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# Analysis of Ventilation Methods for Controlling Industrial Pollutants

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**Abstract:** The chemical and petrochemical industry production process will produce and leak a variety of industrial pollutants; industrial ventilation is an important way to control the concentration of indoor industrial pollutants and protect employees' safe production. This paper introduces several ventilation methods to control the concentration of industrial pollutants and briefly introduces the principle, use occasions, and advantages and disadvantages of ventilation methods.

**Keywords:** Concentration of industrial pollutants; Industrial ventilation; Ventilation mode

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## Introduction

The chemical and petrochemical industry production process will produce and leak a variety of industrial pollutants, some of these industrial pollutants belong to the human body toxic gas, and some belong to explosive dangerous gas, part of the workshop because there are a large number of high-power electrical equipment in the room, will release a lot of heat, these need to be timely and effective discharge outdoor, To ensure the safety of indoor personnel and the stable operation of equipment. Industrial ventilation is the most direct and effective solution to control such problems, and it is an essential safety measure for modern petrochemical and chemical workshops. When doing industrial ventilation design, we should first consider the local mechanical ventilation of the control pollution source, and consider the design of natural ventilation or comprehensive ventilation when there is no condition to design local mechanical ventilation.

### 1. Natural ventilation

Natural ventilation refers to the use of doors, windows, ventilation skylights, unpowered ventilation equipment, and other ventilation facilities, the use of indoor and outdoor wind pressure, and hot pressure for ventilation. Natural ventilation is the simplest and most energy-saving way of ventilation. When we do industrial ventilation, first analyze the characteristics of indoor pollution sources, in the need to eliminate a large amount of waste heat, residual humidity, or harmful gases generated in the plant is lighter than the air and is not extremely toxic or cause serious pollution to the surrounding air, natural ventilation is preferred for ventilation. Such as aluminum foil production workshops, steam turbine generator rooms, polysilicon production plants, etc., these workshops have a common feature: that is, indoors will produce a lot of water vapor or emit a lot of waste heat all year round. When doing the natural ventilation design of this kind of workshop, we should make use of these harmful properties, plan a reasonable airflow flow, set ventilation shutters in the lower area of the workshop (usually set below the windowsill), set ventilation skylight or natural ventilator in the upper part of the workshop (the roof is best) to achieve the best ventilation effect.

Natural ventilation has great advantages in energy saving, equipment maintenance, and so on because it does not use a ventilator, but it also has its shortcomings. First, affected by the external climate, when the indoor and outdoor wind pressure and hot pressure are not enough to effectively discharge the indoor harmful gas outdoors, the ventilation effect is very poor; Second, it is easy to form air short circuits, individual plant span is large, and the ventilation effect in the middle area of the plant is not ideal. Given the second situation, we can set jet fans in the lower area of the plant to optimize the airflow channel.

### 2. Mechanical ventilation

Mechanical ventilation, as the name suggests, refers to the ventilation mode of the directional flow of airflow by the power generated by the fan. When natural ventilation is not enough to meet the requirements of process production or the design health standards of industrial enterprises, we will use mechanical ventilation. Mechanical ventilation is the most important ventilation method in the chemical and petrochemical plant room because its ventilation volume can be determined according to the design value, the outdoor climate has little influence on it, the air duct arrangement is flexible, and the indoor pollutant emission effect is obvious. From the scope of ventilation, mechanical ventilation can be divided into two forms local ventilation and comprehensive ventilation, from the principle of avoiding the expansion of pollution

sources and energy saving, we should give priority to the form of local ventilation.

## **2.1 Local ventilation**

Local ventilation is divided into local supply air and local exhaust air, which is a ventilation method to improve the air quality of the local area through the fan. The following is a brief introduction to the two ventilation methods.

### **2.1.1 Local air supply**

Local air supply refers to the form of air supply to the designated post through the post-air supply device. Local air supply is often used in large factories without heating or air conditioning in the room, such factories, to ensure the working environment of workers. Air conditioning air is sent to the working area of workers, which can significantly improve the air quality and temperature of the post and improve the comfort of workers in production. Because the local air supply changes the air that was originally in a state of disordered flow, this kind of ventilation is generally not used in places where industrial pollutants are not allowed to spread or places that will affect the chemical process.

