



COMPREHENSIVE TREATMENT OF ECOLOGY AND ENVIRONMENT

- ⊙ VOCs treatment
- ⊙ Acidic, alkaline and special gas treatment
- ⊙ Waste liquid concentration
- ⊙ Material drying

Cadair Environmental

Tel: +86 010 8088 5839

E-mail: admin@cadair.com.cn

<http://www.cadair.com.cn>

Beijing: 14th floor, Greenland Central Plaza Phase II, Xinhua North Road, Tongzhou District, Beijing

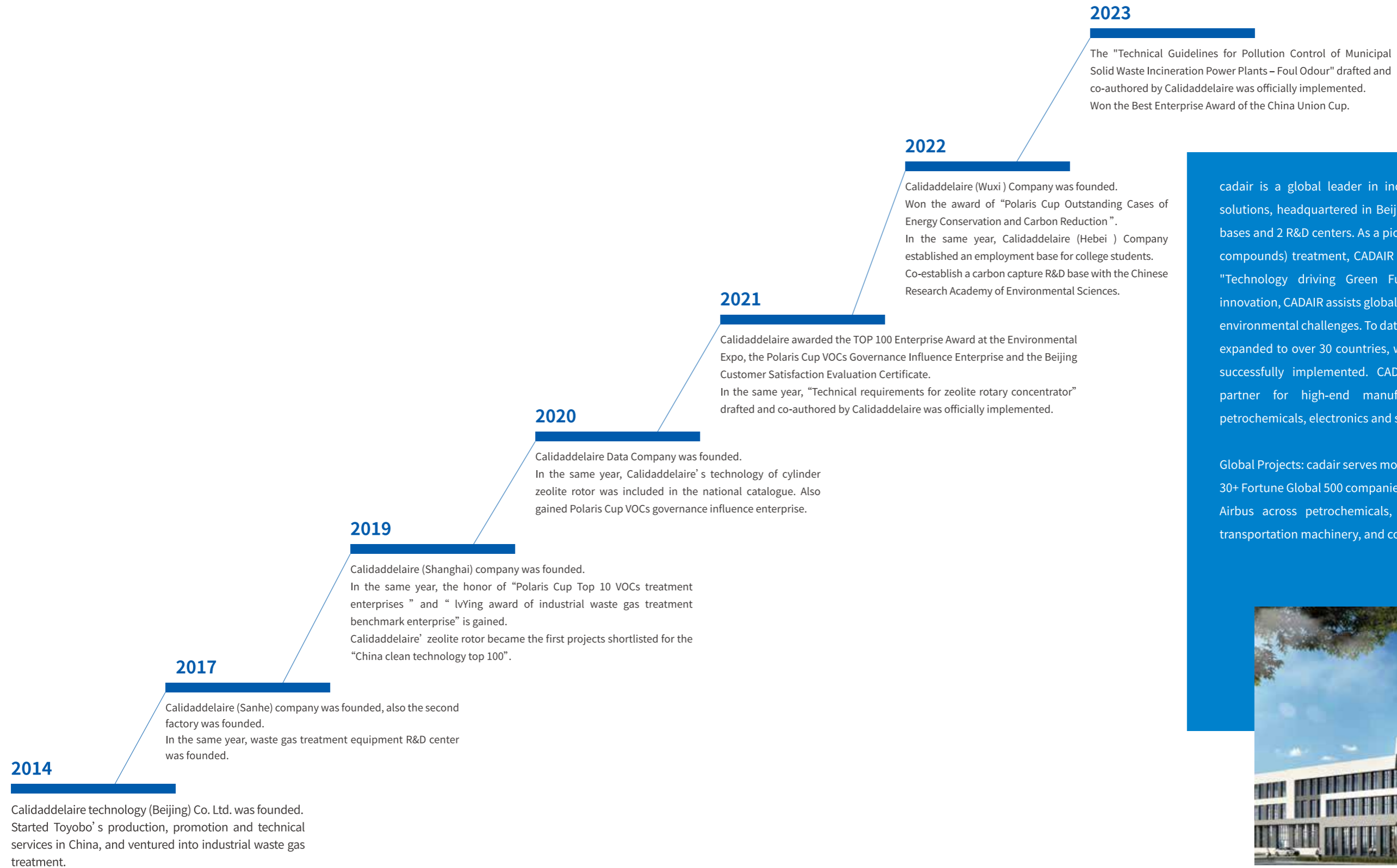
Shanghai: Room 1609, Hongyun Building, 501 Wuning Road, Putuo District, Shanghai

Tianjin: E3-9 Binhai International Enterprise Avenue, 199 Haiyuan Road, Tanggu, Binhai New Area, Tianjin

Wuxi: No. 29 Huayi Road, Xinwu District, Wuxi City, Jiangsu Province



Technology driving Green Future



cadair is a global leader in industrial air pollution control solutions, headquartered in Beijing, China, with 3 production bases and 2 R&D centers. As a pioneer in VOCs (volatile organic compounds) treatment, CADAIR is dedicated to its mission of "Technology driving Green Future." Through continuous innovation, CADAIR assists global clients in addressing complex environmental challenges. To date, the company's business has expanded to over 30 countries, with more than 1,000 projects successfully implemented. CADAIR has become a trusted partner for high-end manufacturing sectors including petrochemicals, electronics and semiconductors, and aircraft.

Global Projects: cadair serves more than 1,000 clients including 30+ Fortune Global 500 companies such as BASF, Samsung, and Airbus across petrochemicals, fine chemicals, electronics, transportation machinery, and construction machinery.

