



# **Product Brochure**

Flue Gas Treatment

Enthusiasm · Innovation · Service · Respect · Responsibility

# **About MSTN**

MSTN TECHNOLOGIES CO., LTD. has been committed to environmental governance since 2004, and has successively obtained certifications including National High-tech Enterprise, Specialized and Sophisticated SMEs, Beijing Intellectual Property Pilot, Beijing Gazelle Enterprise, etc. We have gradually become a specialized environmental protection company integrating technology R&D, process design, equipment manufacturing, system integration, and EPC. We independently developed flue gas DeS-Ox, DeNOx and dust removal technology, wastewater treatment technology, CCUS technology, multiple series of environmental protection skid-mounted equipment, smart environmental protection technology, smart monitoring system, etc., which have accumulated nearly 100 intellectual property rights. We have successfully completed over 300 flue gas treatment projects and over 50 wastewater treatment projects, including BT, BOT, EPC and other modes

Up to now, MSTN has several subsidiaries, four major production plants, and two R&D centers. We will adhere to the core values of "positivity, innovation, service, respect, and responsibility", and focus on segmented markets, environmental protection, continuous innovation, and providing more professional, high-quality, and advanced products and services to achieve the vision of "Developing and Protecting, Earth Life Better".



R&D Centers

4

Manufacturing Plants



350<sup>+</sup>

# CONTENTS

DeSOx Technology	02
Wet DeSOx and Dust Collection Technology	02
<ul> <li>M·Dwave<sup>®</sup> Reverse Jetting Technology</li> </ul>	02
M·Sulfurp <sup>®</sup> Acid Gas Treatment/Waste Acid Recovery Technology	03
<ul> <li>M·Sorb<sup>®</sup> Sulfur Dioxide Recovery Technology</li> </ul>	03
<ul> <li>M·HyPerO<sup>®</sup> Hydrogen Peroxide Oxidation DeSOx Technology</li> </ul>	04

## H<sub>2</sub>S Removal Technology

Complex Iron H <sub>2</sub> S Removal	05
DeNOx Technology	07
Low Temperature Ozone Oxidation DeNOx Technology	07
<ul> <li>M·SNCR DeNOx Technology</li> </ul>	07
M·SCR DeNOx Technology	
CCUS Technology	09
M · CO2C Carbon Dioxide Capture Technology	
<ul> <li>Hydrate Based Carbon Dioxide Capture Technology</li> </ul>	10

1.6

## **DeSOx Technology**

## Wet DeSOx and Dust Collection Technology

It is a wet flue gas alkali washing process and can not only efficiently remove SOx, but also the particulates in flue gas to a large extent. Each functional area is built with independent modules which may be tailored according to project requirements, to make the project technically advanced and economic.

At present, more than 70 systems have been successfully operated in China, including treatment of SOx and dust from catalytic, coal-fired and oil-fired boilers, MTO and other flue gas emission plants.

## ▶ M·Dwave<sup>®</sup> Reverse Jetting Technology

M·Dwave system is a wet alkali washing process, featured by simple design and low maintenance. It can not only desulfurize the flue gas and treat the wastewater in one column, but make the flue gas load fluctuation under well control.

At present, more than 20 systems have been successfully operated in China, including treatment of exhaust gas from sulfur recovery, acid water stripping and other plants.

### **Technical Advantages**

- Realizing desulfurization, denitrification, dust removal, mist removal and other functions at the same time.
- Dust can achieve ultra-clean emissions of less than 5mg/Nm<sup>3</sup>.
- Cope with high temperature, run-off and other special working conditions.

Para.	Inlet	Outlet	
Flue gas flow rate, Nm³/h	460,000 wet basis		
SO2 mg/Nm³	1,800 wet basis	≤95 dry basis	
Dust mg/Nm³	Up to 540 dry basis	≤45 dry basis	
3,300,000 t/a Catalytic Cracki	ng Regeneration Flue Gas De	sulfurization and Dust	



**Technical Advantages** 

• Efficient waste heat utilization system, no white smoke and rain generation.

Inlet	Outlet
90,000 wet basis	
Up to 30,000 wet basis	≤60 dry basis
	·



 270,000 t/a Sulfur Recovery Plant Exhaust Gas Purification Project of a CNPC Petrochemical Company

Collection Project of a CNPC Petrochemical Company

## M·Sulfurp<sup>®</sup> Acid Gas Treatment/Waste Acid Recovery Technology

This process converts sulfide in sulfur-containing waste gas into 98% concentrated sulfuric acid. Its great advantage is not only to deal with different concentration (high to low) of acid gas but also the complex impurities in acid gas.

## Technical Advantages

- It produces 98% concentrated sulfuric acid, which has economic value.
- No other chemical or consumption.
- No waste liquid, waste residue, etc.
- The system converts SO<sub>2</sub> to 98% concentrated sulfuric acid eventually.
- System heat recovers by-product steam.



