KIYEON E&C

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ENGINEERING & CATALYST
FOR AIR POLLUTION CONTROL

KIYEON E&C

ECO&
DREAM

KOSDAQ
LISTED COMPANY

Thinks Eco, Dreams Future

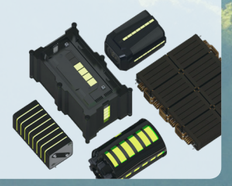
환경을 생각하고
미래를 꿈꾸다

With dreams and challenges, We make a world better
As the member of the ecosystem, we dedicate to give new value to
the Earth With the dream-achieving technology of Green new material
We create clean energy and protect the environment

우리는 꿈과 도전으로 더 나은 세상을 만듭니다.
생태계의 일원으로 지구에 새로운 가치를 부여하고자 헌신합니다.
그린 신소재의 꿈을 이루는 기술을 통해
우리는 깨끗한 에너지를 만들고 환경을 지킵니다.

LIB CATHODE PRECURSOR DIVISION

LIB CATHODE PRECURSOR



ENVIRONMENT CATALYST DIVISION

ENVIRONMENT CATALYST

ENVIRONMENTAL ENGINEERING DIVISION

KIYEON E&C
&
PLANT DIVISION

KIYEON E&C

A company specialized in air pollutant reduction system
based on catalyst technology

ENGINEERING & CATALYST
FOR AIR POLLUTION CONTROLT

Catalyst Division

At KIYEON E&C, we are carrying out R&D, design, and manufacturing catalysts that play a key role in reducing air pollutants. In addition, we purchase and supply optimal catalysts from outside. We supply tailor made de-NO_x catalyst (SCR) adaptable to variety of exhaust gas conditions, oxidation catalysts that reduce VOCs, odors, and Ozones, and various adsorbents and process catalysts.

EPC DIVISION

We have the manpower, experience, and licenses to carry out basic design, detail design, procurement, and construction for workplaces where environmental catalysts or environmental facilities are applied. In the meantime, we experienced variety of project. It includes refinery plant project, such as SK Innovation Co., Ltd. and GS Caltex Co., Ltd. for SCR (denitrification) facility and catalyst supply turn key project. Also we have a track record of performing various engineering services for petrochemical and fine chemical plants, such as SCR (denitrification) facility turn-key work for Korea Petrochemical and VOC reduction facility turn-key work for HUCHEMS and many others. In addition, we have performed and supplied engineering services related to various environmental facilities to power plant companies, such as Korea Zinc Co., Ltd, LG Chem, LOTTE Chemicals Co., Ltd, GS Power Co., Ltd. and many other compannies.

CEO'S MESSAGE

KIYEON E&C Corp., Ltd. is continuously growing specialty company for air pollution control that performs the entire process from EPC (Basic/Detail Engineering, Procurement & Construction) to catalyst development.
For a comfortable air environment, based on catalyst technology, we are progressing at all times with the same mind as when it was founded.

In detail, the EPC business segment has our own special engineering know-how and experiences in reducing Nitrogen oxides (NOx), air pollutants such as CO, VOC, odor, Ozone, and other harmful gases, and the Catalyst business segment has the ability to research, produce, and supply environmental catalysts such as SCR catalyst of metal base support for Nitrogen oxides reduction, Honeycomb type SCR catalyst, oxidation catalysts that can reduce CO and Ozone, VOCs (volatile organic compound), and CO reduction catalysts applied to petrochemical plants.

Through an organic combination of the construction division in charge of EPC, the R&D division that researches and develops catalysts, and the catalyst production division, we promise to be the best business partner to provide the total solution that customers want to reduce air pollution from manufacturing, installation, operation, and maintenance/repair beyond design.

CEO **Kim Tae-Won**

HISTORY

2009
- 09, JUN — Established for the purpose of wholesale and retail business of nanotechnology and nanomaterials such as catalysts

2010
- 22, DEC — Addition of mechanical facility construction business, environmental machinery facility and facility operation business, etc. to the business purpose
- 05, JAN — Acquisition of construction business license for mechanical equipment construction business

2011
- 25, AUG — Established an affiliated research institute

2012
- 14, APR — Venture company confirmation certificate

2015
- 04, MAY — Patent registration for Ozone decomposition catalyst and manufacturing method
- 20, JAN — Patent registration for manufacturing method of specific solvent-targeted active metal-impregnated activated carbon fiber

- 13, JUN — Established KIYEON E&C's own factory

2017
- 28, JUL — Entered the power plant SCR business by registering GS Power Co., Ltd. construction, service, and qualified company certification
- 26, JUL — Patent registration for regenerative selective catalytic reduction device, established new technology

2018
- 12, APR — Patent registration for heat recovery boiler system for combined power generation

2019
- 18, JUN — Atmospheric environment specialized construction business registration

2020
- 03, JAN — Acquired ISO9001: 2015 certificate

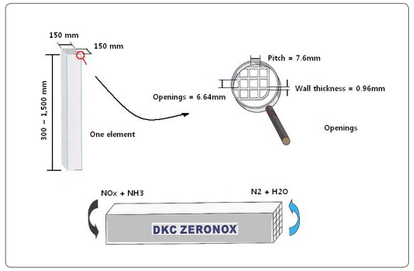
2021
- 01, OCT — Attracted investment from ECO&DREAM Co., Ltd.