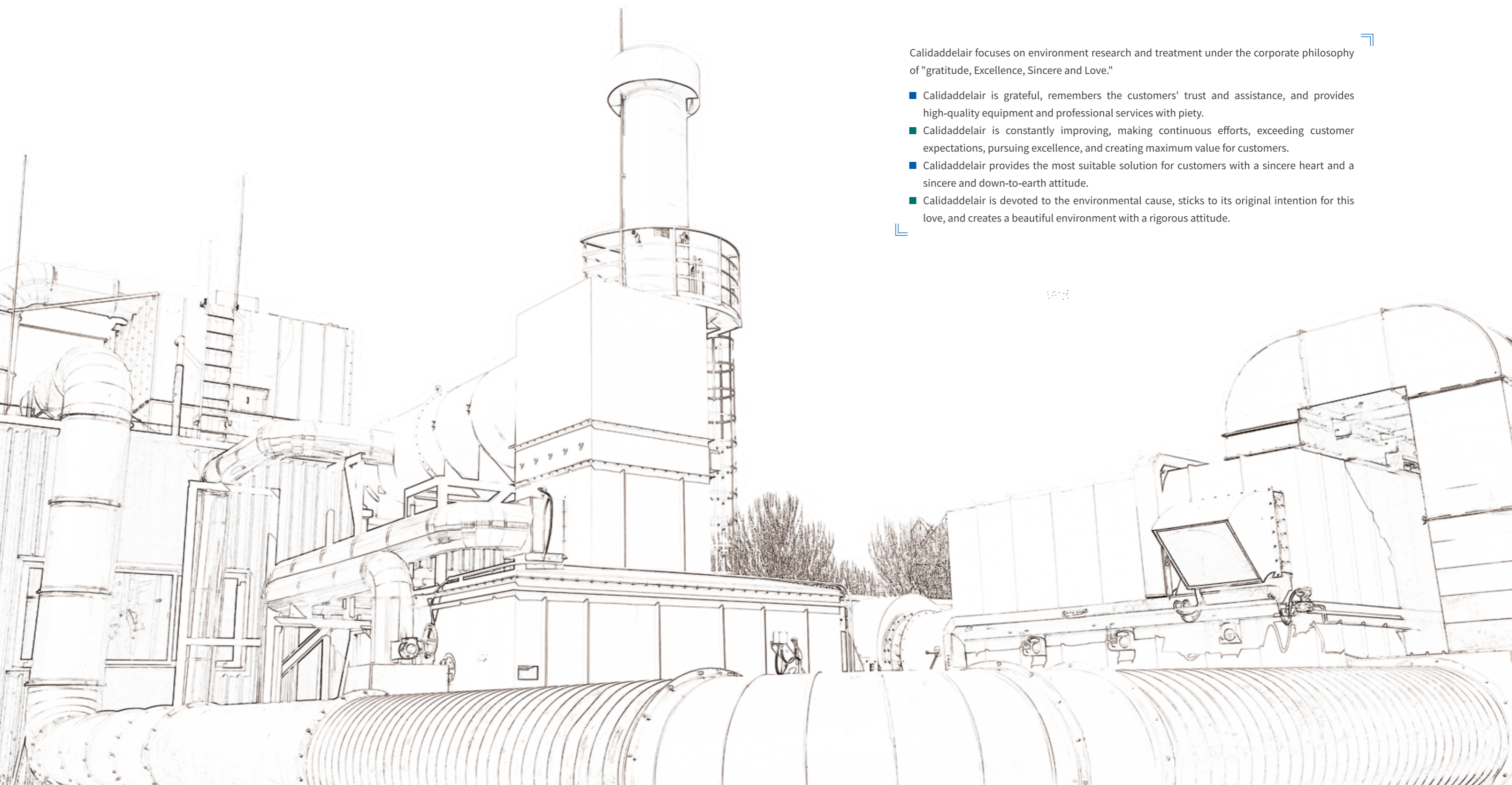


GRATITUDE

EXCELLENCE, SINCERITY, LOVE

Calidaddelair focuses on environment research and treatment under the corporate philosophy of "gratitude, Excellence, Sincere and Love."

- Calidaddelair is grateful, remembers the customers' trust and assistance, and provides high-quality equipment and professional services with piety.
- Calidaddelair is constantly improving, making continuous efforts, exceeding customer expectations, pursuing excellence, and creating maximum value for customers.
- Calidaddelair provides the most suitable solution for customers with a sincere heart and a sincere and down-to-earth attitude.
- Calidaddelair is devoted to the environmental cause, sticks to its original intention for this love, and creates a beautiful environment with a rigorous attitude.

