KC Cottrell

Gas Treatment Systems

A Global Leader in Air Pollution Control

- People & Technology keeping our planet sustainable...

Wet FGD System

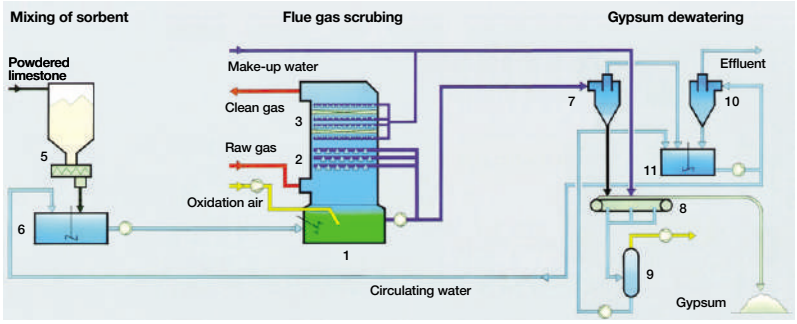
1 Wet Limestone-Gypsum Process

Sulfur oxide (SOx) emitted during the burning of fuel is highly toxic and causes acid rain.
It is generated by facilities that burn fuel containing sulfur, such as coal and oil.

The wet limestone-gypsum process uses a wet scrubber to remove SOx from flue gas. Limestone or slaked lime is used as sorbent. As the sorbent reacts with SOx, gypsum is generated as a byproduct. The discharged gypsum is recycled to make gypsum board or cement.

SO_2 is removed from flue gas in the absorber or scrubber tower using limestone slurry.
The absorbed SO_2 is oxidized in the absorber sump to form marketable calcium sulfate crystals (gypsum).
The pH level in the absorber sump, which changes depending on the quantity of SO_2 removed in the absorber, is controlled by adding limestone slurry. This enables continuous production of high purity gypsum.

Gypsum slurry from the absorber sump is thickened in a hydrocyclone and then more than 90% is dewatered by a vacuum belt filter. Alternatively, a centrifuge may be used in place of the vacuum belt filter.



1. Absorber sump
2. Absorption zone
3. Demister
4. Oxidation air blower
5. Sorbent silo
6. Tank for freshly prepared scrubbing suspension
7. Gypsum slurry Hydrocyclone station
8. Vacuum belt filter
9. Vacuum pump
10. Waste water Hydrocyclone station
11. Circulating water tank

Advantages

- High removal efficiency
- Low sorbent and power consumption
- High reliability and availability
- Stable byproduct (commercial grade gypsum)

Projects

- Dangjin Thermal Power Plant Units 1~4
  500MWX 4, Korea (1995)
- Cheongju Local Heating Public Cooperation,
  Korea (2000)
- Samcheonpo Thermal Power Plant Units 1~4
  560MW X 4, Korea (2002)
- Hadong Thermal Power Plant Units 7~8
  500MW X 4, Korea (2006)

• Cheongju Local Heating Public Cooperation

• Dangjin Thermal Power Plant

• Samcheonpo Thermal Power Plant

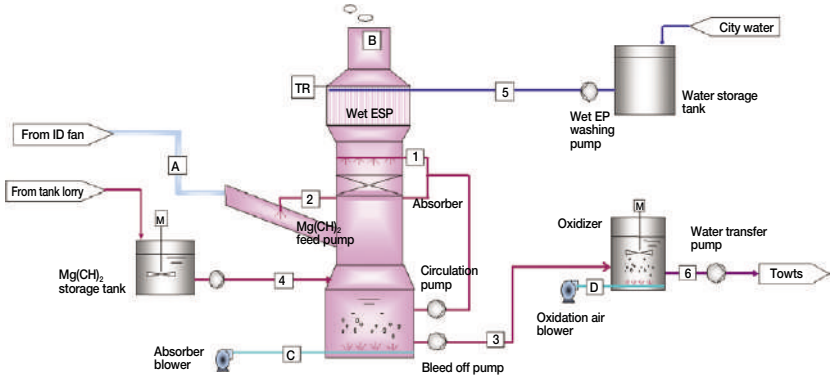
• Hadong Thermal Power Plant

2 Wet Mg/Na FGD Process

The wet scrubbing method using the Moretana Plate and magnesium hydroxide ($Mg(OH)_2$) or sodium hydroxide (NaOH) accounts for more than 51% of the Japanese market and 90% of the Taiwanese market. An optimal process with a proven track record, it uses $Mg(OH)_2$ or NaOH solutions to circulate flue gas from boilers to remove SO_2 and dust through gas-liquid contact.

Higher SO_2 removal efficiency can be achieved by increasing the pH and SO_3^{2-} levels of the sorbent. The higher the pH level, the sharper the decline in the solubility of $MgSO_3$. Due to this phenomenon, sedimentation of $MgSO_3$ may occur. To prevent clogging caused by sedimentation and to optimize desulfurization, it is important to control the pH and SO_3^{2-} levels of the sorbent. The optimal level is determined by the exit SO_2 concentration from the absorber.

In general, the pH level of the sorbent should be 6.0 ~ 6.5 and the SO_3^{2-} ion concentration should be below 0.1 mol/L. The SO_3^{2-} level of the sorbent is controlled by adjusting the amount of oxidation air.