2022
- 04, AUG — Selected as an excellent research small and medium-sized company by Korea Midland Power

SCR CATALYST

Honeycomb Type

• Through the technical joint venture of Germany's En-virontherm, DKC Corporation was established in Chengdu, Sichuan Province for Honeycomb type SCR catalyst production. We are the exclusive domestic supplier for Honeycomb type SCR catalyst. We have supplied 500 MW of the Taean Thermal Power Plant as well as SCR facilities such as SK General Chemical (Geocentric). In addition, we have developed Metal base support SCR catalysts through R&D projects and supplied them to LOTTE Chemical, Korea Zinc, and GS Power and other end users.



Pitch (mm)	Application	End User
3.3	Low dust application	Clean fuel Power Plant
3.7	上同	Hybrid system
4.3	上同	Co-generation Power Plant
5.0	上同	
6.1	High dust application	Power Plant, Incinerator, Engine etc

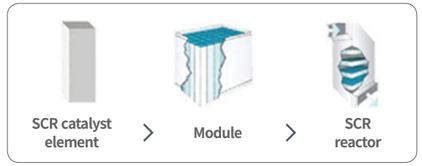
Pitch (mm)	Application	End User
6.5	上同	
7.0	上同	Coal base Power Plant
7.4	上同	
7.6	上同	
8.2	上同	
10.0	上同	
11.9	上同	

⬆ Variety of SCR catalysts and application

Module Packing

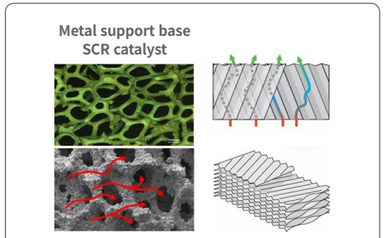
Characteristics of KIYEON's SCR catalyst

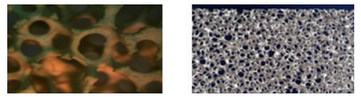
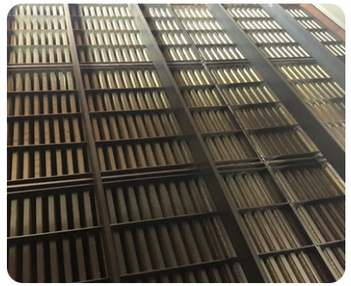
- High conversion and efficiency
- Low SO_2/SO_3 conversion
- Low NH_3 slip
- Wide range of operation temperature
- High attrition strength
- High strength high efficiency (HSHE) technology



Metal corrugate support SCR Catalyst

- Maximize contact between effluent gas and catalyst surface
- Maximize conversion of NOx
- Minimize SCR catalyst volume and weight (under 50% compared it with Honeycomb type SCR catalyst)



Metal foam base (LNG Fuel only)	Metal corrugate support SCR Catalyst
	
Installed SCR catalyst	Installed SCR catalyst
	
• 100 Mw Co-gen Power plant • 60 Mw Co-gen Power plant • HUCHEMS and other petrochemical plant	• 100 Mw Co-gen Power plant • LOTTE Chemical – Heavy fuel Power Plant • LOTTE Chemical PC Boiler and others

Reference

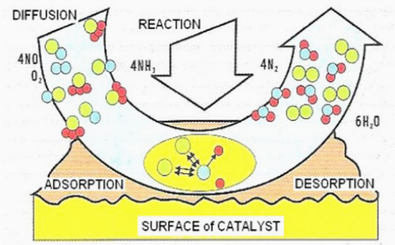
Honeycomb Type	Metal corrugate support	Metal foam base
		
⬆ SK Innovation & many others	⬆ Lotte Chemicals & many others	⬆ KOREA Zinc & many others