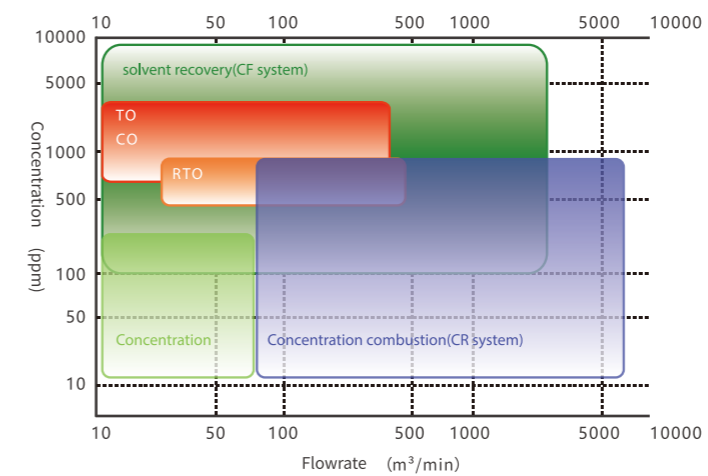


VOCs TREATMENTS

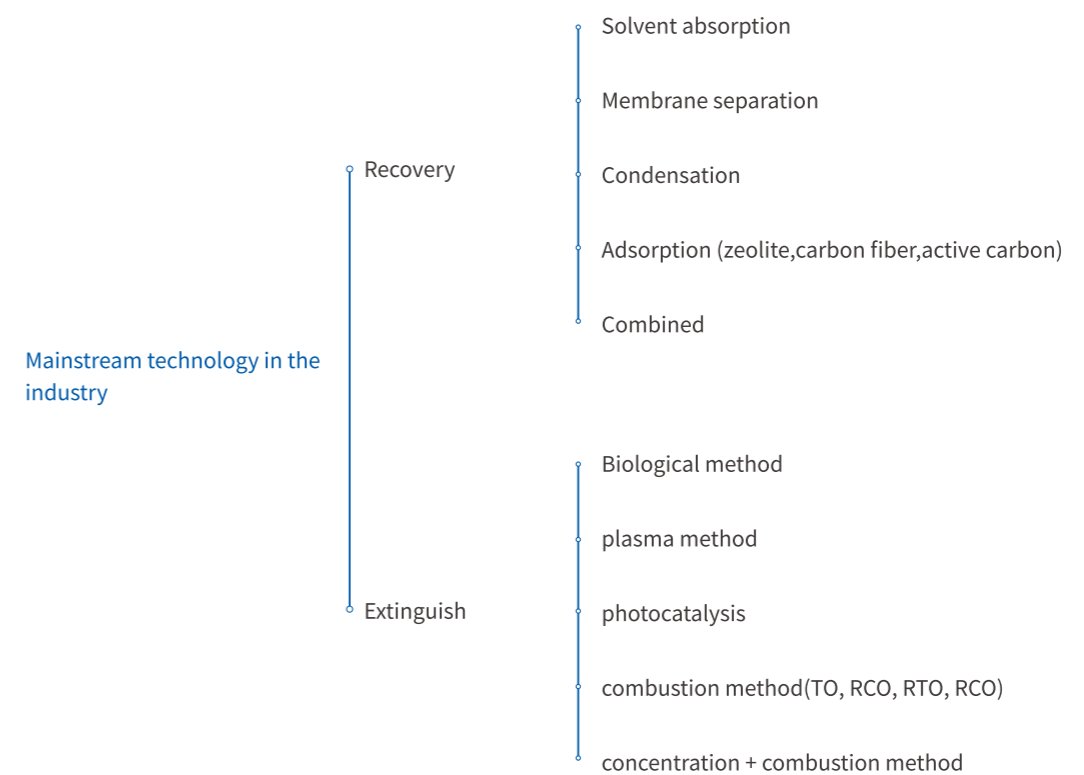
Volatile Organic Compounds

VOCs are the abbreviation of volatile organic compounds. They refer to organic compounds with the boiling point of 260°C or less at atmospheric pressure, or a saturated vapor pressure of greater than or equal to 20°C. 10 Pa has all organic compounds with corresponding volatility.

The main components include: alkanes, aromatics, esters, aldehydes and others. Recently, More than 300 have been identified. It includes: benzene series, organic chlorides, Freon series, ketones, amines, alcohols, ethers, organic esters, acids and petroleum hydrocarbon compounds.



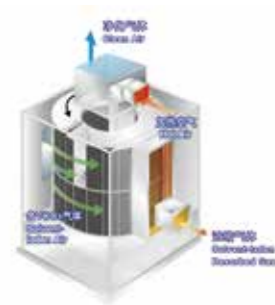
In the industrial process, there would be various of VOCs off gas emissions. According to the different concentration and flowrate, concentration + recovery and concentration + oxidation can be used to clean the off gas. The table on the left can be used as a guideline for choosing proper technology.



ADSORPTION CONCENTRATION TECHNOLOGY

When the low VOCs concentration waste gas passes the honeycomb zeolite, VOCs molecular is adsorbed in the zeolite. The purified gas is discharged to the atmosphere. The honeycomb zeolite with adsorbed VOCs keeps revolving. Less quantity hot gas flows through ,desorbs and regenerates the zeolite. Then the low concentration waste gas is concentrated to the high concentration waste gas.

Some other apparatuses can be connected following this process, such as direct incinerator, catalytic oxidizer, regenerative thermal oxidizer, refrigeration recovery or other solvent recovery apparatuses.



$$\text{Concentration ratio} = \frac{\text{Adsorption quantity} \times \text{Treatment efficiency}}{\text{Desorption volume}} \quad \text{or} \quad \frac{\text{Concentration of desorbed gas}}{\text{Concentration of inlet gas}}$$

$$\text{Purification efficiency} = \frac{\text{The inlet concentration of original gas} - \text{The outlet concentration of purified gas}}{\text{The inlet concentration of original gas}}$$

VOCs can be treated: Benzene, Toluene, xylene, ethanol, isopropanol, butanol, MEK, acetone, cyclohexanone, NMP, ethyl ester, propyl ester, butyl ester and various chlorine solvents.

Introduction of zeolites

Modular zeolite manufactured by special process is used in the honeycomb zeolite of Calidaddelaire , with very high zeolite content, and the excellent adsorption and concentration performance. Especially for treating aromatic organic compounds, it has higher adsorption capacity, advantage in treating high humidity waste gas, no sharply increasing of the water adsorption.

Component	concentration	Temperature and humidity	Concentration ratio	Desorption temperature	Purification efficiency
Toluene, xylene	120mg/m ³	30°C RH60%	40	180°C	90%
NMP	200mg/m ³	25°C RH54%	30	180°C	93%
IPA	150mg/m ³	30°C RH50%	30	180°C	92%
Ethyl acetate	800mg/m ³	30°C RH50%	7	180°C	98.5%

Some selections

Type	Air volume (Nm ³ /Hr)	L (mm)	W(mm)	H(mm)
CR1.2W-0512GL- I	12,000	3,300	2,700	3,200
CR1.2W-0512GM- II	12,000	4,200	3,400	3,200
CR8W-1818GL- I	80,000	4,000	3,000	3,800
CR8W-1818GM- II	80,000	4,300	3,400	3,800
CR12W-2124GL- I	120,000	4,300	3,200	4,100
CR12W-2124GM- II	120,000	4,800	4,000	4,100
CR16W-2428GL- I	160,000	4,800	4,000	4,400
CR30W-2836GL- I	300,000	5,400	4,300	4,800

SOLUTIONS OF CONCENTRATION AND INCINERATION

CR-CF concentration recovery apparatus

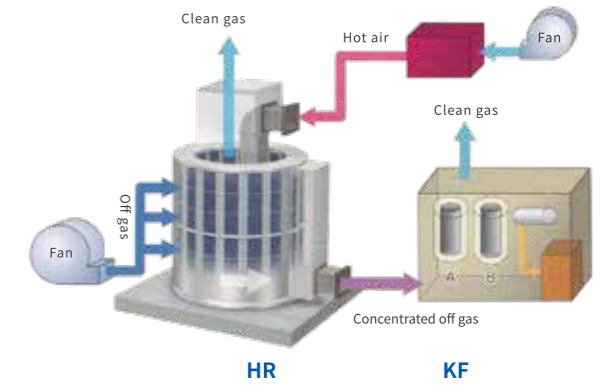
Characters and functions:

Much cost is reduced after the low concentration and high flowrate waste gas is concentrated into high concentration and low flowrate waste gas.

Fits to recovery waste gas.

Treatment cost is reduced dramatically when recovery liquid is needed to treat.

Compare to incinerators, Carbon dioxide and Noxin emission is reduced by using recovery apparatus.



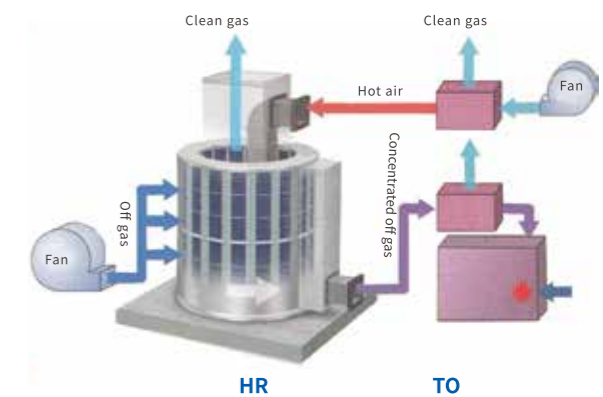
HR-TO concentration and direct incineration

Characters and functions:

Wide range of gases can be treated, even including compounds that can poison catalyst.

