# Activated Carbon Adsorption for Catalytic Combustion Equipment

## I. Working Process

This device is a combined VOC exhaust purification system integrating activated carbon adsorption/concentration and catalytic combustion desorption/regeneration as two core technologies, balancing the economy of adsorption purification with the high efficiency of catalytic combustion, fundamentally solving the challenge of treating large-volume, low-concentration organic exhaust, and achieving the closed-loop operation of "Adsorption up to standard + Desorption and regeneration" closed-loop operation.

Core process flow: Large-volume, low-concentration VOC exhaust first enters the activated carbon adsorption unit, where organic pollutants are efficiently adsorbed and retained by the activated carbon, and the purified gas is discharged up to standard. When the activated carbon adsorption reaches saturation, the system automatically switches to desorption and regeneration mode; the high-concentration organic exhaust adsorbed is desorbed by hot air heating, forming low-volume, high-concentration exhaust. The high-concentration exhaust enters the catalytic combustion unit, where it is completely oxidized and decomposed into harmless carbon dioxide and water at low temperatures of 200~400℃ with the action of a catalyst, while the released heat can be recovered for desorption heating, achieving energy saving. The entire process requires no manual intervention and is fully automated, eliminating the drawback of frequent consumable replacement with single adsorption and solving the problem of high energy consumption in treating low-concentration exhaust with single catalytic combustion for low-concentration waste gases.

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## II. Core Parameters

Treatment process: Activated carbon adsorption/concentration + catalytic combustion desorption/regeneration

Catalytic combustion temperature: 200~400℃ (low temperature, high efficiency)

Exhaust treatment range: Large-volume, low-concentration organic exhaust (VOCs)

Purification efficiency: ≥97% (dual purification of adsorption + catalytic combustion)

Desorption method: Hot air desorption (heat can be recovered and reused)

Control method: PLC fully automatic control, automatic switching between adsorption/desorption modes

Applicable exhaust types: Benzene, toluene, xylene, acetone, ethyl acetate and other catalytically oxidizable VOCs

Operating energy consumption: Desorption heat can be recovered, reducing energy consumption by more than 30% compared to pure catalytic combustion.

## III. Operating Instructions

Before starting the equipment, inspect the activated carbon adsorption unit, catalytic combustion unit, fan, heating device, and control system to confirm all components are functioning normally, seals are intact, and the catalyst is undamaged.

Adsorption mode: Start the fan to direct VOC exhaust into the activated carbon adsorption unit, ensuring the exhaust passes evenly through the adsorption layer; the purified gas is discharged up to standard. The system monitors adsorption saturation in real time and automatically switches to desorption mode when the set value is reached.

Desorption + Catalytic combustion mode: The system automatically activates the hot air desorption device to desorb the VOCs from saturated activated carbon into high-concentration exhaust, which is then fed into the catalytic combustion unit for oxidative decomposition under the action of a low-temperature catalyst; the heat generated during desorption can be recovered and recycled to reduce energy consumption.

Routine maintenance: Regularly check the adsorption effectiveness of the activated carbon and replace or regenerate it in a timely manner based on operating conditions; periodically clean the catalytic combustion unit, inspect catalyst activity, and replace it when necessary; regularly check the fan, heating device, and pipelines to ensure there are no leaks or faults.

Safety precautions: During equipment operation, do not disassemble the adsorption or combustion unit arbitrarily, and keep open flames away from the equipment; closely monitor temperature and pressure parameters during desorption and combustion processes, and shut down immediately for inspection if any abnormality occurs; the equipment must be equipped with explosion-proof and flame-retardant devices to prevent safety hazards.

## IV. Product Advantages

**Advanced process, complementary advantages**: Combining activated carbon adsorption (low investment, suitable for low concentrations) and catalytic combustion (low energy consumption, thorough purification) into two major technologies, avoiding the defects of single processes and achieving more stable treatment results.

**Energy-saving and efficient, economical operation**: Low-temperature catalytic combustion (200~400℃) has low energy consumption; desorption heat can be recovered and recycled, greatly reducing operating costs; activated carbon can be repeatedly desorbed and regenerated, reducing consumable replacement frequency and lowering operation and maintenance costs.

**Thorough purification, guaranteed compliance**: Dual purification process with VOCs purification efficiency ⩾97%; oxidative decomposition products are carbon dioxide and water with no secondary pollution, fully meeting environmental emission standards.

**Fully automatic operation, easy to use**: PLC intelligent control system enables fully automated switching of adsorption, desorption, and catalytic combustion processes, requiring no manual supervision, reducing labor costs, and ensuring more stable operation.

**Wide adaptability, flexible customization**: Capable of treating various large-volume, low-concentration VOC exhaust, adaptable to different industry conditions; equipment specifications can be customized according to exhaust concentration and air volume with strong compatibility.

**Safe and reliable, easy to maintain**: The equipment has a well-designed structure with multiple safety protection devices, ensuring stable operation; routine maintenance mainly involves inspecting and replacing consumables, with simple operation requiring no professional technical personnel.

## V. Applicable Industries

Widely applicable to **coating, printing, chemical industry, petroleum and petrochemical, pharmaceutical, plastics processing, electronics, furniture, packaging, and rubber** industries, especially suitable for treating large-volume, low-concentration, non-recoverable VOC VOC exhaust, such as paint booth exhaust, printing ink exhaust, solvent evaporation exhaust, and chemical raw material exhaust, etc. It is the preferred equipment for industrial enterprises' VOC VOC exhaust treatment.

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