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Processing Lean Natural Gas

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Abstract

The traditional approach for processing sour gas is to utilize solvent systems for natural gas cleanup and employing Claus technology for conversion of H_2S to elemental sulfur. However, this technology is difficult to operate and could be uneconomical for lean natural gas, which has high amounts of H_2S and CO_2. There are ultra-sour fields in the world that are underexploited because of poor economics. Operating companies are in search of solutions to process these resources.

In the past, membranes could be used for the removal of H_2S and CO_2 only when the acid gas sulfur levels are low. But some wellhead sources of natural gas may contain sour gas components as high as 80%. In combination with water, these gas streams are highly corrosive and can rapidly destroy pipelines and equipment, unless they are removed. Otherwise, exotic and expensive construction materials are required. Before entering distribution pipelines, natural gas needs to be purified from the acid gases, CO_2 and H_2S, to prevent pipeline corrosion. Next to being corrosive, H_2S is also highly toxic, thus allowing permissible limits to be in small traces (<4ppm) only. For CO_2, the pipeline specification is often set at 2% or 3%, with an additional reduction required (<50 ppm) if the gas is turned into liquefied natural gas (LNG).

Some companies have developed polymeric membranes that can be used for bulk H_2S removal from natural gas, even at very high H_2S concentrations and high operating pressures. This approach allows for more sustainable development of new sour gas fields or for retrofitting existing applications. The membrane system can be used to either treat the gas to meet pipeline specifications or make a bulk cut of acid gases, and then the final pipeline specifications can be met using the traditional amine processes or other traditional follow-on operations. Ideally, the permeate gas from the membrane system is reinjected as opposed to being converted to elemental sulfur. This hybrid approach has been considered by some studies to be more economical.

This report addresses the treatment of lean natural gas in an onshore location using membrane technology utilizing polyether-block-amide (PEBAX®) material as membrane, followed by absorption using Methyl diethanolamine (MDEA) as a solvent. The analysis is carried out for a 350 MMscfd of ultra-sour lean natural gas containing 20% of H_2S and 20% of CO_2. A material balance table, an equipment list with sizes, and process flow diagrams are also included in the report. A simulation was carried out using ProMax® version 5.0. An Excel-based tool, iPEP Navigator® is also provided for easy economic analysis in different regions of the world.

The technological and economic assessment of the process is IHS Markit PEP's independent interpretation of a potential commercial process based on information presented in the open literature, such as patents or technical articles, and may not reflect in whole or in part the actual plant configuration. IHS Markit PEP believes that they are sufficiently representative of the process and process economics within the range of accuracy necessary for economic evaluations of the conceptual process designs.

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