Applications
Ironworks and refinery of fuel gas more than 100,000 m³/h

Osaka Gas Engineering Co., Ltd.

FRC desulfurization system

• Sulfur and cyanide removal from cal gas with sulfric acid recovery

Features

• Using an oxidation catalyst, the system efficiently removes hydrogen sulfide and hydrogen cyanide from coal gas.
• No additional desulfurizing agent is required because ammonium contained in coal gas is used for desulfurization.
No steam is needed for regeneration either.
• Desulfurization waste liquor is recovered as sulfuric acid. No secondary contamination.

←Premix-type recovery tower
↓ Fumaks desulfurization plan

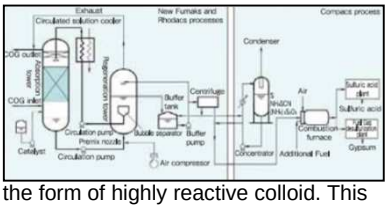
Overview (Technical principles, actions, etc.)

Fumaks process : The principle of desulfurization process
Circulating desulfurizing solution mixed with a pinch of picric acid in the absorption tower, the system absorbs and removes hydrogen sulfide along with ammonium contained in coal gas. Exposing desulfurizing solution, which is transferred to the regeneration tower, to air leads oxidative decomposition of hydrogen sulfide with picric acid working as a catalyst to separate sulfur for regeneration. The solution free of hydrogen sulfide is recirculated to the absorption tower. Very quick reaction by means of picric acid and advanced type pre-mix nozzles enable highly efficient and smooth processing. The regeneration process does not need steam, thus is cost-efficient, Absorption and regeneration reactions are presented in the following formulas.

・Absorption reaction $NH_4OH + H_2S \rightarrow NH_4S + H_2O$

・Regeneration reaction $NH_4HS + 1/2O_2 \xrightarrow[\text{(picric acid)}]{\text{Catalyst}} NH_4OH + S\downarrow$

FRC desulfurization system→



Rhodacs process : The principle of Cyanide removal process
Sulfur generated in the desulfurizing solution within the Fumaks process is in the form of highly reactive colloid. This colloidal sulfur changes hydrogen cyanide, which is absorbed from coal gas along with hydrogen sulfide, into rhodanate which is not toxic. Thus, presented in the following formulas, cyanide is removed.
The two step reactions in the Rhodacs process are,
・Polysulfide reaction $2NH_3 + H_2S + xS \rightarrow (NH_4)_2S_{x+1}$
・Rhodanation reaction $(NH_4)_2S_{x+1} + HCN + NH_3 \rightarrow NH_4SCN + (NH_4)_2Sx$

Compacs process : The principle of waste recovery process
Desulfurizing solution containing sulfur, rhodanate, etc, is concentrated and combusted to recover sulfuric acid. This makes a closed system for removal of hydrogen sulfide and hydrogen cyanide without secondary contamination.

Introductory Track Record

Installations in Asian countries (The New Fumaks process uses the premix nozzle.)
The system was installed by a number of Japanese companies and institutions including Sumitomo Metal Industries, Nippon Steel, Kawatetsu Chemical Industry, The Kansai Coke and Chemicals and Osaka Gas.

Year of nstallation	Site name	Applied process	Gas processed Nm³/H	Gas
1962	Tianjin Gas Company, China	New Fumaks Rhodacs Compacs	35,000	Coal gas
1963	Kwangyang Ironworks, POSCO, Korea	New Fumaks Rhodacs (Soda base)	24,500	Coal gas Secondary desulfurization
1989	〃	〃	24,500	〃
1990	〃	〃	24,500	〃
1991	〃	〃	32,000	〃
1999	Shanghai Baosteel Group Corporation, China	New Fumaks Rhodacs Compacs	105,000	Coal gas
Prospect in 2012	Boashan Iron & Steel Co., Ltd. / Shanghai Baosteel Chemical Co., Ltd., China	New Fumaks Rhodacs	105,000	Coal gas

Effects

・High desulfurizing efficiency by catalytic reaction of picric acid.
・A metal-free catalyst enables combustion of desulfurizing solution.
・The pre-mix nozzle needs less air for regeneration.
The exhaust may be injected into COG.
・The pre-mix nozzle needs no tall regeneration tower.
・Highly reactive sulfur enables efficient HCN removal.
・Cost-efficient with no need of steam or heat.
・H2S and HCN are fixed within the desulfurizing solution. As withdrown solution can be stored in the tank, the waste recovery plant (sulfuric acid plant) can be maintained while the desulfurizing plant is in operation.
・It is not necessary to handle highly toxic H2S and HCN gases