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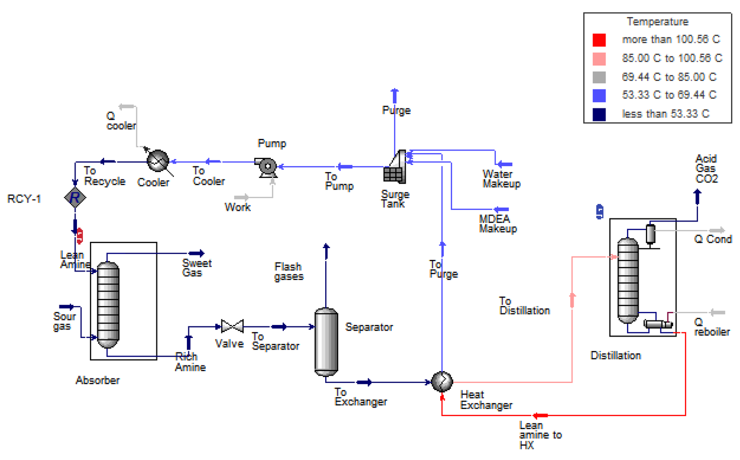
EMBODIED ENERGY ANALYSIS AND GHG EMISSION FROM ACID GAS REMOVAL

Abstract

The removal of acid gases such as carbon dioxide and hydrogen sulphide from sour gas streams using aqueous alkanolamine reactive solutions is an essential part of industrial processes. Absorption and stripping purification, low heat of reaction, low level of corrosivity, high stability. However, the disadvantage of this solvent is its slow reaction with CO2 which could be one of the reasons for not able to achieve the target molar composition of CO2 being absorbed in an absorber. Thesteps are important because the contaminants exceedance of permitted safe levels can cause greater corrosion rates, health hazard impacts, and deterioration to environment. Methyl diethanolamine (MDEA), as a tertiary alkanolamine. MDEA has various advantages such as low vapor pressure, less energy requirements molar composition of CO2 found in simulated sweet gas was 0.175 whereas the composition from ammonia plant was 0.0042. Even though activated energy analysis hit the target value the process could be more efficient by changing the type of solvent, flow rates and composition

Design and Implementation

The goal of this project is to simulate an amine sweetening unit. The entire simulation was carried out with keeping the CO_2 absorption and removal as a primary concern. This section illustrates the properties and components of sweet gas, fluid package selected to perform gas sweetening simulation and finally the design of two main equipment that are absorber and distillation column which are basically the heart of this process.



Conclusion

Many industrial processes encounter acid gases, such as the presence of acid gases (CO2 and H2S) in natural gas. The removal of these gases from sour gas is referred to as gas sweetening, and the process is referred to as an amine sweetening unit. The absorption of CO2 in MDEA and the stripping, in which CO2 is removed from MDEA and MDEA is recycled back into the process, are the two parts of the amine sweetening unit. The simulation of an amine sweetening unit was carried out using basic temperature and pressure principles; the absorber operates best at low temperatures and high pressures, same as for distillation, temperature and pressure should be regulated according to the boiling points of vapor/liquid mixture of inlet stream.

Objective and Motivation

Motivation

When dealing with gas sweetening, there is a mass transfer process where H2S is moved from one phase to another, it is important to support the theory with relevant calculations to be able to evaluate the progress of the sweetening process and establish a mass balance using equilibrium theory. To investigate the area of gas sweetening the different methods used should be documented. Research into relevant equipment for the most used methods should be done, to be able to make a detailed model for the process. One process is chosen and evaluated thoroughly to evaluate the efficiency of that specific cleaning method. Amine Sweetening is a regenerative process to treat a gas or liquid through the absorption of acid gas and Sulphur components, most commonly, (H2S), carbon dioxide and mercaptans. The contaminants are removed via contact with an amine/water solution.[3]

1.2 Aim of Project

The aim of this article is to give an overview of the challenges, implications, and mitigation techniques in the construction industry for reducing and controlling CO2 emissions. It's important to note that picking low-embodied-energy materials may result in greater operational energy usage. A material with a larger embodied energy, on the other hand, may result in a building with a lower operating energy. Because embedded energy may reach up to 20% of a building's energy usage, lowering it can have a major influence on the building's total environmental impact. [3]

