

MIT Prkalp Problem Statement

A company from Gujrat want to separate hydrogen sulfide (H₂S) from crude oil using gas stream. The composition of feed crude oil stream is given in Table 1. The gas stream composition is given in Table 2. Hydrocarbon mixture contains real hydrocarbon compounds as well as one pseudo compound (i.e. C₃₀+*). The exit crude oil stream should contain Less than 5 ppm of H₂S.

1.1. Feed Hydrocarbon Stream Data

Table 1. Composition of Liquid Stream			
Component	Mole Fraction	Component	Mole Fraction
Nitrogen	0.0028	n-C25	0.0120
CO2	0.0006	n-C24	0.0127
H2S	0.0102	n-C23	0.0143
Methane	0.0296	n-C22	0.0159
Ethane	0.0383	n-C21	0.0171
Propane	0.0022	n-C20	0.0175
i-Butane	0.0025	n-C19	0.0184
n-Butane	0.0005	n-C18	0.0201
i-Pentane	0.0030	n-C17	0.0213
n-Pentane	0.0003	n-C16	0.0224
Oxygen	0.0000	n-C15	0.0250
H2O	0.3685	n-C14	0.0254
n-Heptane	0.0074	n-C13	0.0258
n-Hexane	0.0056	n-C12	0.0191
n-C30	0.0051	n-C11	0.0177
n-C29	0.0051	n-Decane	0.0112
n-C28	0.0056	n-Nonane	0.0078
n-C27	0.0032	n-Octane	0.0037
n-C26	0.0001	C30+*	0.2020

Pseudo Components

Following properties of pseudo components have been used for the composition

Component	MW (g/mol)	Density (kg/m ³) / (lb/ft ³)
C30+*	653.26	1108 (69.17)

Feed crude oil Conditions:

Temperature = 60 °C, Pressure = 100 psia

1.2. Feed Gas Stream Data

Table 2. Composition of Gas Stream	
Component	Mole Fraction
Nitrogen	0.95
Oxygen	0.05

Feed Gas Stream Temperature = 30 °C

Feed Gas Stream Pressure = 52 psia

1.3. Problem Specification

Following crude oil flowrate is to be considered for design purpose. The turndown of the crude oil is 50%.

Crude Flowrate (BPD)	20000
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- a) Propose the separation scheme for H₂S removal.
- b) Calculate the minimum gas flowrate (kg/h) required to the column during normal and turndown operation.
- c) Estimate the number of stages required.

Note: Specify all assumptions and detailed considerations during presentation.

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