

Carbon filtering

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Carbon filtering is a method of filtering that uses a bed of activated carbon to remove contaminants and impurities, using chemical adsorption.

Each particle/granule of carbon provides a large surface area/pore structure, allowing contaminants the maximum possible exposure to the active sites within the filter media. One pound (454 g) of activated carbon contains a surface area of approximately 100 acres (40 Hectares).

Activated carbon works via a process called adsorption, whereby pollutant molecules in the fluid to be treated are trapped inside the pore structure of the carbon substrate. Carbon filtering is commonly used for water purification, in air purifiers and industrial gas processing, for example the removal of siloxanes and hydrogen sulfide from biogas. It is also used in a number of other applications, including respirator masks, the purification of sugarcane and in the recovery of precious metals, especially gold. It is also used in cigarette filters.

Active charcoal carbon filters are most effective at removing chlorine, sediment, volatile organic compounds (VOCs), taste and odor from water. They are not effective at removing minerals, salts, and dissolved inorganic compounds.

Typical particle sizes that can be removed by carbon filters range from 0.5 to 50 micrometres. The particle size will be used as part of the filter description. The efficacy of a carbon filter is also based upon the flow rate regulation. When the water is allowed to flow through the filter at a slower rate, the contaminants are exposed to the filter media for a longer amount of time.

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Types of carbon filters

There are two predominant types of carbon filters used in the filtration industry: powdered block filters and granular activated filters. In general, carbon block filters are more effective at removing a larger number of contaminants, based upon the increased surface area of carbon. Many carbon filters also use secondary media such as silver to prevent bacteria growth within the filter. Alternatively, the activated carbon itself may be impregnated with silver to provide this bacteriostatic property.

History of carbon filters

^[1] Carbon filters have been used for several hundred years and are considered one of the oldest means of water purification. Historians have shown evidence that carbon filtration may have been used in ancient Egyptian cultures for medical purposes and as a purifying agent.^[2] 2000 B.C. Sanskrit text refers to filtering water through charcoal (1905 translation of "Sushruta Samhita" by Francis Evelyn Place). The first recorded use of a carbon filter to purify potable water on a large scale occurred in 19th century England.^[2]

Currently, carbon filters are used in individual homes as point-of-use water filters, groundwater remediation, landfill leachate, industrial wastewater and, occasionally, in municipal water treatment facilities. They are also used as pre-treatment devices for reverse osmosis systems and as specialized filters designed to remove chlorine-resistant cysts, such as giardia and cryptosporidium.

Hydrogen production

For small-scale production of hydrogen, water purifiers are installed to prevent formation of minerals on the surface of the electrodes and to remove organics and chlorine from utility water. First the water passes through a 20 micrometer interference (mesh or screen filter) filter to remove sand and dust particles, second, a charcoal filter (activated carbon) to remove organics and chlorine, third stage, a de-ionizing filter to remove metallic ions. A test can be done before and after the filter for proper functioning on barium, calcium, potassium, magnesium, sodium and silicon.

Radiation and nuclear medicine

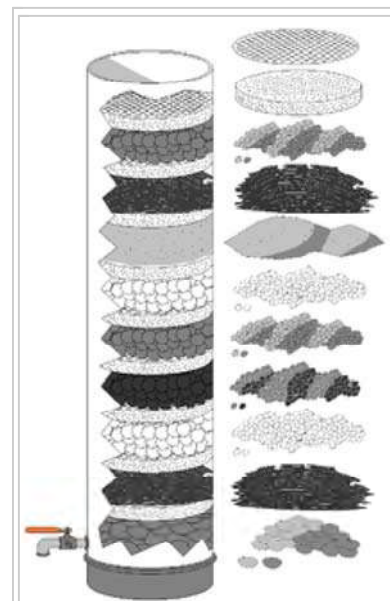
Carbon filters, along with HEPA filters, are widely used in the construction of hot cells. This allows the room to exhaust air that contains infinitesimal quantities of radioactivity and contaminants.

See also

- Water filter
- List of waste-water treatment technologies

References

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 - "A Citizen's Guide to Activated Carbon Treatment. Document no. EPA 542-F-01-020" (PDF). EPA. 2001.
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Carbon filtering is usually used in water filtration systems. In this illustration, the activated carbon is in the fourth level (counted from bottom).



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