## ▶ M·Sorb<sup>®</sup> Sulfur Dioxide Recovery Technology

This process uses the organic solvent to absorb  $SO_2$  in flue gas and recycles it. It consists of pre-scrubbing, absorption, and solvent regeneration. The recycled  $SO_2$  may be used as raw material and fed to sulfur and acid production plants.

Para.	Inlet	Outlet
Flue gas flow rate, Nm³/h	72,000 wet basis	
SO2 mg/Nm <sup>3</sup>	22,770 wet basis	≤70 dry basis

📕 150,000 t/a Sulfur Recovery Plant Exhaust Gas Treatment Project of a SINOPEC Petrochemical Company



## M·HyPerO<sup>®</sup> Hydrogen Peroxide Oxidation DeSOx Technology

This process uses hydrogen peroxide as an absorbent to absorb  $SO_2$  in flue gas to produce valuable sulfuric acid.

It is mainly applied in acid industry, such as WSA gas emission cleaning treatment.

Para.	Inlet	Outlet
Flue gas flow rate, Nm³/h	18,000 wet basis	
SO2 mg/Nm <sup>3</sup>	1,270 wet basis	≤100 dry basis

📕 WSA Exhaust Gas Treatment Project of a Chemical Plant in Shanghai



## H<sub>2</sub>S Removal Technology

## ▶ Complex Iron H<sub>2</sub>S Removal

Complex iron H<sub>2</sub>S Removal technology is a wet oxidation method that uses complex iron as a catalyst to remove hydrogen sulfide. Its characteristic is to directly convert H<sub>2</sub>S into elemental S, and the treated H<sub>2</sub>S content to less than 10ppm. It is a new type of desulfurization technology with simple process, high sulfur capacity, and environmentally friendly and non-toxic characteristics.



## **Principle of Reaction**

- **Desulfurization Reaction**  $H_2S+2Fe^{3+} \rightarrow 2H^++S\downarrow + 2Fe^{2+}$  $1/20_2 + H_20 + 2Fe^{2+} \rightarrow 20H^- + 2Fe^{3+}$
- Regeneration Reaction
- Total Reaction  $H_2S + 1/2O_2 \rightarrow H_2O + S\downarrow$



Common Scale	•				
Gas volume (Nm³/h)	Inlet H <sub>2</sub> S (ppm)	Outlet H₂S (ppm)	Inlet Pressure (kPa)	Power (kW/h)	Size (m)
10000	5000	10	10	11.5	3×6
20000	5000	10	10	13.5	3×8
30000	5000	10	10	17	3×10
40000	5000	10	10	19	3.5×16
50000	5000	10	10	26	4×17.5

## Technical Advantages

### O Simple Process

The treatment process is simple, utilizing a one-step method to rapidly oxidize H<sub>2</sub>S directly into elemental sulfur (S). It achieves high H<sub>2</sub>S removal efficiency, can reduce H<sub>2</sub>S to below 10 ppm.

#### Strong Anti-Fluctuation Capability 0

The system automatically handles fluctuations without manual intervention, ensuring stable desulfurization rates under variable conditions.

#### Low Operating Costs 0

The complex iron catalyst is regenerable and reusable, with no side reactions, significantly reducing OPEX.

## • High Sulfur Loading Capacity

The complex iron catalyst have high sulfur capacity. Can significantly reduce the amount of circulating fluid, reduce equipment size, and save investment and operating costs.

#### Effective Organic Sulfur Removal 0

Capable of removing organic sulfur compounds (COS and mercaptans).

### Compact & Skid-Mounted Design

The system has a small footprint, making it ideal for skid-mounted deployment, especially suited for small-scale projects.

#### High Safety & Environmental Benefits 0

The iron-chelate catalyst is non-toxic and harmless to humans and the environment.

## • Near-zero waste Emission

The system produces no waste gas, solid waste, or liquid effluent.

### **Applications**













WWTP Biogas Processing

Livestock Farm Biogas Processing



## **DeNOx Technology**

## Low Temperature Ozone Oxidation DeNOx Technology M·SNCR DeNOx Technology

This process uses ozone to oxidize NOx in flue gas into N2O5 which is effectively removed by an alkali washing system. It is very suitable for wet flue gas desulfurization system due to its high adaptability, minor modification and low investment cost. At present, more than 20 systems have been successfully operated in China.

## **Technical Advantages**

- It is suitable for normal temperature flue gas atmosphere.
- Its DeNOx efficiency is more than 90%.
- It may be started or stopped as needed.
- It consumes no chemicals.

Para.	Inlet	Outlet
Flue gas flow rate, Nm³/h	350,000, wet basis	
NOx mg/Nm <sup>3</sup>	220 dry basis	40 dry basis

A 3,400,000 t/a Catalytic Regeneration Flue Gas DeNOx Project of a SINOPEC Petrochemical Company



This process uses NH<sub>3</sub> as a reductant to convert NOx in flue gas into N<sub>2</sub> and H<sub>2</sub>O in a high temperature environment. It is suitable for the system that has a flue gas temperature above 800°C and a low DeNOx efficiency.