Fewer consumable materials, reduce cost of changing material .

Beware of feasibility of the system when there is chlorine solvent or organic silicon in the gas.



HR-RTO concentration and regenerative thermal oxidation

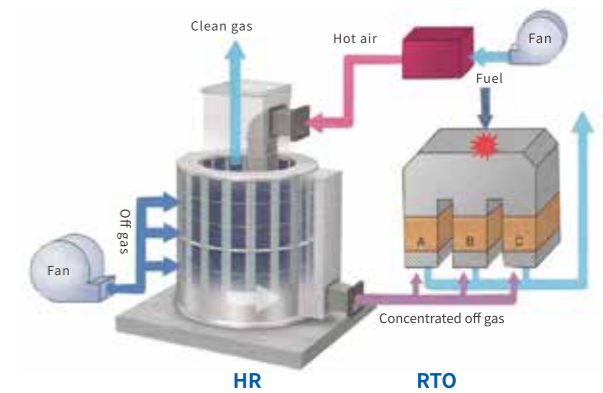
Characters and functions:

Dramatically reduce decomposition of solvents, reduce fuel consumption.

Heating the waste gas to startup by electrical heater, no other fuel is needed.

In the followed normal operation, no electrical heating is needed, operation can be done only by the recovered heat.

Be careful to prevent catalyst poison when there is flame retardant (chlorine solvent) solvent or organic silicon in the gas.



HR-CO concentration and catalytic oxidation

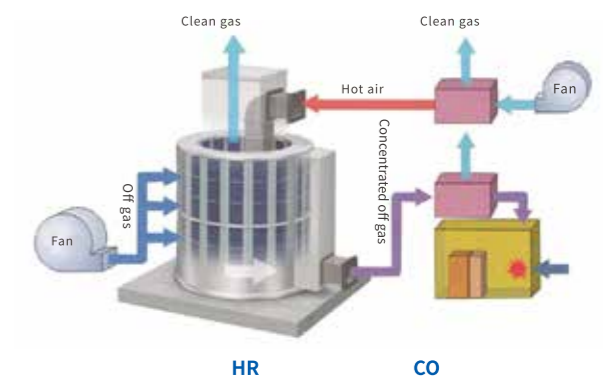
Characters and functions:

Reduce the decomposition of the solvents remarkably, also less fuel consumption.

Heating the waste gas to startup by electrical heater, no other fuel is needed.

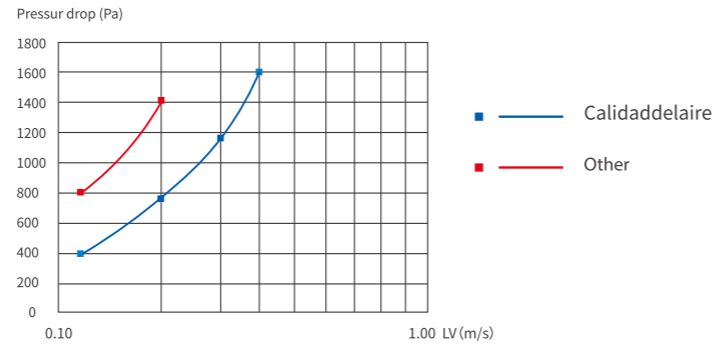
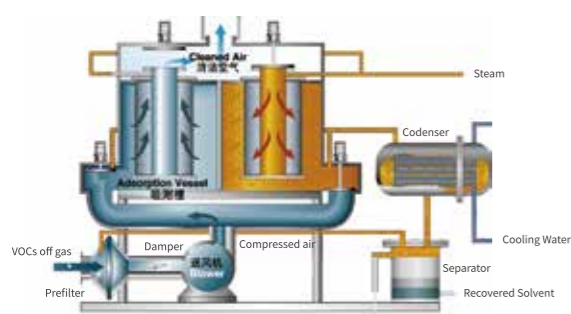
In the followed normal operation, no electrical heating is needed, operation can be done only by the recovered heat.

Be careful to prevent catalyst poison when there is flame retardant (chlorine solvent) solvent or organic silicon in the gas.



ADSORPTION RECOVERY APPARATUS

Advanced carbon fiber imported from Japan is used, much high quality solvent is recovered from the VOCs waste gas. The discharging of gas meets the national standard.



Characters and functions

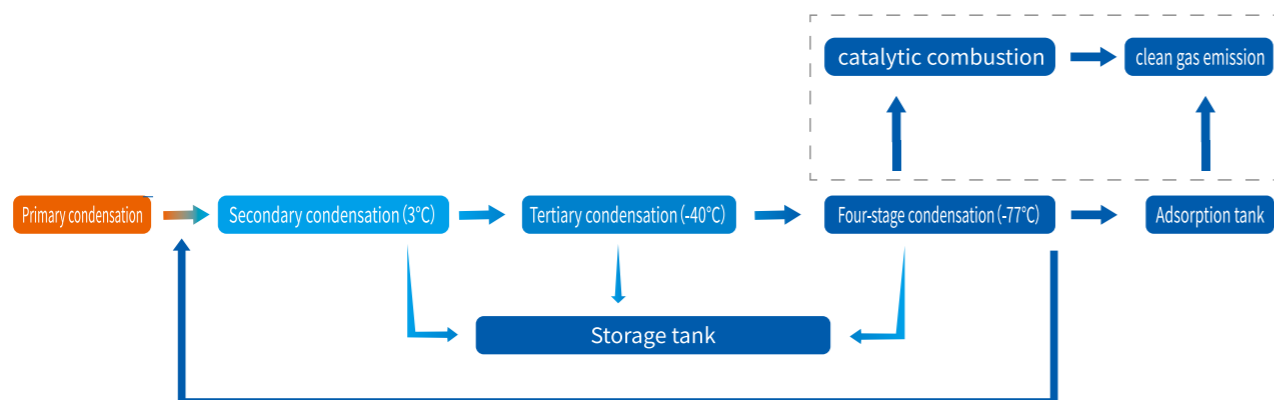
- Excellent removal performance: high adsorption rate and fast desorption speed, as well as excellent adsorption and desorption performance.
- High-quality recovered solvent: improve recovered solvent quality by reducing thermal decomposition during adsorption and desorption.
- Excellent safety performance: the structure is used for normal pressure. Due to the less heat storage generated by VOCs adsorption, the safety performance is excellent.
- Fits to many kinds of gases: Besides normal VOCs gas, some kinds of polymer monomer gas (such as Styrene, vinyl acetate, vinyl chloride) can be recovered and removed.

