

# The next stage of filtration

**F**iltering particulate matter from air addresses only part of the problem of achieving good quality air. What about odours caused by gases? John Gardiner considers the role of activated carbon.

Even if it is only in the deep fat fryer, we are all familiar with the use of carbon to remove odours. Fitted into an air-handling system, a carbon adsorber removes gaseous and

odorous contaminants from the intake or exhaust air, depending on the requirements of the application.

Activated carbon is produced by roasting coconut shell and similar substances in an inert atmosphere, thus expanding the material and increasing its surface area. The internal surface is a mass of thousands of tiny pores, the size of which is determined by the raw material and activating processes used in

manufacture. Small pores are ideal for adsorbing small molecules, usually in the gaseous state.

As offending vapours are adsorbed, the weight of the carbon will increase to a saturation limit, when it must be replaced. A good grade will normally adsorb 20 to 50% of its own weight.

Several forms of activated carbon are available. The form usually used in air-handling systems is granular.

Although department stores, offices, supermarkets and other public areas rarely employ carbon filtration, applications could arise in kitchens, recreation rooms, hospitals and bars. The most likely candidates for treatment are animal rooms and meat packaging plants.

### Effectiveness

Manufacturers of carbon filters say they are effective against a wide range of contaminants - from



Smells and fumes often originate outside buildings. At Manchester International Airport's departure lounge carbon adsorbers in the fresh-air intakes remove fumes produced by aircraft - such as aviation fuel.

radioactive isotopes to cooking odours. Standard carbon filters have varying levels of effectiveness. They are very good at removing the odours of detergent, poultry, rubber and tobacco smoke, but much less effective against ammonia and formaldehyde. If required to filter methane, ethylene or octane, their performance is poor. However, manufacturers have now developed an impregnated activated carbon which may be used for sulphur dioxide, hydrogen chloride and ammonia.

### "The human nose is extremely sensitive to smells"

Where there are several different contaminants, a multi-stage filter with different impregnated activated carbon units may be the best solution.

Standard activated carbon is suitable for use up to 40°C and a relative humidity up to 70%. As carbon adsorbs water vapour, humidity affects its capacity; in general, though, this has no effect on normal ventilation air.

The effectiveness of the carbon adsorber depends on contact time and the amount of material presented to the airstream, so the required volume of carbon may be calculated from the contact time and air volume. Contact time is normally limited by the grade of carbon used and the acceptable pressure drop in an air-handling system.

One practical approach is to arrange the system so that individual cells of adsorbent material each handle part of the total air volume. This approach also limits the total face area required.

### Test

To estimate the size and arrangement of a system, it is necessary to know the size and arrangement of a

building, the rate of contamination and capacity for adsorption. The most dependable test is to pass a measured quantity of the actual air through an experimental adsorber and measure the time needed for the odour to break through. Unfortunately, this process could take months, and is thus not always a practical solution.

The human nose is extremely sensitive to smells and is thus an effective - and cheap - test of whether a carbon adsorber is working. Levels of perception differ widely. The threshold for carbon tetra-chloride is 71.8 parts per million. That for artificial musk is only four parts per million million.

The function of a carbon filter is to remove gases - not solids. A suitable pre-filter must be installed to ensure that the carbon filter can perform its correct function and does not become clogged by solid particulate matter. The minimum atmospheric dust spot efficiency that should be considered is 30% to BS 6540 (86% arrestance). However, it is advisable to go up to 85% efficiency (90% arrestance) to ensure full protection.

### Day-to-day

In conclusion, carbon adsorption is a pre-requisite for many specialist applications, but it is also worth considering for many day-to-day situations. After using well-filtered recirculated air with tobacco smoke and body odours removed certainly saves money and may well be cleaner than 'fresh air' from a vehicle-congested road. At the same time, it is always a good idea to pass outside air through a carbon adsorber to ensure that the building occupants are breathing clean, as well as 'fresh', air. □

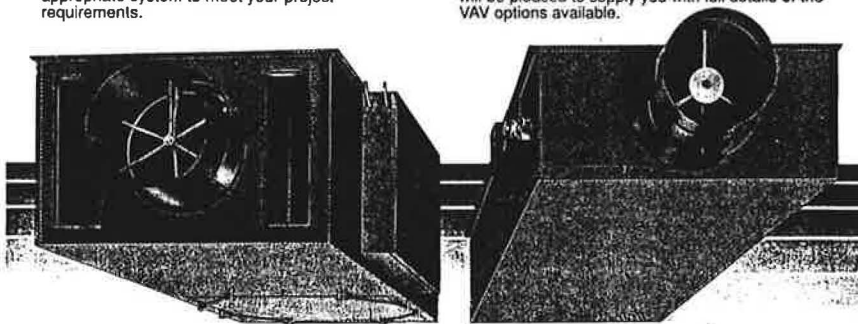
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