탈질(SCR/SNCR) 설비

SCR (Selective Catalytic Reduction) Technology Overview

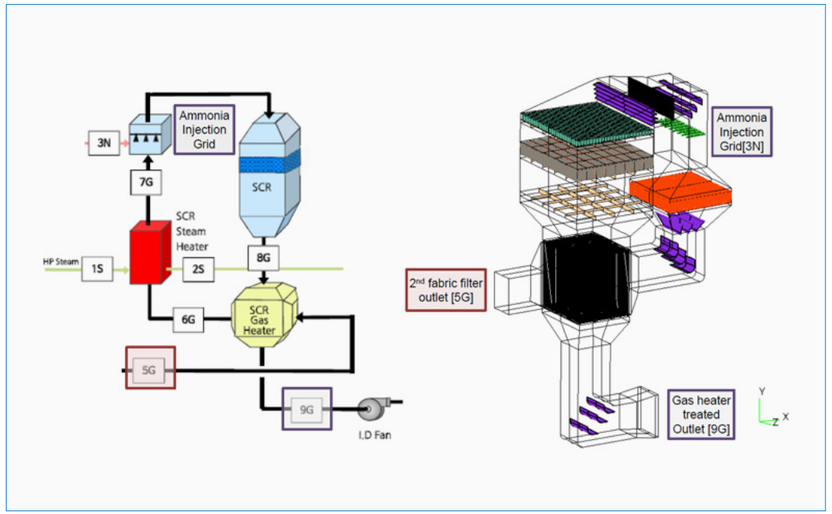
- Most of the nitrogen oxide abatement processes currently applied are selective catalytic reduction (SCR) processes that selectively reduce nitrogen oxides by using ammonia (NH_3) or urea as reducing agent, and it is a process that has had many commercial achievements since it was first proposed. The main mechanisms of the entire process are as follows.
- KIYEON has the best catalyst and technologies for SCR process.

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$
$$6NO + 4NH_3 \rightarrow 5N_2 + 6H_2O$$
$$6NO_2 + 8NH_3 \rightarrow 7N_2 + 12H_2O$$
$$2NO_2 + 4NH_3 + O_2 \rightarrow 3N_2 + 6H_2O$$



- In addition, methods such as direct reduction methods and wet methods have been proposed, but they are known to be ineffective, and the SCR method using a reducing agent has been proven to be the most effective method.

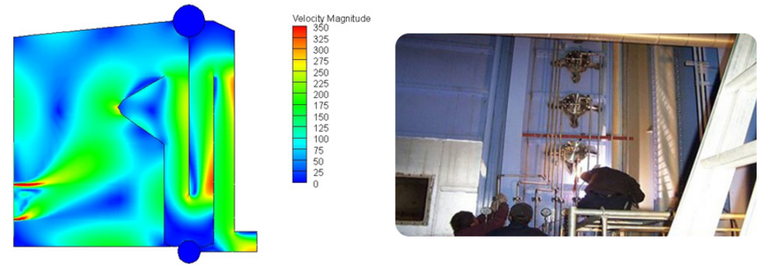
Description of SCR system



SNCR system

- To reduce NOx (nitrogen oxides), selective catalytic reduction (SCR) is commonly used. The necessary factors are 1) the reducing agent, 2) SCR catalyst, and 3) temperature of the off gas required for the catalyst.
- However, in some facilities, especially boilers, when a reducing agent (such as Urea, or NH_3) is added to the combustion space, NOx can be reduced by up to 70% without catalyst, if the temperature conditions are right.
- In general, it is known that for SNCR, the temperature of the appropriate area in the furnace is from 850°C to a maximum of 1,100°C, but in actual field, it is confirmed that 850~950 °C generally achieves a maximum NOx reduction efficiency of 50~70%.

Velocity analysis



Reference

KOREA ZINC
SCR Turn key

LOTTE CHEMICAL
SCR Turn key

PETRO CHEM
SCR Turn key

SK Innovation
SCR 2 units Turn key

GS POWER
SCR Turn key

HUCHEMS
SCR Turn key

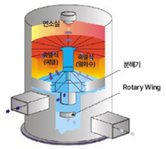
⬆ SCR Turn key project

RTO/RCO SYSTEM

RTO/RCO System Overview

- KIYEON E&C Co., Ltd. has developed and applied a regenerative heat/catalytic oxidation system that can completely reduce VOCs, odors, and CO with almost no loss of heat energy By designing to abate VOCs, odors, and CO in off gas through one system using heat storage materials.
- VOCs and gases containing odorous substances approach the combustion temperature while passing through the preheated ceramic layer and het up after passing through the air distribution device, and at high temperatures in the combustion area, VOCs and odorous substances oxidatively decompose and pass through the thermal storage material at the outlet side, accumulating high-temperature waste heat in the ceramic. According to this cycle cycle, heat storage and heat generation are cross-operated at regular intervals and discharged as harmless and odorless clean gas.

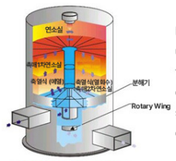
RTO (Regenerative Thermal Oxidizer)



It is an all-in-one facility that completely burns VOCs and odorous substances in a high-temperature combustion chamber by using a valve to change the wind direction of the exhaust gas, away from the standard damper method for wind direction conversion or the method by rotation of the air distributor.