Combined technology of condensation+adsorption/catalytic combustion

The combination of condensation and adsorption is a popular method at the moment, and most people are familiar with it. Multi-stage condensation is used to condense oil and gas to temperatures ranging from -40°C to -80°C . More than 90% of the oil vapor are liquefied and recovered after multistage condensation, with the remainder being low-concentration residual gas. The adsorption tank adsorbs and enriches the organic matter in the residual gas, allowing it to be discharged to standard. Adsorbed and enriched organic matter returns to the condensation stage after desorption to continue condensation and liquefaction.

At the condensation end, the catalytic combustion process can be selected based on the owner's local emission requirements.

This system successfully combines the benefits of the condensation method and the adsorption/catalytic combustion method. Condensation can effectively recover organic compounds, and the adsorption/catalytic combustion method can reduce the concentration of condensed exhaust gas to meet discharge standards.



THERMAL INCINERATION DEVICE

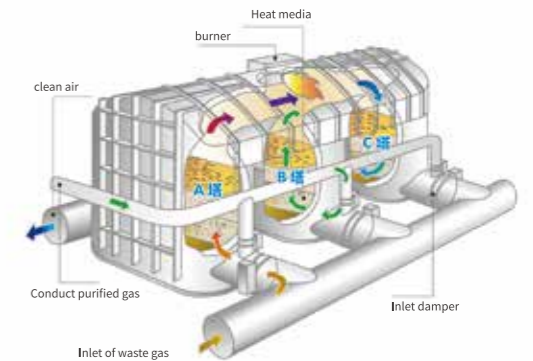
Thermal incineration is heating the waste gas and controlling the combustion temperature above 760°C . At this temperature, most organic compound decomposes into CO_2 and H_2O , and the removal efficiency can reach above 99%.

Thermal incineration can treat almost all VOCs waste gas, the main way is TO and RTO.

3-canister RTO

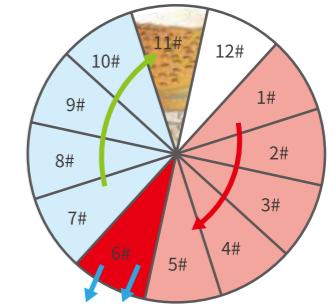
Process

Ceramic heat media and heat insulation layer are fitted in the canister. Waste gas goes into canister A (waste gas canister in this cycle), heated to certain temperature and gets to the reaction temperature, goes into burning chamber. The organic compounds in the waste gas react and change into carbon dioxide and water. The purified gas goes into canister C (purified gas canister in this cycle), heats the heat media, discharges to atmosphere through stack. Some part of purified gas is sent back to canister B and purges the residue waste gas in the canister and flows this residual waste gas into waste gas canister to pre-heat and burn.



Rotary RTO

Rotary RTO is made up of 12 heat storage chambers loading heat media. The waste gas is preheated through 1~5# heat storage chamber, then flows into oxidation chamber and decomposes, high temperature purified gas is cooled by 7~11# heat storage chamber and emits. In this cycle, 6# chamber is purge zone, and 12# chamber is isolate zone.

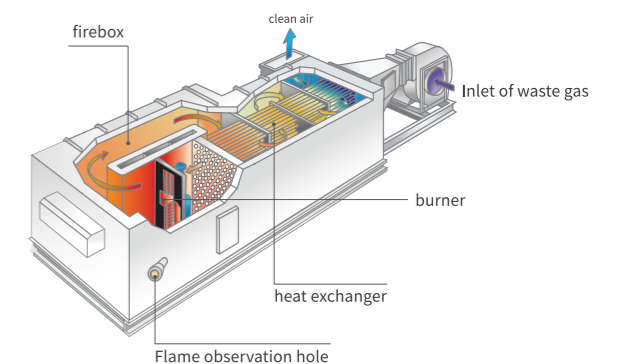


The Calidaddelaire rotary wing RTO adopts a rotary control valve, control waste gas switch cyclically to different heat storage chambers.

Contents	Rotary RTO	3-canister RTO
System suitability	1500-2000mg/m ³ , system can keep burning by itself, with very low energy consumption.	1500-2000mg/m ³ , system can keep burning by itself, with very low energy consumption.
Treatment efficiency	99%, depends on leak efficiency of valve.	99%, stable efficiency and reliable.
Fluctuation of back pressure	Low, <100Pa	Little above rotary RTO
Gas flow control valve	Only single rotary control valve, easy to control, the corrosion depends on the seal method.	9 puppet valves, relatively complex, high operate frequency, long lifetime.
Energy consumption	No difference	No difference
structure and floor area of equipment	Single cylinder structure, compact, small floor area, light weight.	Structure is multi-canisters, relatively big floor area.

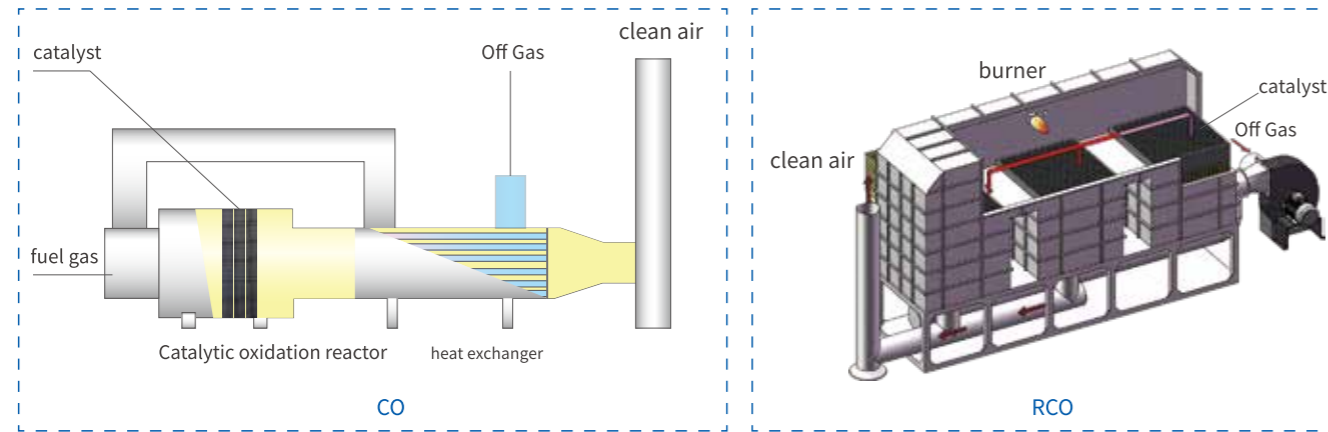
TO combustion device

The waste gas is directed directly to the furnace by the fan, where it first enters the heat exchanger for preheating before entering the combustion chamber. At 760°C , the waste gas is oxidized to CO_2 and H_2O , and the heat is transferred to the heat exchanger to preheat the waste gas, and the purified gas is discharged after cooling.



