Optimize the separators at processing crude oil primary treatment

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Abstract: The process of monitoring the gas compositions outside from the separation stages of gas from oil, is a very important process and gives a complete perception of the optimization of these facilities, for processing oil and through this can be addressed the situation and access to the optimal situation in production. Where it can maintain heavy hydrocarbon fluids in the liquid phase instead of turning phase Gas and go to the ignition burners, In the absence of surface facilities to process gas and are losing those important quantities. Therefore, this research was based on some of the results of gases from the stages of insulation and work on the treatment of heavy hydrocarbons, including hexane and the possibility of benefiting from it and extract from the rest of the other compounds. In the initial periods of commencement of production (Primary development plan PDP) of oil from the fields, which do not have treatment of associated gas where it can benefit from the production of this unit until the completion of the surface facilities at (Final development plan FDP).

1 Introduction

Estimating the amount of liquid collected from the gas / oil separation system is a very complex task, because it requires the application of flash calculations that need to solve the cubic equation of the system and the use of some numerical techniques. These difficulties can be overcome through computer simulation programs that require a lot of experimental data, a long time, and experience in the field... Access to optimization is more difficult and requires study of modeling and working on PVT. This is in the case of studying the ideal case of the system in general from the bottom of the reservoir to the surface at the surface structures [1].

In this project, the ideal situation for the operation of liquid surface structures after discharge from the well, especially in the isolation plant (isolation of gas from oil), where optimization is considered to reduce losses and increase profits ... Surface installations suffer from deviation from their idealized position. Deviation is accompanied by a significant loss of fluid produced, as well as other effects that lead to shortening the life of the equipment or unit due to problems such as corrosion, etc.

This project supports a new technique to simplify this problem. It is proposed to design a new unit dealing with the gas out of the buffer (separator) and work on the quick treatment to reach the ideal situation after the impossibility of access to the ideal situation through the control system where the control system deals with the conditions of the buffer and restore them to normal situation in the event of any defect, Up to optimization [2].

In this project I studied the equations of scientists (Redlich - Kwong) who worked on finding the ideal pressure for the first buffer. Also, the study of Dr. Mohamed Saleh Al - Jawad has been studied. The study was published under the title "Optimum Separation Pressure for Heavy Oils Sequential Separation". And other sources [8].

And by looking at the most isolates and control the value of optimization, most of the isolates do not reach high values in achieving optimization, so the gas is accompanied by a large proportion of hexane, so came the idea of study of that.
2 Optimization

According to the opinion of the famous French scientist Pareto, it means an economic term that indicates the maximum of public welfare, that is, the situation from which it cannot be moved to another situation, where everyone in the economic system is better than before? "In other words, The resources will be realized when the well-being of a person cannot be increased without harming the well-being of another. Accordingly, in allocating resources to its citizens, the state may trade between the efficiency criterion and the justice criterion in allocating resources between different uses. If justice chooses in efficiency and commits justice to justice? This is a bug 
in general, in terms of optimization in the field of fragmentation, optimization works to increase production and thus increase the profit achieved in addition to prolong the life of equipment and reduce the costs and losses resulting from away from optimization [9].

3 Project Idea

The idea of the project is mainly to set up an integrated unit that determines the ratio of C+ on the outside stream of the first buffer as well as the second buffer and work on isolating these compounds from the gas stream going to the combustion burners and treating it to preserve it as a liquid compound returned to the production tanks and be part of the oil. Instead of leaving it as gas goes into combustion flares or gas processing units in the case of processing units [4,5].

The unit is considered a unit of production of C+ most of the component of the mixture is the Hexane compound has a significant industrial importance in the past years, where the United States topped the production of hexane and by 39% of the world production and reached prices more than (1000) per metric ton.

The metric ton adjusts 7 barrels of oil, which means that the price of liquid is sold in hexane is better than the price of oil is sold at a price of more than double.

4 Calculations and economic feasibility.

It is possible to visualize the economic feasibility through the language of numbers, for example, was prepared study on one of the separators in one of the fields in south of Iraq, and show the following

![Figure 1: Shows the volume of gas burned from the start of production from the field to the completion of gas treatment plants (2013-2022).](image)

The gas shall be installed outside the first and second insulation sides.