1.3 Constraints

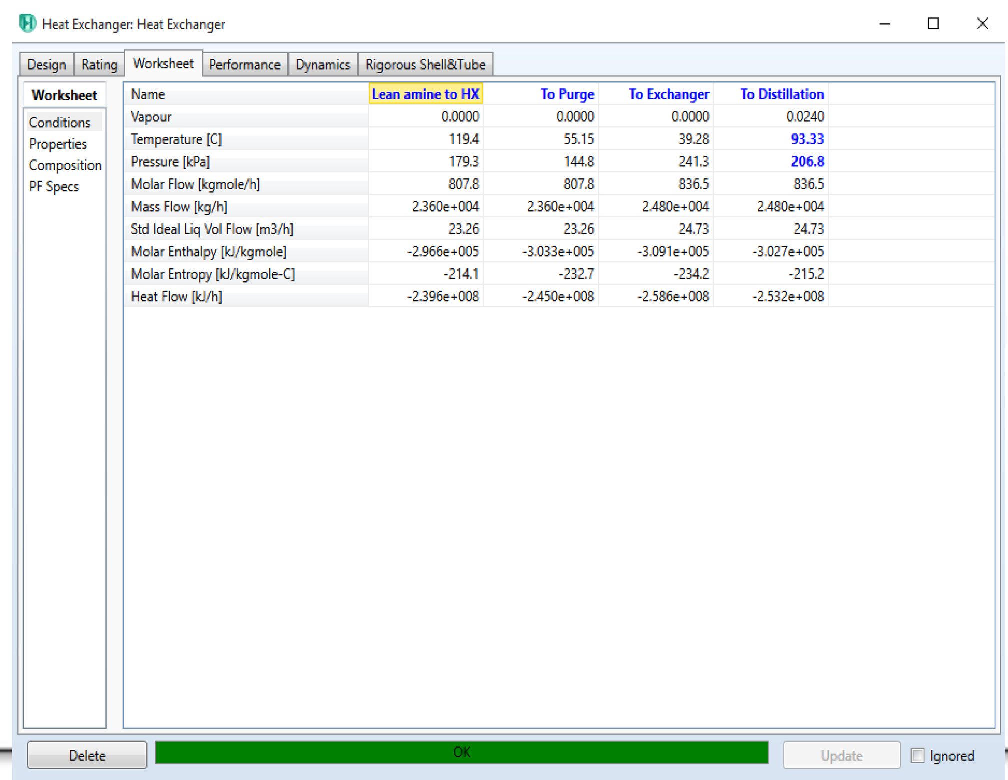
During the project, a few requirements were verified. Because the venture took place during the pandemic, we were only provided one set of data and were unable to conduct additional research to validate our findings. We were similarly unable to alter the preliminary borders. We also needed to conduct a sizable portion of our meetings through the internet. Regardless, we had the option of determining this issue by scheduling a weekly meeting.

1.4 Standard

Enforcing standards and policies, conducting impact assessments, adopting low-carbon technology, and limiting energy usage are some of the strategies for reducing CO2 in the building sector. additionally, our project follows ASME CODE PRESSURE VESSELS AND COLUMNS.

Results

In this section, the results of our simulation were compared with ammonia plant from CO2 removal unit data. Table 4 shows the flow rate of CO2 and H2S in the sour gas stream, as well as the temperature and pressure of this mainstream in Table5. It is considered a sour gas feed with 17.820 mole % CO2. The amine plant should be designed to produce sales gas with a CO2 content of less than 0.415 mole % in sweet gas stream, A case study is conducted using Aspen HYSYS to investigate the effect of lean amine temperature on CO2 removal by varying MDEA solution temperature from 37.73°C (same as feed gas temperature) to 39.63°C.As shown on table 5-1 and table 5-2 in a Appendix A.



Name	Lean amine to HX	To Purge	To Exchanger	To Distillation
Vapour	0.0000	0.0000	0.0000	0.0240
Temperature [C]	119.4	55.15	39.28	93.33
Pressure [kPa]	179.3	144.8	241.3	206.8
Molar Flow [kgmole/h]	807.8	807.8	836.5	836.5
Mass Flow [kg/h]	2.360e+004	2.360e+004	2.480e+004	2.480e+004
Std Ideal Liq Vol Flow [m3/h]	23.26	23.26	24.73	24.73
Molar Enthalpy [kJ/kgmole]	-2.966e+005	-3.033e+005	-3.091e+005	-3.027e+005
Molar Entropy [kJ/kgmole-C]	-214.1	-232.7	-234.2	-215.2
Heat Flow [kJ/h]	-2.396e+008	-2.450e+008	-2.586e+008	-2.532e+008

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