CATALYTIC COMBUSTION DEVICE

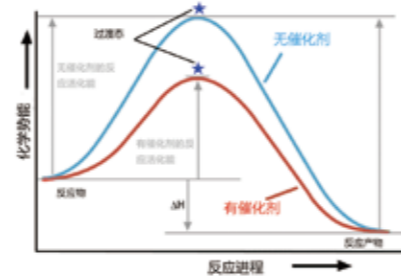
Catalytic combustion is oxidizing and decomposing VOCs by the catalyst at a lower temperature, with the reaction temperature typically ranging between 250 and 500 ° C. Catalytic combustion is not appropriate when the waste gas contains substances that can cause catalyst poisoning or easily produce dioxins, such as sulfur and halogen. The remaining VOCs are generally acceptable, particularly for medium-concentration waste gas. CO and RCO are the two most common methods.



Technical principal

A catalytic combustion device is used to carry out the catalytic combustion process. A heat exchanger preheats the organic waste gas to 200~400 ° C before it enters the combustion chamber. The molecules of hydrocarbons and oxygen molecules in the mixed gas are adsorbed on the surface of the catalyst and activated as they pass through the catalyst bed. Because surface adsorption lowers the activation energy of the reaction, hydrocarbons and oxygen molecules are rapidly oxidized to produce CO₂ and H₂O at a lower temperature.

Catalysts can reduce the activating energy of an oxidation chemical reaction, lowering the temperature of the reaction. Thermal oxidation requires 760 ° C, whereas catalytic oxidation requires only 300°C.



MAGIC CUBE SOLUTIONS

Pre-processor, zeolite rotor and incinerator are all modularized in this system. The layout of the system can be arranged freely according to the field condition, which likes magic cube. Different kind of arrangement fits for different installation field.

FLEXIBLE QUICK LOW COST

- Modularized design, volume production.
- Only 7 days for installation and commissioning.
- 30% cost is reduced.
- Free and changeable arrangement, easy to installation, high efficiency ,and high quality of engineering.
- Different incineration technology is selected for different concentration and flowrate.



ACIDIC, ALKALINE AND SPECIAL GAS TREATMENT

Treatment of acidic and alkali waste gas

After the process exhaust gas containing acidic or alkaline components enters the scrubber, it undergoes a neutralization reaction with the circulating chemical solution in the scrubber by adding acid or alkali. The exhaust gas contacts the circulating water in the scrubber in a cross-flow or vertical interception manner. As the gas and chemical solution pass through the packing layer, the packing divides the gas and pierces the liquid, thereby increasing the contact area between the exhaust gas and the liquid. By using a pH meter to control the dosing system, a level gauge to control the water replenishment system, a conductivity meter to control the drainage system, and pressure difference and pressure sensors to monitor operation, precise control of the acidity, alkalinity, and conductivity of the circulating water in the scrubber is achieved.

Characters and functions

- The design of the scrubber exceeds industry standards, with a wetting factor 30% higher than the industry average;
- Selecting the packing reasonably without nesting and sinking;
- Multi-level baffles to prevent airflow short-circuiting;
- Balancing device is added to conserve chemicals;
- Precise calculation and reasonable and balanced designing of dosing points , complete mixing of the chemicals is guaranteed ;
- Enhanced anti-corrosion system for fan, water pump, and duct components.



Special gas (such as arsine and phosphorane) treatment system

The dry adsorber utilizes nanoscale adsorbents as reactants. Gases such as arsine, phosphine, and diborane are effectively adsorbed by the molecular structure of the adsorbent, which forces the harmful gases to react into solidified substances, achieving high adsorption efficiency.

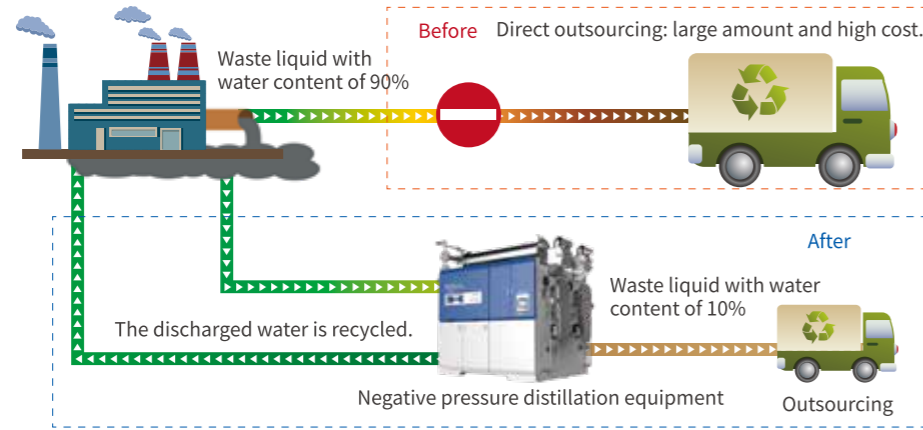
Characters and functions

- High efficiency: The concentration of exhaust gas at the outlet is guaranteed to meet the standard, and the performance is verified through online gas detectors and indicator agents (color-changing balls).
- Low fire risk: By replacing the physical adsorption (van der Waals force) of activated carbon with chemical absorption (acid-base neutralization), the risk of fire is reduced.
- Low maintenance cost.



NEGATIVE PRESSURE DISTILLER

When oil refining, metal processing, and other industries use emulsified oil, cutting fluid, electroplating solution, alkali washing, acid washing, and phosphating, a large number of waste liquids are produced, and the concentration of pollutants in these waste liquids far exceeds that of wastewater, making conventional sewage treatment processes difficult to degrade pollutants. In light of this situation, Cadair introduced Japanese negative pressure distillation technology, which directly assisted enterprises in lowering the cost of outsourcing.