• Wet Mg flowchart

• Jeju Power Plant

Advantages

- Easy operation and maintenance
- Simple structure and compact size
- Proven track record

Projects

- Jeju Power Plant Units 1~2, Korea (2004, 2009)
- BLCP Thermal Power Plant, Thailand (2005)

3 FGD Using Alkaline Waste Water

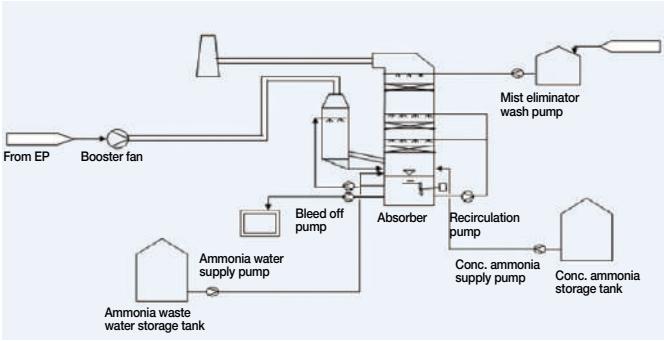
The use of alkaline waste water eliminates the need for additional costly chemicals. This lowers the energy costs due to less pressure loss.

Advantages

- Over 95% removal efficiency
- Reduction in chemicals and energy cost

Projects

- Daegu Cogeneration Plant (2002)



• Flow Chart

• Daegu Cogeneration Plant

Semi-Dry Reactor System

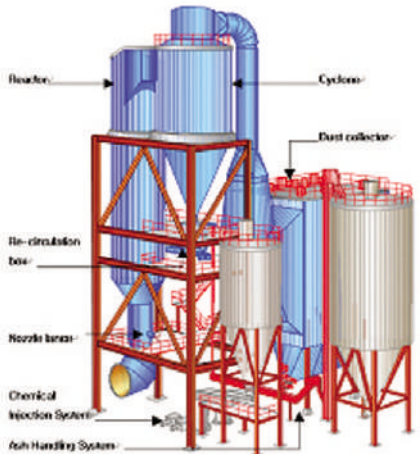
1 GSA Technology (Fluidized Technique)

In a GSA system, dust particles from flue gas, reaction products, and alkaline chemicals fed into the system and floating inside the reactor. They get in contact with flue gas to remove various pollutants with high efficiency.

The dust concentration inside the GSA system reactor is 50 to 100 times higher compared to conventional reactors. The surface of each dust particle is coated with alkaline chemicals which are injected into the reactor either in the form of a slurry or solid. The coated dust particles come into contact with acidic pollutants such as SOx, HF and HCl to neutralize and remove them.

The next step is the cyclone, where most of the dust is removed. Dust is completely removed by the ESP or Bag Filter later in the process so that only clean air is released into the atmosphere.

The reaction products and dust captured in the cyclone are recycled to the reactor and used as an absorbent. This means lower operating costs due to the reuse of alkaline chemicals. The GSA system can be run at minimal cost according to the target discharge rate if it is linked up to an acid gas monitoring system.



• GSA - Bag Filter & ESP Chongging, China

Advantages

- Short installation period due to flexible module design
- Low maintenance/repair cost
- Operating cost savings due to reuse of chemicals
- High removal efficiency

• Chongging(China)

Projects

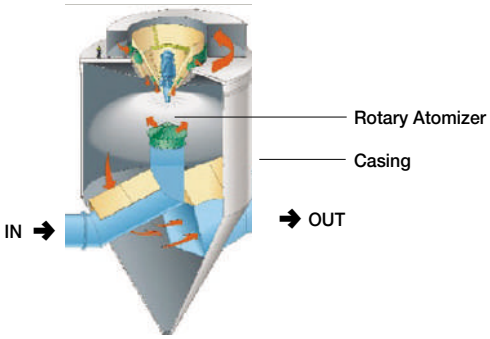
- Nine Dragons Paper Manufacturing Power Plant, China (2008)
- Formosa Plastic Factory Power Plant, USA (2009)

• Shildally(USA)

• Kara(Denmark)

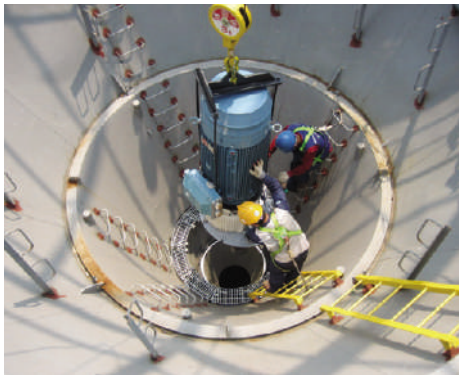
2 Rotary Atomizer System

High speed rotating wheel (10,000~20,000RPM) inside Rotary Atomizer sprays chemicals and coolants in the form of fine droplets to enhance reactivity. Fine particle size increases reaction efficiency, while circular spraying at high RPM facilitates contact with acid gases (HCl, HF, SO_2).



• Rotary atomizer System

• Gwangyang Ferronickel Plant



• Rotary Atomizer Installation

Advantages

- Particle size adjustment enhances reactivity, leading to lower chemical usage
- Compact size and easy maintenance

Projects

- Gwangyang Ferronickel Plant, POSCO, Korea (2007)
- Goyang Branch, Korea District Heating Corporation, Korea (2007)

3 Atomizing Spray Dryer System

In designing a semi-dry reactor featuring a dual fluid nozzle, the most important point is to maintain consistent gas flow inside the reactor and to evenly inject sorbent into the gas flow.

The dual fluid nozzle, which plays a key role in boosting removal efficiency, has superior spraying performance than the one fluid nozzle. In addition, the droplets sprayed have uniform particle size.

• KCES incinerator

Projects

- Sunglim Oil & Chemical Company, Korea (2003)
- KCES incinerator, Korea (2001)
- Guri incineratior, Korea (1999)
- Gunpo incineratior, Korea (1998)

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