Table 1: Compositions of gas at separators

| Date | C2 | H2 | CO2 | C1 | C3 | nC4 | iC5 | C6+ | Total | Density |
|------|----|----|-----|----|----|-----|-----|-----|-------|---------|
| 2015 | 0  | 1.57| 0.55| 76.39| 20.15| 6.631| 2.271| 0.291| 100    | 0       |
| 2016 | 0  | 1.60| 0.56| 75.52| 20.15| 6.631| 2.271| 0.291| 100    | 0.724   |
| 2017 | 0  | 1.54| 0.55| 75.52| 20.15| 6.631| 2.271| 0.291| 100    | 1.175   |
| 2018 | 0  | 1.60| 0.56| 75.52| 20.15| 6.631| 2.271| 0.291| 100    | 1.724   |

The rate of C+ ratio is (0.478%) and above which must be kept as part of the oil.

As for the production tanks, we can identify the percentage of Hydrocarbons and above from the following table:

Table 2: Compositions of gas at tanks
Now and after calculating the ratios of the directors we get the amount of oil can be preserved in the liquid phase and considered a quantity of oil according to the following calculations:

Table 3: Calculations of hexane volume

| Mol%  | Z factor | volume % | Total vol | C+ vol std | C+ vol m³ | 30% | Bbd |
|-------|----------|----------|-----------|------------|-----------|-----|-----|
|       |          |          |           |            |           |     |     |
| Out let from separators | 0.478 | 1 | 0.478 | 34000000 | 162,520 | 4,602 | 1,390 | 2,519 |
| out let from tanks | 2.689 | 1 | 2.689 | 5000000 | 132,950 | 3,764 | 1,129 | 2,519 |

Where the size of this ratio is approximately (2509) m³/D.
Further the interest can be visualized if applied in more than one field through the chart below

Figure 2: Quantities of gas currently burned in some producing fields.
Where profitability is estimated in large quantities with a quantity of 1% of total production.

5 Diagram of unit
As shown in figure (3)

Figure 3: Diagram of unit
6 Manual operation of unit

The unit feeds the gas from the gas pipeline going to the burners and coming from the two sides of the insulation of the first and second blocks where it receives gas in the unit (scrubber), which is the first units that receive gas and purge of impurities where it contains a set of trays that pass the gas from the bottom to the top and pressure less than the pressure of the second buffer by (1 bar) to ensure that the reverse pressure does not get the second buffer. where the unit of scrubber ensures that the gas is purified of impurities which may cause some problems in the other units of the unit and is a suction unit.

Then, in the case of hydrogen sulfide gas (H₂S), the gas is passed on the absorber unit to purify the mixed gas of hydrogen sulfide gas (H₂S) where the gas is withdrawn by treating it with a chemical solvent dissolved in contact. The gas is then passed on to the air cooler unit for the purpose of reducing the temperature of the gas gradually to condensate to a temperature of (36 °C), which is the evaporation rate of the pentane, ensuring that the pentane is not condensed with the mixture. Then pass by a double phase buffer and pressure (1 bar) to release the condensate gases less than C + while preserving the rest of the higher components of C + liquid phase in order to transfer them to the production tank.

7 Simulation and results

The idea or project was supposed to be implemented through a HYSYS simulation program, but the lack of a program prevented data from being given to give an idea of the expected results. As shown in figure (4).

![Figure 4: simulation Hysys.](image)

8 Hexane properties

As shown table (4)

| Chemical property                      | Value            |
|----------------------------------------|------------------|
| Chemical formula                       | C₆H₁₄            |
| Molar mass                             | 86.18 g·mol⁻¹    |
| Appearance                             | Colorless liquid |
| Density                                | 0.6606 g mL⁻¹    |
| Melting point                          | −96 to −94 °C; −141 to −137 °F; 177 to 179 K |
| Boiling point                          | 68.5 to 69.1 °C; 155.2 to 156.3 °F; 341.6 to 342.2 K |
| Solubility in water                    | 9.5 mg L⁻¹       |
| log P                                  | 3.764            |
| Vapor pressure                         | 17.60 kPa (at 20.0 °C) |
| Henry's law constant (k_H)             | 7.6 nmol Pa⁻¹ kg⁻¹ |
| UV-vis (λ_max)                         | 200 nm           |
| Magnetic susceptibility (χ)             | −74.6•10⁻⁶ cm³/mol |
| Refractive index (n_D)                 | 1.375            |
9 Environmental dimension

The project has another goal, in addition to increasing production, it reduces the emission of smoke emitted, as it will decrease by the number of volumes as is known. In the figure below, the combustion of hexane generates 6 volumes of CO$_2$ in the figure 5.

![Hexane combustion reaction](image)

Figure 5: Hexane combustion reaction

References

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