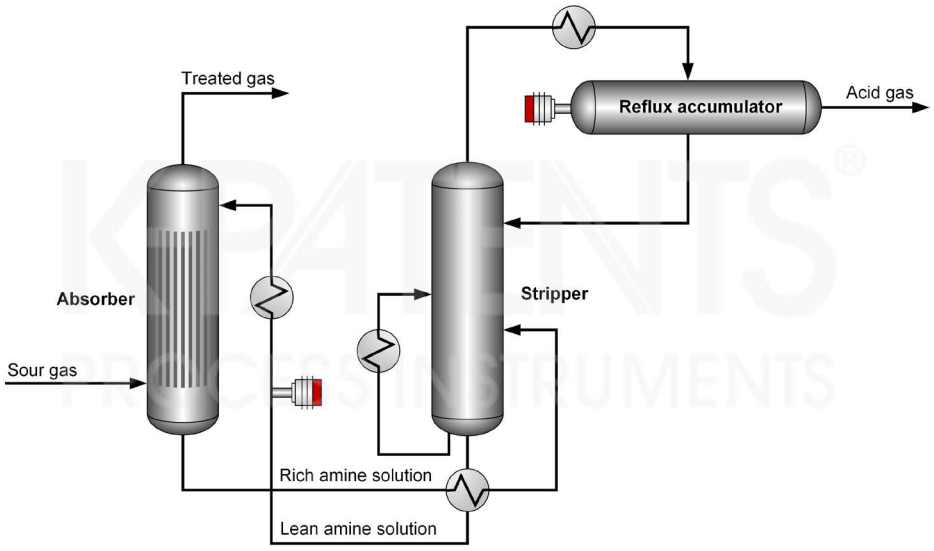
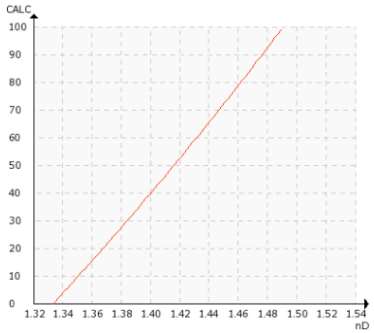


MONOETHANOLAMINE (MEA), DIETHANOLAMINE (DEA), METHYLDIETHANOLAMINE (MDEA)

Typical end products

Pipeline quality dry natural gas, liquefied petroleum gas (LPG).

Chemical curve: MDEA R.I. per Conc% b.w. at Ref. Temp. of 20˚C



Introduction

Natural gas contains significant amount of hydrogen sulfide (H_2S) and carbon dioxide (CO_2). Natural gas is also referred to as *sour gas* because of its strong odor, caused by the sulfur content. These sulfur compounds render it extremely harmful, even lethal, to breathe. Natural gas can also be extremely corrosive. Carbon dioxide must be removed before the gas can be transformed into liquid form (liquefaction LNG) for transportation. Liquefaction happens at a extremely low temperature (-161 °C or -258 °F) at which carbon dioxide can freeze and consequently block pipe lines.

Amine gas treating, also known as *gas sweetening* and acid gas removal, refers to a group of processes that use aqueous solutions of various amines to remove H_2S and CO_2 from gases. It is a common unit process used in refineries, petrochemical plants, natural gas processing plants and other industries.

The acid gas absorption in amine solution is conducted using a two-column operation: the first column is used to absorb the acid gas into the absorbent amine, the second column is used to regenerate the amine.

The process relies on counter current flow to achieve optimum mixing. A lean solution (low acid gas) enters the top of the absorber and flows to the bottom; acid gas enters the bottom of the absorber tower and bubbles to the top.

The rich amine (high acid gas) enters the stripper, where the acid gases are released, and the clean amine is returned to the absorber. The acid gases collect and exit at the top of the stripper.

Application

In the regeneration process the amine can degrade or be depleted. In order to achieve the proper acid gas removal, the optimum amine concentration must be maintained. Most acid gas recovery systems use either monoethanolamine (MEA), diethanol-amine (DEA) or methyldiethanolamine (MDEA).

Degraded and corrosive by-products are removed by carbon filters. Carbon filters also remove amine from the solution, therefore continual amine top-up is required.

Filtration is done through a slipstream, so the amine concentration is not totally depleted on each pass. Therefore, the top-up must be based on the quantity filtered.

The amine concentration is traditionally measured by lab titration. This technique assumes that all alkalinity is due to amine and can give false readings because of the many inhibiting factors. Furthermore, unlike periodical sampling, continuous in-line measurement provides an instant feedback to indicate any fluctuations in the process. This instant feedback can be used for real-time process control.

Instrumentation and installation

The K-Patents Process Refractometer PR-43-GP is used to measure the lean amine concentration of the acid gas from the MEA/DEA regeneration stripper column. By maintaining an optimum amine concentration, the appropriate acid gas removal can be achieved.

Reliable amine concentrations of 18-20 % are an advantage for optimal H_2S removal. The final amine concentration can be controlled with a top-up, so that the appropriate amount of MEA at 10-15 wt-% is fed into the process to remove CO_2, as:

- too low a MEA will lower the absorption efficiency
- too high a MEA will increase the corrosion of the process equipment (corrosion protection)

The K-Patents refractometer is unaffected by alkalinity or any other possible inhibiters present in the process.

Standard sensor material can be used in this application. Silicon oil is often added to the MEA solution to prevent foaming and therefore periodical prism cleaning (every 3-4 weeks) may be needed. Installation in a by-pass is recommended.

Instruments with hazardous and intrinsic safety approvals are available when required.

Instrumentation	Description
	K-Patents Process Refractometer PR-43-GP is a heavy-duty instrument with non-weld body construction for diverse oil and gas industry applications. The refractometer is installed in the main processing line by welding stud and flange connection for 2 inch, 2.5 inch and larger pipe sizes and vessels, or via flange and FTC Flow through cell connection for 0.5 inch, 1 inch, 1.5 inch and 2 inch pipe sizes.
User Interface	Selectable multichannel MI, compact CI or a web-based WI user interface options allow the user to select the most preferred way to access and use the refractometer measurement and diagnostics data.
Measurement range	Refractive Index (nD) 1.3200 – 1.5300, corresponding to 0-100 % by weight.