factors may limit the use of direct combustion methods unless there is a demand for the heat generated. They may best be applied to processes employing combustion. Catalytic units require temperatures of at least 500 F and consequently it may be necessary to preheat the contaminated air to this value.

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