HYDROGEN CYANIDE (HCN) AND CARBONYL SULPHIDE (COS) HYDROLYSIS

Cost-effective catalytic conversion for the treatment of synthesis gas (syngas)

Shell Global Solutions

AT A GLANCE

Customer driver: Conventional amine treating solvents are unable to remove COS from syngas and off-gas streams, and HCN causes severe degradation of the amine solvent.

Solution: A hydrolysis process that catalytically converts HCN and COS

Value delivered: Cost-effective removal of HCN and COS, more selective solvent use and reduced solvent degradation

Proof point: Four reference units worldwide

Gasification processes produce syngas that is composed mainly of hydrogen and carbon monoxide (CO). However, contaminants such as COS and HCN are also formed. Failure to remove HCN leads to amine degradation in the downstream amine unit, and COS compromises the total sulphur specification of the treated gas. Deep removal of both these contaminants is impossible using conventional amine treating solvents.

ABOUT THE TECHNOLOGY

The catalytic conversion of HCN and COS is a cost-effective process for reducing the harmful effects of these components in gas streams. This hydrolysis technology has two main fields of application:

- syngas treatment upstream of an amine unit for coal or oil gasification processes; and
- syngas treatment where the presence of HCN or COS is unacceptable to downstream processing units such as gas to liquid processes.

PROCESS DESCRIPTION

The HCN and COS in syngas are converted in a fixed-bed reactor filled with a catalyst system according to:

$HCN + H_2O \Leftrightarrow NH_3 + CO$

$COS + H_2O \Leftrightarrow H_2O + CO_2$

The syngas is fed to the guard reactor where partial conversion of HCN and COS takes place. The guard reactor's primary function is to collect soot and debris on top of the bed and protect the main reactor, where full conversion of HCN and COS occurs.

After passing through the catalyst beds, the syngas is cooled and the water is knocked out. Most of the ammonia (NH_3), traces of formate and some of the carbon dioxide (CO_2) and hydrogen sulphide (H_2S) will dissolve in the knocked-out water, which is then typically routed to a sour water stripper or other water treating facility.

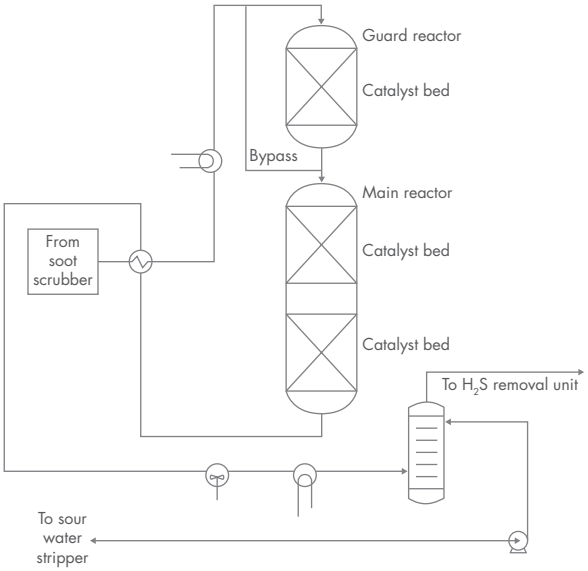


Figure 1: Simplified process flow scheme.

HCN/COS HYDROLYSIS ENABLES MORE SELECTIVE SOLVENT USE AND CAN HELP TO REDUCE SOLVENT DEGRADATION.

BUSINESS VALUE

Shell Global Solutions HCN/COS hydrolysis technology cost-effectively removes HCN and COS. Catalytic conversion creates NH_3 and H_2S, which can be removed easily in downstream processes.

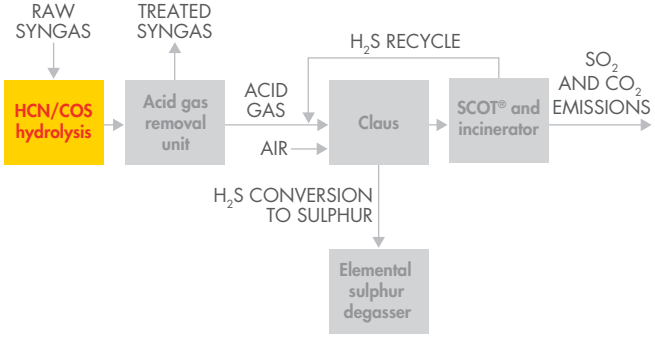
In addition, HCN/COS hydrolysis enables more selective solvent use and can help to reduce solvent degradation.

Our services include:

- basis of design;
- proprietary catalysts;
- process warranties;
- operating manuals;
- performance monitoring methods;
- plant optimisation; and
- advice on unit operation.

Catalysts can be sourced through CRI/Criterion Inc., the global catalyst technology company of the Shell Group.

HIGH-PERFORMANCE GAS-TREATING SOLUTIONS SERIES



HAVE YOU CONSIDERED HOW YOU CAN

- cost-effectively remove HCN and COS from gas streams?
- enable more selective solvent use?
- reduce solvent degradation?

PROOF POINTS

WILLEM-ALEXANDER POWER PLANT

The acid gas removal unit at Nuon's integrated gasification combined-cycle (IGCC) showpiece power station in Buggenum, the Netherlands, applies HCN/COS hydrolysis and the Sulfinol® process to cut the syngas's sulphur content to less than 20 ppmv.

SANNAZZARO REFINERY

Eni's refinery near Pavia, Italy, creates syngas from heavy residues, which it supplies to the nearby EniPower power plant. The plant features cutting-edge technologies, including Shell Global Solutions residue gasification and HCN/COS hydrolysis technologies.

REFERENCES

Client	Location	Capacity, $\times 10^6$ Nm^3/d	Feedstock
Urea plant	Australia	9.4	Coal
IGCC power plant	Korea	4.2	Coal
Eni refinery	Sannazzaro, Italy	~3.7	Oil
Nuon IGCC power plant	Buggenum, the Netherlands	3.4	Coal

For further information, please visit our website at www.shell.com/globalsolutions

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