※ Heat recovery efficiency 95% or more / Treatment efficiency 98% or more

RCO (Regenerative Catalytic Oxidizer)



It is the same type as the RTO, but by using a catalyst, the operating temperature inside the combustion chamber is operated below 400°C. The system is simple, so maintenance and operation are easy.

- Our valve type RTO/RCO completely solves the chronic gas leak problem by converting the leakage problem of the rotating body, which has been pointed out as a problem of the existing rotating rotary type, to the valve method, and prevents failure due to deformation of the rotating body and an integrated structure. It is a newly developed product that has dramatically improved maintenance difficulties, which is a weakness of.

Previous model ROTARY RTO/RCO

⬆ R- JD(6,000 CMH)

New model VALVE ROTARY RTO/RCO

⬆ A-A-Development(60,000 CMH)

Reference

DAEHWA - RTO

ESG - RTO/RCO

L engineering - RTO/RCO

D engineering - RTO/RCO

⬆ RTO / RCO project

Reference (Scrubber system)

HANWHA - Scrubber system for NOx abatement

HUCHEMS - NH_3 stripping 및 Absorption system

⬆ Scrubber project

VOC/CO REDUCTION SYSTEM

VOC(Volatile Organic Compound)

• It is a hydrocarbon compound that generates ozone, which is the cause of chemical smog, through a photochemical reaction with nitrogen compounds and other chemicals in the air.

Type of factory	Source	Types of VOC substances
Stamp and ink manufacturing plant	Automotive, electronic product painting, dryer, metal, glass, etc.	Benzene, Toluene, Xylene, Naphta, Alcohols, Esters, organic solvent, etc.
Solvent, adhesive and synthetic resin manufacturing plant	Plastic, plywood manufacturing process	Stvlene, Aldehydes, Esters etc
Chemical plant	Petrochemical, organic synthesis process	Benzene, Toluene, Xylene, Aldehyde, Alcohols, organic acids, etc.
Odor Substance Handling Plant	Fertilizer, feed, fire extinguisher manufacturing process, etc.	Amines and sulfur compounds
Automotive and petrochemical	Various processes such as BTX process	Aliphatic/aromatic hydrocarbons, benzene, etc.
Textile manufacturing plant	Chemical fiber weaving process, etc.	Acetone, Alcohols, CH_3S_2 etc.
Dry cleaning	Large laundry	Chlorinated hydrocarbons, gasoline, etc.
Metal and electronics	PCB factory, etc.	Chlorinated hydrocarbons, ester alcohols, organic acids, etc.
Etc	Tobacco dryer, perfume manufacturing process, etc.	Alcohols, Esters

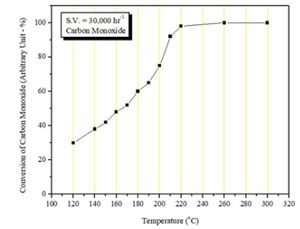
VOC material removal technology

Technology	Principle	Apply	Characteristic
Catalytic combustion	Combustion through catalyst contact at 200~400°C	Mostly combustible gas	High efficiency, catalyst replacement required, low operating cost, catalyst poisoning
Direct combustion	Combustion with direct heat source at 800~900°C	Mostly combustible gas	Advantageous to high concentration, increase in operating cost, deterioration in device durability, and Nox generation problems
Bio Reactor	Biodegradation	Most odorous ubstances	Freeze prevention facility required
Condensation	Cooling and ondensation	High boiling point substances	Advantageous for removing high-concentration substances
Absorption	Activated carbon, Zeolite adsorption	Most odorous substances	Regeneration and pretreatment units required
Chemical cleaning	Neutralize with acid and alkali	Ammonia, amines	Acid/alkaline wastewater treatment facility required

CO reduction system

• CO (carbon monoxide) has a strong affinity for haemoglobin, and increased concentrations in confined spaces can cause harm to humans and animals.
In order to solve this problem, we have developed and put into practical system that recovers heat energy and killing CO through complete oxidation of CO by applying specially designed CO reduction catalyst technology.

CO reduction catalyst w/ very high conversion



Conversion of Carbon MoCOide over the ZEROCO-III Catalyst(a high-temperature catalyst)

Reference

DAEHWA
농축기 + Catalytic Oxidizer

HUCHEMS
MNB Plant CO reduction system and catalyst

HUCHEMS
VOC reduction catalyst and system

HUCHEMS
CO reduction system and catalyst

T engineering
CO unit system (Yulchon)

T engineering
CO unit system (Yeosu)

HUCHEMS
VOC reduction catalyst and system

HUCHEMS
VOC reduction catalyst and system

E engineering
VOC Removal system PKG

⬆ Catalytic Oxidizer - VOCs reduction system and catalyst