Methanol: syngas after scrubber

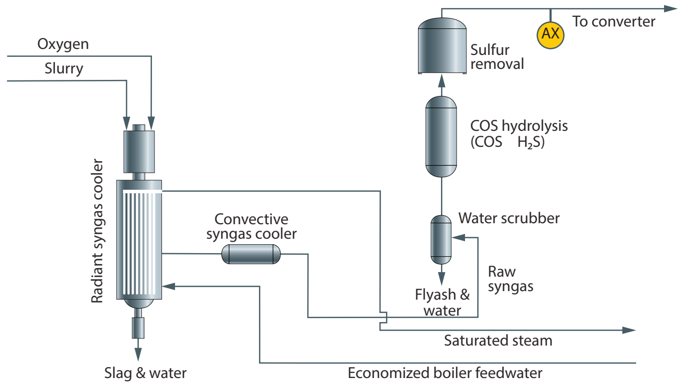

Figure 1: Typical syngas measurement point*

Benefits at a glance

- Unique spectroscopic capability to measure all syngas components, including H_2 and N_2
- Pipe-centric sampling and measurement at the sample tap
- Sample can often be returned to process, avoiding disposal to flare header
- Complete syngas speciation
- No valves, columns, or carrier gas
- No routine calibration required
- Fouling cannot damage the Rxn-30 optical probe and cleaning is easy
- No interference from moisture vapor in the raw syngas sample when the sample is kept above its dewpoint

Raw syngas from a gasifier typically saturated with steam and also contains significant amounts of particulate matter. To remove these particulates often requires a combination of a candle filter and a water scrubber for removing any remaining fine particulates and chlorides. The water scrubber also provides additional moisture in preparation for the shift converter, in which the water shift reaction is used to convert CO in the syngas to CO_2 and H_2. Any carbonyl sulfide (COS) compounds in the syngas are converted to H_2S using a catalytic hydrolysis reactor, so that the sulfur can be eliminated in subsequent acid gas removal processes.

Measurement of raw syngas composition

The Raman Rxn5 analyzer is a unique solution to the sampling and measurement of this particular process stream. A typical Raman spectrum and stream composition for a raw syngas stream after the main scrubber is shown in Figure 2. Note the simplicity and complete speciation of H_2, CO, CO_2 and CH_4 as individual peaks in the Raman spectrum. Low levels of both H_2S and NH_3 can also be measured in the same sample, when present at concentrations > 0.1%. As the Raman Rxn5 is essentially transparent to moisture, any residual moisture present in the stream does not interfere with the analysis as long as it does not condense, and the analysis represents a dry basis result. The Raman Rxn5 uses a normalized analysis which makes it very robust to changes in process pressure, temperature, and flow, as well as to any slow fouling that may occur.

Reliability issues with traditional methods for syngas analysis

Syngas is often measured with process gas chromatography (GC) or mass spectrometry (MS). Both technologies require a low pressure sample and sample transport if the analyzer cannot be located close to the sample tap point, adding lag time to the speed of analysis. In the case of the gasifier raw syngas streams, the use of a dynamic reflux sampler (DRS) or equivalent system is mandatory. Protecting the analyzer from liquid carryover is the main challenge as this event can damage columns in a GC or the ionization chamber in an MS. The Rxn-30 probe used by the Raman Rxn5 cannot be damaged by liquid carryover or fouling.

* See the general Methanol: production analytics overview

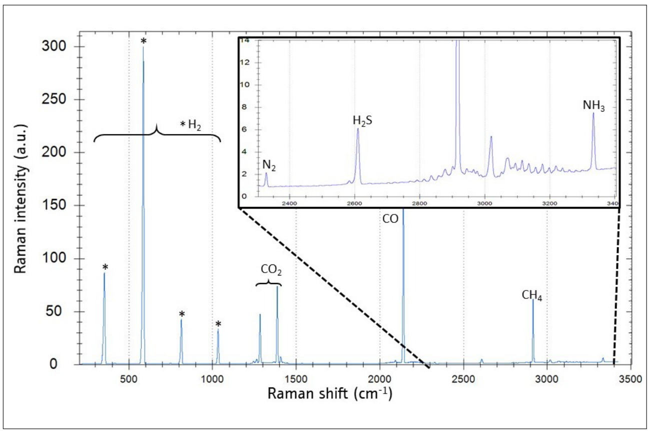

Figure 2: Raman spectrum of typical syngas stream

Solution: Raman Rnx5 analyzer with the syngas after scrubber method

The use of a liquid removal system is mandatory for the syngas stream after the gasifier scrubber. The Rxn-30 probe can be easily integrated into sample conditioning systems to measure process streams at higher temperatures and pressures. The ability to measure at higher pressures often allows the sample to be returned to the process, eliminating waste and costly flaring. The use of fiber optic cables allows the probe to be placed at the sample tap location, eliminating the need for long heated sample transfer lines and sample lag time.

The Raman Rxn5 syngas after scrubber contains the following per measurement point:

- Dedicated laser module
- Rxn-30 fiber optic probe
- Industrial hybrid electro-optical cable (up to 150 m long, customized to your plant requirements)
- Combined pressure and temperature sensor with cable (up to 150 m long, customized to your plant requirements)
- Dedicated syngas after scrubber method

Typical process conditions	P (barg)	T (°C)
At sample tap	49	199
At Rxn-30 probe	49	55

Typical stream composition

Component	Range (Mol%)	Normal (Mol%)	Precision (Mol%) k=2	Cal gas (Mol%)	Precision (Mol%) k=2
Hydrogen	25-45	34.3	0.02	35	0.02
Nitrogen	0-2	0.4	0.01	1	0.01
Carbon monoxide	30-50	40	0.02	38	0.02
Carbon dioxide	10-30	21.7	0.03	21	0.03
Methane	0-10	2.3	0.01	5	0.01
Hydrogen sulfide	0-2	0.4	0.01	0	N/M
Ammonia	0-2	0.9	0.01	0	N/M

Table 1: Typical process conditions and stream composition

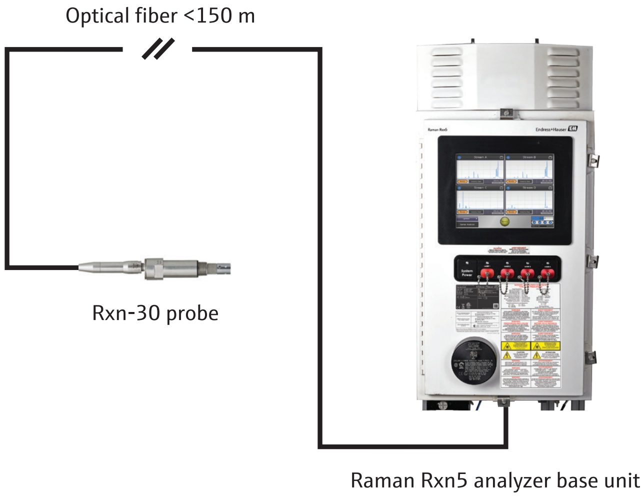

Figure 3: Recommended system configuration

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