## **Technical Advantages**

- The reaction temperature should be above 800°C.
- Reconstruction of furnace is simple, requiring a small quantity of work.
- It has a DeNOx efficiency of  $40 \sim 60\%$  and can be used together with other DeNOx processes to achieve a higher efficiency and reduce the investment cost.

Para.	Inlet	Outlet
Flue gas flow rate, Nm³/h	350,000 wet basis	
NOx mg/Nm³	150 wet basis	80 dry basis

▼ 2\*310 t/h Power Boiler Flue Gas Denitrification Project In a Refining Company of Sinopec



## M·SCR DeNOx Technology

This process uses  $\mathsf{NH}_3$  as a reductant to convert NOx into  $\mathsf{N}_2$  and  $\mathsf{H}_2\mathsf{O}$  under the action of catalyst.

## Technical Advantages

- The DeNOx catalyst has a wide reaction temperature range from 150°C to 550°C.
- Flow field simulation makes the overall design optimized.
- It produces no secondary pollutants.
- It has a high DeNOx efficiency, meeting the cleaning emission standard.
- It is easy to reconstruct and requires a small quantity of works.



Para.	Inlet	Outlet
Flue gas flow rate, Nm³/h	175000 wet easis	
NOx mg/Nm <sup>3</sup>	100 wet basis	35 dry basis

1,000,000 t/a Ethylene Cracking Furnace (6 sets )Flue Gas Denitration Project of a Company.



## **CCUS Technology**

## M · CO2C Carbon Dioxide Capture Technology

M • CO2C technology is a resource utilization technology for CO<sub>2</sub> capture developed by MSTN based on years of experience in acid gas treatment, combined with the use of specially developed high-efficiency absorbents. Compared with traditional alcohol amine absorbents, the two-phase absorption process only sends the heavy phase enriched in CO<sub>2</sub> after phase separation into the desorption system, which greatly reduces the scale and energy consumption of the desorption tower.

### Technical Advantages

- 95% absorption efficiency+1.8~2.2GJ/tCO<sub>2</sub> desorption energy consumption.
- Phase change absorbent patent: precise control of phase change boundary (20%~40%).
- Smart Image Recognition System: Real time monitoring of absorption liquid stratification status.



Para.	Traditional amine method	MCO2C technology
Desorption energy consumption (GJ/tCO <sub>2</sub> )	3.5~4.0	1.8~2.2
Phase change control accuracy	Non	±5%Interface



Special absorbent: active amine+phase separation agent+active agent

Coal-fired power plant(12% CO<sub>2</sub>) Steel plant(8%~15% CO<sub>2</sub>)

Application



## Cases

# The CO<sub>2</sub> capture block for flue gas with a capacity of 300Nm $^{3}$ /h of an oil field coal-fired boiler for one oil field subsidiary

A special formula of amine solution was adopted in this project to achieve phase change absorption of  $CO_2$ , with an average  $CO_2$ capture rate of over 95%. The heat balance and water balance were fully considered, with designs such as increasing inter stage cooling for absorption, increasing rich liquid splitting for desorption, and preheating rich liquid for tower top gas. A special structure of phase separator has been designed, and the phase interface is stable within the required range.

## The Technical scheme for 200Nm $^3$ /h flue gas CO<sub>2</sub> capture block in a university

A special formula of amine solution was adopted in this project to achieve phase change absorption of  $CO_2$ , with an average  $CO_2$ capture rate of over 95%. The heat balance and water balance were fully considered, with designs such as increasing inter stage cooling for absorption, increasing rich liquid splitting for desorption, and preheating rich liquid for tower top gas. A special structure of phase separator has been designed, an intelligent image recognition system has been added and the phase interface is stable within the required range.

## Hydrate Based Carbon Dioxide Capture Technology

Gas hydrates are crystals composed of water and gas under appropriate low temperature and high pressure conditions. Therefore, taking advantage of the large difference in phase equilibrium formed by different gas hydrates can effectively separate carbon dioxide from flue gas. MSTN adopts a special structure of microchannel mixer to fully contact the gas-liquid and improve the absorption rate by 83% wt~99% wt, and uses microwave-assisted to further improve the desorption rate.



## **Technical Advantages**

- 83%~99% absorption rate+desorption at room temperature and pressure.
- Microchannel mixer: gas-liquid contact efficiency increased by 40%.
- Microwave assisted desorption: energy consumption is only one-third of traditional heating.



Pressure Time Curve during the Formation of CO<sub>2</sub> Hydrates

## Developing and Protecting, Earth Life Better

**S Tel:**(0086-10) -65862969

Fax:(0086-10) -65923846

( Website:www.mstn.com.cn www.mstnland.com





WeChat Public Account

\* First Edition 2025