

Viscous impingement unit filters do not have efficiencies as high as can be expected with some other types of unit filters, but their first cost and upkeep are generally lower, whether of the cleanable or the throw-away type. They require more careful attention than the automatic oil type if the resistance is to be maintained within reasonable limits.

Safety Requirements

An investigation of safety ordinances should be made by the engineer when the installation of an air cleaner of any considerable size is contemplated. It is possible that a combustible filtering media may not be permitted in accordance with some existing local regulations. Combust-

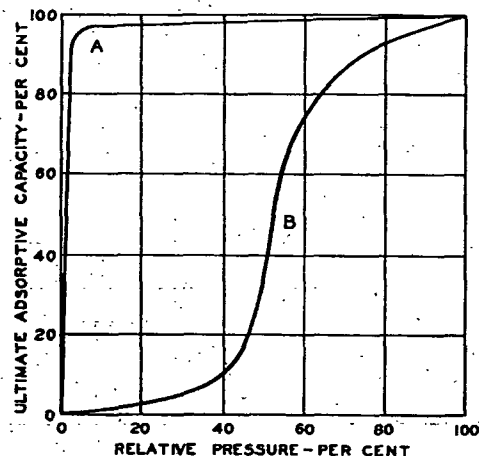


FIG. 4. ADSORPTION AT RELATIVE PRESSURES BY CHARCOAL OF A TYPICAL ORGANIC GAS (A) AND WATER VAPOR (B)

tion of dust and lint on a filtering medium is possible, though the medium itself may not burn.

ADSORPTION OF VAPORS OTHER THAN WATER

Many of the foreign gases in the atmosphere are selectively adsorbed by charcoal. Included are many of the organic gases, such as those emanating from animals and people, some of the gaseous constituents of combustion, alcohols, ketones, esters, and gaseous products of putrefaction.

The selective action of charcoal with a mixture of water vapor and organic gases is shown in Fig. 4.

Charcoals differ widely in their adsorptive capacity. Those which have marked adsorption characteristics, such as properly prepared coconut shell charcoals, are sometimes called *activated charcoals* or *activated carbon*. These materials can adsorb approximately 50 per cent of their own weight in many organic gases at 70 F. The charcoal may be used for a long time by reactivation at high temperatures, under which condition it gives up the adsorbed gases. Temperatures of approximately 1000 F are desirable for reactivation. Charcoals for use in air handling systems should be

able to stand physical handling, including reactivation without excessive loss by breakage or dusting.

As applied in air handling systems, the charcoal is placed in perforated metal containers which are grouped in frames and set in the air stream. The percentage removal of an organic gas, such as carbon tetrachloride, is 95 per cent or above when placed in intimate contact with the carbon at 70 F. In commercial apparatus there may be a by-pass effect which depends on the physical arrangement of the charcoal containers. This by-passing reduces the percentage removed in the total gas passing through the adsorber. Resistance to air flow is usually selected within the general range of resistance of impingement filters.

The required quantity of recirculated air to be treated is determined by the requirements for contaminant-free air, minus the outdoor air, divided by the fraction denoting the percentage removal of the gas in question in the adsorber bank which is to be used.

Adsorbers may be applied to reduce objectionable gases entering through the outdoor air inlet. They may also be used to reduce the odors caused by exhausts from processing. Adsorber beds, in all cases, should be protected from dust, free oil and grease.

REFERENCES

- Design and Application of Oil-Coated Air Filters, by H. C. Murphy (A.S.H.V.E. TRANSACTIONS, Vol. 33, 1927, p. 73).
- Operation and Maintenance of Air Filters, by W. G. Frank (*Heating, Piping and Air Conditioning*, May, 1931, p. 378).
- Size and Characteristics of Air-Borne Impurities, by W. G. Frank (*Heating, Piping and Air Conditioning*, January, 1932, p. 35).
- Fundamental Principles in the Design of Dry Air Filters, by Otto Wechsberg (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, April, 1933, p. 217).
- The Economic Factors in Converting Recirculated Air for Ventilation, by H. E. Ziel and Henry Sleik (A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, July, 1943, p. 367).
- Operation, Maintenance of Cloth-Screened Dust Collectors, by W. F. Terry (*Heating, Piping and Air Conditioning*, May, p. 259, June, p. 304, 1933).
- Testing and Rating of Air Cleaning Devices Used in General Ventilation Work, by Samuel R. Lewis (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 277).
- A.S.H.V.E. RESEARCH REPORT No. 1094—Air Filter Performance as Affected by Kind of Dust, Rate of Dust Feed, and Air Velocity Through Filter, by F. B. Rowley and R. C. Jordan (A.S.H.V.E. TRANSACTIONS, Vol. 44, 1938, p. 415).
- A.S.H.V.E. RESEARCH REPORT No. 1122—Air Filter Performance as Affected by Low Rate of Dust Feed, Various Types of Carbon, and Dust Particle Size and Density, by F. B. Rowley and R. C. Jordan (A.S.H.V.E. TRANSACTIONS, Vol. 45, 1939, p. 339).
- A.S.H.V.E. RESEARCH REPORT No. 1145—The Effect of Lint on Air Filter Performance, by F. B. Rowley and R. C. Jordan (A.S.H.V.E. TRANSACTIONS, Vol. 46, 1940, p. 25).
- A.S.H.V.E. RESEARCH REPORT No. 1169—Comparison of the Weight, Particle Count and Discoloration Methods of Testing Air Filters, by F. B. Rowley and R. C. Jordan (A.S.H.V.E. TRANSACTIONS, Vol. 47, 1941, p. 29).
- A.S.H.V.E. RESEARCH REPORT No. 1187—Economical Air Velocities for Mechanical Air Filtration, by F. B. Rowley and R. C. Jordan (A.S.H.V.E. TRANSACTIONS, Vol. 47, 1941, p. 391).
- A.S.H.V.E. RESEARCH REPORT No. 1218—Overloading of Viscous Air Filters During Accelerated Tests, by F. B. Rowley and R. C. Jordan (A.S.H.V.E. TRANSACTIONS, Vol. 48, 1942, p. 437).
- The Dust-Free Space Surrounding Hot Bodies, by H. H. Watson (*Transactions of the Faraday Society*, Vol. 32, 1936, Pt. 2, p. 1073).
- A New Electrostatic Precipitator, by G. W. Penney (*Electrical Engineering*, January, 1937, p. 159).