

## 7.8 Adsorption filters

### 7.8.1 Activated carbon

Activated carbon removes contaminants from water by physical adsorption. Adsorption will be affected by the amount and type of the carbon, the nature and concentration of the contaminant, retention time of water in the unit, and general water quality (temperature, pH, etc.). Granular activated carbon (GAC) is the most common medium employed although powdered activated carbon (PAC) and block carbon are also used. The filter medium is contained in replaceable cartridges; a particulate filter at the outlet of the cartridge removes carbon fines from the treated water. Other similar types of filter are pre-coated activated carbon filters and filters using different adsorbents, such as bone charcoal (an adsorbent made from charred animal bones, consisting principally of hydroxyapatite together with about 10% by weight of carbon).

Activated carbon filters will remove (to varying degrees) suspended solids, chlorine and organic contaminants including pesticides, trihalomethanes (THMs) and some of the humic substances responsible for the yellow to brown coloration in 'peaty' waters. The hydraulic retention time is a critical factor in determining the removal of contaminants. In point of use devices this is often short and can limit the removal of contaminants, particularly pesticides. Domestic devices for treatment of mains water are probably used primarily for aesthetic reasons – removal of compounds causing taste and odour; removal of residual chlorine; partial removal of colour; removal of suspended solids and turbidity.

Unfortunately, activated carbon is an ideal medium for the accumulation and growth of micro-organisms. There is concern that direct consumption of water from activated carbon devices may cause health problems due to bacteria released into the water; inhalation of bacteria-containing aerosols, for example during washing, could also be harmful. Activated carbon removes chlorine from the water, and bacterial growth can occur even on filters treating chlorinated water.

Some filters are impregnated with silver to inhibit the growth of bacteria. However, it has been demonstrated that high numbers of bacteria can be found in water treated by silver impregnated units; apparently silver serves as a selective agent, inactivating some bacteria but allowing others to grow. The problem of bacterial growth will be increased if the user fails to install or maintain the filter as recommended by the manufacturer. Some manufacturers specifically state that their devices should not be used on waters that are "microbiologically unsafe or of unknown quality".

### 7.8.2 Activated alumina filters

Activated alumina is manufactured by calcining aluminium hydroxide. Filters containing granular activated alumina can be used for the removal of arsenic and other chemicals, including fluoride. In point of use applications, once the activated alumina bed reaches its capacity, the spent cartridge has to be replaced and disposed of or returned to the supplier for regeneration.