Technical principal

Depressure the still to above -90Kpa with a vacuum pump, and the boiling point of water will drop to around 45° C. When waste liquid enters the still, it is evaporated and condensed at this temperature before being discharged. Solid substances with a boiling point higher than water and that are insoluble in water will remain in the still and be discharged as residue.

Six advantages

ZERO LIQUID DISCHARGE Reducing the amount by more than 90% can directly evaporate the water in the waste liquid.	LOW TEMPERATURE DISTILLATION Distillation at 45°C will not block or scale.	VACUUM PUMP IS DURABLE AND STABLE Imported from Germany to ensure the pressure stability in the still.
REDUCE OUTSOURCING COSTS BY 80-90% Effectively reduce waste and directly reduce the outsourcing cost of enterprises.	SMALL FLOOR SPACE Fully automatic operation, power-on and long service life.	THE EQUIPMENT RUNS The equipment can run continuously and the operation is simple.

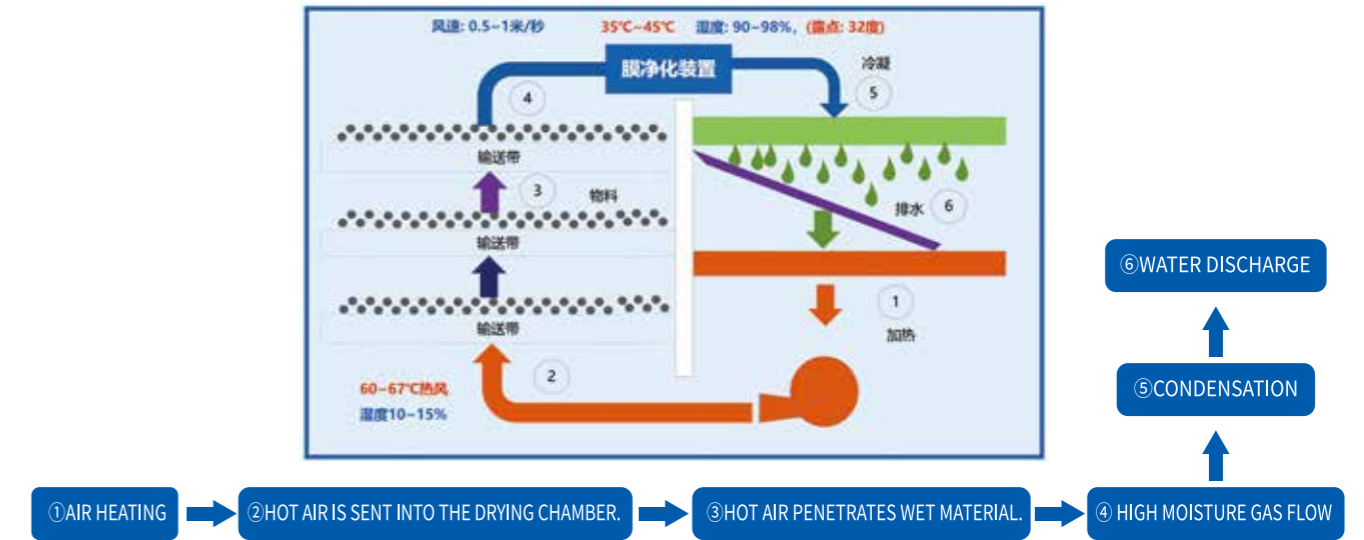
Benefit evaluation

SERIAL NUMBER	PROJECT	OUTSOURCING	AFTER	COST DOWN
1	Unit price(RMB/m³)	5,000	780	4,220
2	Monthly cost (yuan)	1,500,000	234,000	1,266,000
3	Quarterly cost (yuan)	4,500,000	702,000	3,798,000
4	Annual cost (yuan)	18,000,000	2,808,000	15,192,000
remarks	Details of the unit price after negative pressure distillation technology: 20 yuan for electricity, 200 yuan for steam, 60 yuan for equipment maintenance and operation management, and 5000 yuan plus 10% is 500 yuan for residue outsourcing (10% of residue after concentration). As an example, the monthly treatment capacity for hazardous waste of chemical concentrated solution is 300m³.			

THREE-ZERO MATERIAL DRYER

Technical principal

The second generation of ultra-low temperature breeze drying technology is based on the waste heat recovery and dehumidification of low temperature heat pump principles, and employs an ultra-low temperature independent air duct and breeze gradient dehumidification drying method to dehydrate and reduce wet sludge on the mesh belt. The entire system is completely sealed, and there is no heat loss in dry hot air, effectively preventing odor overflow.



Zero dust Dust control strategy Independent research and development of membrane purification technology, the air flow is purified more than 200 times per hour, completely removing dust and ensuring zero dust in the air flow in the heat source room.	Zero attenuation The efficiency is stable without attenuation. Put an end to the trouble that the filter bag of ordinary dryer is blocked to increase the wind resistance, ensure the condensation efficiency and reduce the attenuation; Membrane purification technology firmly locks the ultra-fine dust to avoid the heat exchanger from reducing the heat exchange efficiency due to dust adhesion.	Zero consumables No filter bag and maintenance-free No consumables, avoiding the cost of frequent cleaning and replacement of filter bags. Completely solve the problems of high temperature burning and low temperature condensation of dust removal filter bag.
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LOW WIND SPEED CLOSED-LOOP DESIGN SINGLE FAN ENERGY SAVING AND HIGH EFFICIENCY