### **2.1.2 Local exhaust air**

Local exhaust refers to the ventilation method in which the exhaust hood is set at the specified position to collect industrial pollutants and discharge them through the air pipe. Local exhaust can avoid the spread of harmful substances, and at the same time can collect harmful substances, directional treatment, and directional discharge. We usually set up local exhaust in the following places: near the filling box of pumps and compressors that are prone to produce harmful substances or toxic substances, the feeding and discharging of equipment in the discontinuous production process, the tight place of process processing equipment, the process equipment that may release harmful gases, steam or dust, above the oven, above the small experiment platform, or the fume cabinet. The correct selection of local exhaust hood has an important impact on the quality of the local exhaust effect. Under the technological conditions, the use of a closed exhaust hood is given priority. When the technological conditions are limited, combined with the specific technological form, the exhaust hood suitable for the umbrella-shaped hood, side suction hood, and slot exhaust is selected. The layout position, size, and installation height of the exhaust hood need to be calculated to ensure that industrial pollutants can be effectively collected within the scope of the local exhaust area. When setting the local exhaust air, the process flow should be considered in particular. If the mixture may cause combustion, explosion, condensation, and accumulation of dust or form more toxic substances, the local exhaust system should be set separately.

For the local exhaust of harmful gases, such as higher concentrations of combustible, toxic gases, odor gases, large concentrations of acid, alkaline gases, etc., need to be treated, and cannot be directly discharged into the atmosphere, affecting the environment. According to the type of exhaust gas, a suitable exhaust gas treatment device is set up at the end of the local ventilation system. For combustible gas, it can be led to the factory torch, burned, and then drained; For industrial dust, a bag dust collector, cyclone dust collector, and other dust removal devices can be set in the ventilation system to collect dust; For acidic and alkaline gases, the corresponding alkali washing tower or pickling tower can be set up at the end of the system to neutralize and absorb the tail gas, and the gas containing organic matter or odor can be set up in the ventilation system to adsorb the tail gas or a special chemical adsorption device to empty the exhaust gas after adsorption treatment.

## **2.2 Comprehensive ventilation**

In the workshop that emits heat, humidity, and harmful gases, when the source is dispersed or not fixed and local ventilation cannot be used, or when local ventilation is still difficult to meet the health requirements, comprehensive ventilation should be set up. General ventilation is usually calculated by the number of air changes in the room. General ventilation includes both natural and mechanical ventilation. When designing comprehensive ventilation, first of all, according to the physical properties of indoor pollution sources, when the pollution source belongs to a gas lighter than air, it is appropriate to exhaust from the upper part of the plant and enter the lower part of the air; When the pollution source belongs to the gas heavier than air, it is necessary to set an exhaust outlet in the lower part of the plant (usually the bottom of the exhaust outlet is no more than 0.3m from the ground), and set an intake outlet away from the exhaust outlet, so that a single flow of air in the plant can be formed, and harmful substances can be effectively discharged from the plant. When setting up the exhaust and air intake, the outdoor wind direction and the position of the indoor staff should also be considered. When the plant span is large, the exhaust system and the air supplement system should be set up at the same time. For the general plant, the air supply volume can be designed according to 80% of the exhaust air volume, so that the plant can maintain the state of micro negative pressure, and the harmful substances in the plant do not pollute the adjacent area. For the plant located in the cold area, there are indoor temperature requirements in winter, and the air supply should be heated, usually choose the air supply by the heater or the combined air conditioning unit.

## **3. Emergency ventilation**

In a production plant that may suddenly release a large number of harmful gases or explosive dangerous gases or dust, an accident ventilation system should be designed. The purpose of setting up the accident ventilation system is to discharge harmful gases in time when a large

number of indoor leaks and protect the personal safety of the personnel in the workshop. Toxic gas alarms and combustible gas alarms should be set up in the plant that may release toxic gas or explosive dangerous gas. When the indoor gas concentration reaches the alarm value, the interlock accident fan should be started. The accident fan should be set a switch in the room and the outer wall near the outside door for easy operation.

According to the form of ventilation, there is positive pressure ventilation: a positive pressure small room is generally separated in the explosion area, which is placed non-explosion-proof equipment, and a positive pressure air supply system is set up in the room to ensure that the outdoor explosive dangerous gas does not invade the air supply system; Clean room air supply system: standing in the indoor environment has clean requirements, such as polysilicon generation workshop, the air supply system is set up in the junior high-efficiency filter to ensure the cleanliness of the air supply level.

#### **4. Conclusion**

Industrial pollutants exist widely in the production process of chemical and petrochemical enterprises, and their concentration exceeding the standard will harm the health of employees and even cause accidents. The correct design of an industrial ventilation system is an essential link to ensure the safe and stable production of modern chemical and petrochemical enterprises.

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#### **References**

- [1] SUN Yijian. Industrial Ventilation [M]. Beijing: China Building and Architecture Press, 2014:29-30
- [2] FAN Guojun. Talk about local ventilation method [J]. Shandong Coal Science and Technology, 2010(02): 193-194
- [3] TIAN D D. Analysis of ventilation methods for controlling industrial pollutants [J]. Oil Refining and Chemical Industry.2015(06): 71-72. (in Chinese)