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Opinion Article

Tetraethylene Glycol (TEG) Dehydration Process for Petroleum Gas Extraction

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DESCRIPTION

Shale gas is seen as one of the most promising future substitutes for conventional energy as a sort of clean energy with abundant supplies. According to the Energy Information Administration (EIA), global shale gas output reached 7688 × 10^8 m^3, with America contributing the most, and the bulk of dry natural gas production in the United States will come from shale and tight gas resources until 2050. China, as the world's second largest reservoir, is speeding shale gas exploration and usage in order to satisfy rising energy demand, with annual shale gas production increasing by tenfold from 2014 to 2020. By 2040, shale gas extraction is estimated to account for more than 30% of China's total natural gas supply.

In contrast to conventional natural gas fields, shale gas wells are numerous and widely scattered, yet production and well applied extensively are fast declining. As a result, modularized and transportable processing plants that can be relocated within a field to fight the production uncertainty that comes with the development of a shale gas resource become important and necessary. Furthermore, the majority of China's shale gas deposits are near densely populated areas, posing environmental and health problems. As a result, minimizing the occupied area and achieving facility relocation and reutilization, as well as promptly placing the facilities into operation while reducing environmental contamination, are crucial for shale gas development. In most regions, shale gas appears as a sweet gas with no acid components. However, it is usually saturated with water, which has a number of disadvantages, including the production of hydrates, pipeline corrosion, and a reduction in heat capacity. To ensure safe processing and transportation, water vapors from shale gas must be removed prior to transmission and burning. Various natural gas dehydration technologies, including solid/liquid desiccant and refrigeration-based systems, have been extensively researched. The simplest of these approaches is a refrigeration-based method that includes condensation by cooling. Furthermore, due to the limitations of natural gas hydrate development, which necessitates the use of hydrate inhibitors, this method is rarely used.

Furthermore, unless the feed gas pressure is high enough, gas cooling consumes a large amount of energy. With water dew point as low as 50°C; solid desiccant adsorption can obtain a very low water concentration in the dry gas. Moreover, as compared to other natural gas dehydration methods, the adsorption process has a high Capital Cost (CapEx) and Operational Cost (OpEx). CapEx for solid desiccant adsorption is claimed to be 2-3 times higher than that of liquid absorption. As a result of its economic and technological advantages, solvent absorption is the most widely used methodology. Several glycols, such as ethylene glycol, diethylene glycol, Tetraethylene Glycol (TEG), and triethylene glycol, have been proven to be appropriate for commercial usage in liquid desiccant absorption technologies. Because of its low volatility, strong hygroscopicity, and high thermal stability, TEG is the most extensively utilized solvent for absorption among different types of liquid desiccants. Because of the excellent performance of TEG in the natural gas dehydration industry, several studies have been conducted on the TEG dehydration process to improve dehydrating performances, such as predicting water removal efficiency, estimating TEG purity using a new approach, equipment sizing and type selection, studies on the influence of solvent purity, equilibrium model improvement, stripping gas injection, and so on. Although there is a wealth of literature on the process simulation and parameter optimization of the natural gas dehydration process, none of the researchers have focused on process optimization for shale gas field rolling exploration, where device modularization and relocation, as well as environmental performance, are major concerns. With the recent expansion of shale gas field exploration in China, some constraints for the standard TEG process for shale gas dehydration have been discovered.

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