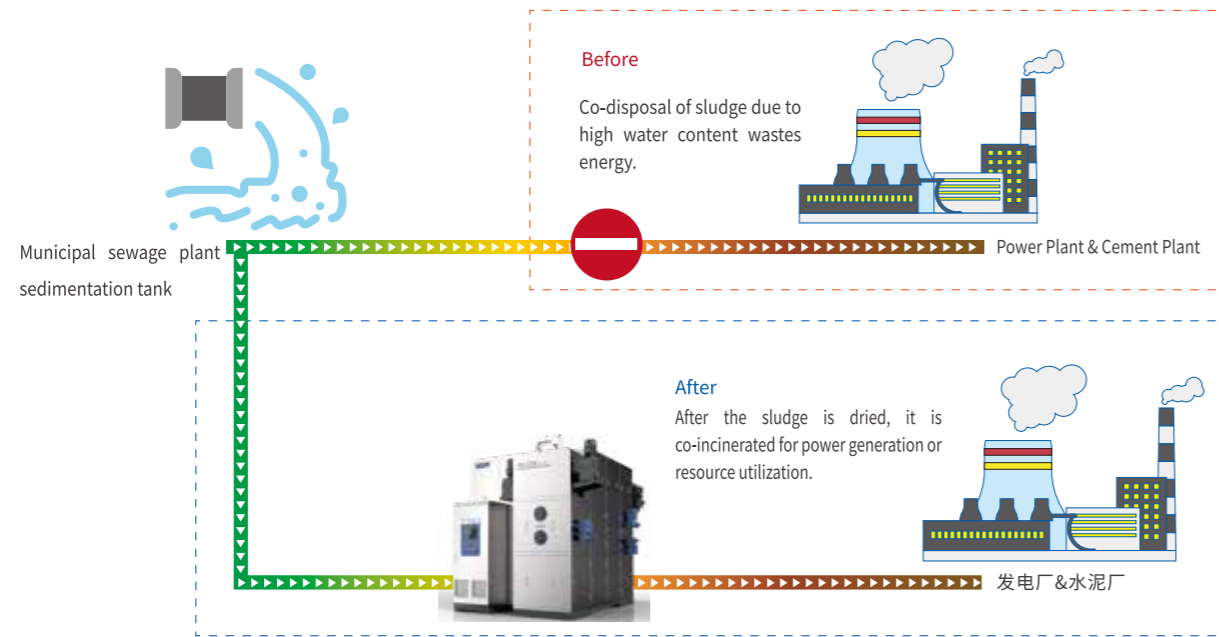
Microchannel membrane purification system

Cadair's micro-channel membrane purification technology can firmly lock dust and remove corrosive gases such as acid, alkali, and salt without regular maintenance or cleaning, significantly reducing labor costs.

- Each cubic meter has 620 micro-channels and a dust adsorption area of up to 300 square meters, resulting in extremely high dust absorption efficiency and thorough dust removal.
- No need for high pressure, atmospheric dust removal, low fan energy consumption, and complete elimination of the powder leakage phenomenon in general filtering and pulse dust removal equipment.
- Even very fine dust will be adsorbed, and dust removal will be more thorough, allowing the problem of fine dust blocking or shielding the heat exchanger to be eliminated, and the equipment to always maintain high-efficiency operation, avoiding the situation where efficiency fluctuates up and down and efficiency is lost by 10-20% due to conventional filtration.
- The dryer's gas is purified more than 200 times per hour, and all acid, alkali, and salt are completely absorbed and discharged to prevent corrosion of the equipment.
- Closed-loop dust removal eliminates the need for tail gas treatment equipment.

COLLABORATIVE TREATMENT OF MUNICIPAL SLUDGE

Sludge from cities is complicated and difficult to treat. Dewatering and drying have become critical components of sludge treatment and disposal. Cadair's second generation ultra-low temperature breeze drying technology has perfect engineering, safety, dependability, environmental friendliness, wisdom, high efficiency, and mature technology.



-  **REDUC/TION**
-  **RESOURCE RECOVERY**
-  **STABILIZA/TION**
-  **RECOVERY OF WASTE HEAT**

OPERATION AND MAINTENANCE PLATFORM

Calidaddelaire and Hebei University of Technology are working together to create an intelligent operation and maintenance service platform dedicated to data-driven industrial intelligence, such as big data, the Internet of Things, and other new generation information technology empowerment in the traditional environmental protection equipment industry. It can provide a number of overall solutions, such as equipment interconnection, remote operation and maintenance, process optimization, environmental protection and safety, and so on, in order to achieve one-click summary of dynamic data on equipment operation, real-time monitoring of production and pollution control, and joint prevention and control.

Reduce operation and maintenance costs

- Improve equipment reliability and reduce unplanned downtime.
- Realize the remote state perception of edge equipment, and effectively complement the manual inspection.
- Optimize spare parts management and reduce capital occupation.

Optimal state of guarantee system

- Ensure the normal operation of the governance system.
- On-line monitoring of equipment operation status, real-time understanding of equipment loss.
- Realize early identification of fault state, early warning and nip in the bud.



MANUFACTURE BASES

Our own R&D and design teams, more than 30% of total number, hold the world's leading ecological environment treatment technologies. Our branches locate in Beijing, Shanghai, Guangzhou, Tianjin, Xi'an, Taiyuan, Changsha, Shijiazhuang, Zhengzhou, Chengdu, Hefei and Shenyang. Two large scale systematized manufacture bases were founded, with the strict quality control measure, serving for customers in China. High quality ecological environment treatment products are providing for customers constantly.



SOME PERFORMANCES



Treatment of VOCs waste gas in electronic industry
Zeolite rotor + RTO



Treatment of VOCs waste gas in electronic industry
Zeolite rotor + TO



Treatment of acid and alkaline exhaust gases in the semiconductor industry
Scrubber



Treatment of acidic and alkaline waste gas in the tire industry
Activated carbon + spray tower



Treatment of acid and alkaline exhaust gases in the semiconductor industry
Scrubber



Waste gas treatment in engineering machinery coating
Zeolite rotor + RTO



Treatment of organic waste gas in chemical plant
3-canister RTO



Treatment of organic waste gas in chemical plant
Rotary RTO



Treatment of organic waste gas from petroleum refining
3-canister RTO



Treatment of organic waste gas from aluminum-plastic packaging
3-canister RTO



Treatment of organic waste gas in printing industry
Zeolite rotor + CO



Recovery of organic waste gas in soft package industry
Carbon fiber adsorption process



Waste gas treatment in ship manufacture plant coating
Zeolite rotor + CO



Waste gas treatment in ship manufacture plant coating
3-canister RTO



Waste gas treatment in 3C coating
3-canister RTO



Treatment of organic waste gas in pharmaceutical production
3-canister RTO



Treatment of organic waste gas in hazardous waste industry
5-canister RTO



Fischer-Tropsch tail gas treatment
3-canister RTO



Treatment of organic waste gas from rubber materials
Zeolite rotor + RTO



Treatment of organic waste gas in coating industry
Zeolite rotor + RTO



Treatment of organic waste gas from ink production
Zeolite rotor + CO



Concentration project of coating degreasing waste liquid
Daily processing capacity:1T



Chemical cutting fluid concentration project
Daily processing capacity:10T



MVR mother liquor concentration project
Daily processing capacity:10T



Drying project of medical waste residue
Daily processing capacity:50T



Surface treatment sludge drying project
Daily processing capacity:8T



Aluminum alloy sludge drying project
Daily processing capacity:1.3T

Technology driving Green Future