STUDY DESIGN OF MINI REFINERY AND SUGGEST IMPROVEMENT ON HEAT TRANSFER

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ABSTRACT :- In this project to present the entire process description of the refinery by lighting the various amounts of energies (heat, mechanical) consumed but important equipments. Heat exchanger variation of parameters in always and material consumption to reduce heat. The capacity utilizations. Its problems and the fraction of loses in the entire process of refining crude oil in order to obtain the required products. The remedial methods environmental consideration and suggestions to improve for arresting losses. Design can be modified by amplifying ansys output. Here only consider simple design heat exchanger.

INTRODUCTION:-

Wells**:-**The crude is extracted. These wells are located near Bay of Bengal sea coast near land area in Andhra Pradesh.

Imparities in crude**:-** Types

1.oleophobic –Insoluble

- Salt-chloride , sulphate of sodium, potassium , magnesium, calcium.
- Sediments-sand, mud, iron oxide ,iron sulphate.
- Water-emulsified and dispersed.

2.oleophilic –soluble:-

- Sulphur compounds.
- Organ metallic compounds (Ni,Vi,Fe,As).
- Napthanic acids and nitrogen compounds.

3.Requirements of pretreatment of crude:-Due to gas ,water, dirt ,minerals ,sea water/brine contamination.

Thermal:-temp 120°-140°c .Keeping under pressure to crude vapor less.

Chemical:-Heating 120°-140°c,mixing with water.

Electrical:-

- Heating the crude under pressure.
- Provided with electrodes (22/16.5 KVA).
- Addition of water 4-8% vol/vol.
- Crude oil temp 120°-140°c.
- Rquipped with mixing values.
- Drop coalescent tech.
- Brine to dp.

Temperature:-

- Range 120°-140°c.
- Oil emulsion conductivity raises with temperature , affects water droplets setting.
- Low viscosity /large dia.of water droplets enhance the droplets falling velocity.

Pressure:-High enough, 2-3 kg/cm^3 above vapor pressure of oil at the given temp. clued the variation loss.

Waste water:- 4-8% vol/vol. Caustic is added to maintain the PH7(6-8).

Conductivity decreases at high or low ph

Operations:- Oil refinery from the collection of crude oil goes through this

- Mixing of crude and condensate by re-circulation using pumps.
- Peeding of crude condensate mixture using pumps.
- Supply of fuel gas to funnel.
- Crude pre-heating in stage-1 pre-heating section.
- De-salting of crude.
- Crude pre-heating in stage-2 pre-heating section.
- Heating of crude in funnel by convection and radiation heat transfer.
- Phase separation and partially vaporized crude condensate mixture by flashing in column.
- Mass and heat transfer by liquid-vapor contact in atmospheric crude dislocation unit.
- Stripping of fractionated portions.
- Product refusing into column for temperature and pressure .
- Stripped liquid cooling in pre-heating sections and product coolers.
- Storage of products.

HEAT EXCHANGER

There are 12 heat exchangers that are calculated by working condition by using LMTD and variation difference with basic design values. The resulted values are taken as divisional variance by simplifying ansys output consider with 1/25 portion of exact values.

FORMULAS:

$$\text{LMTD} = \frac{(t1-T2)-(t2-T1)}{\ln(t1-T2)-(t2-T1)}$$

t_1= Initial temp of shell

t_2=outlet temp of shell

T_1=Inlet temp of tube

T_2=outlet temp of tube

All heat exchanges are counter flow shell and tube type heat

$Q = U \times A \times LMTD$ U-Universal heat transfer co-efficient

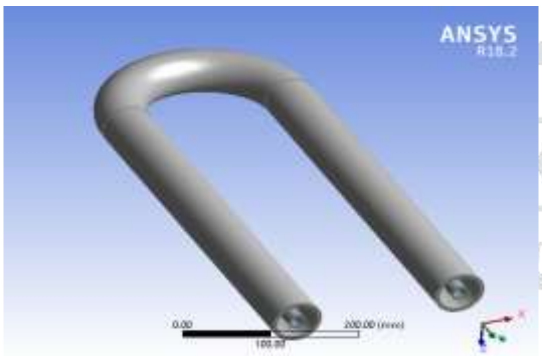
$Q_{oper} = U \times A \times$ operating LMTD

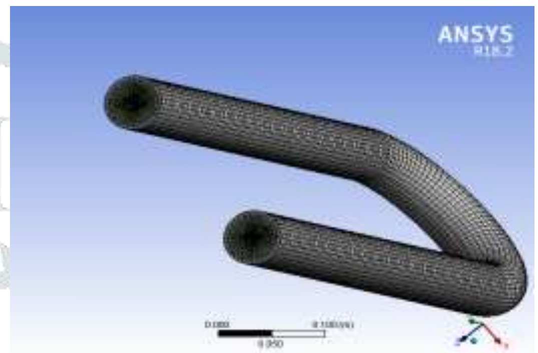
Therefore

Variation of heavy duty = $Q_{oper} - Q_{actual}$

Percentage of heat loss in H.E $= \frac{Qactual - Qoper}{Qactual} x100$

The defining of and problem to find solution .Here in this refinery and discuss about one particular are tube and shell heat exchanger. The products are diesel and water. So boundary condition for ansys design is.





HEAT EXCHANGER DESIGN BODY MESHING

	Name of fluid	Temperature	Velocity
Shell	Diesel	t_1=380°c t_2 = 380°c	18m/s
Tube	water	T_1 = 293°c T_2 =293°c	10m/s

Furnace:-

Heat balance in the crude oil section.

$$Q = 4.92 \times 10^{-8} a.e(T_g^4 - T_f^4)$$

T_f -Absorbing surface temperature.

T_g -Furnace exit temperature.

A-Effective area.

E- Emissivity for gas.

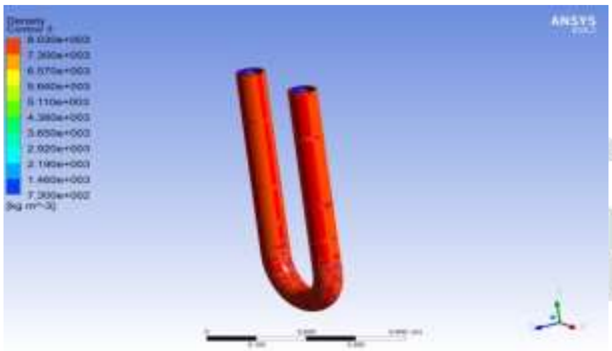
Heat transfer to drain water in desatter

From Newton's─ law of cooling we know that heat transferred

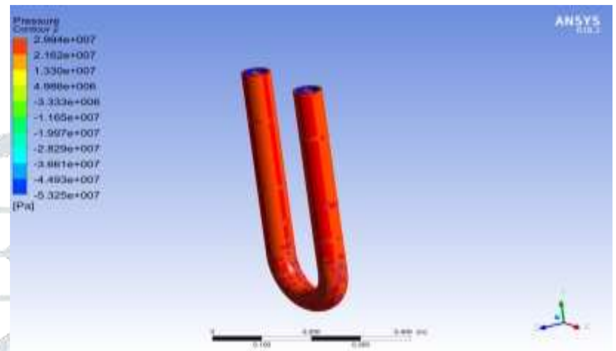
$Q=m \times c_p \times (T_2 - T_1)$ c_p- specific heat, m-watered into feed

$Q=m \times c_p \times (T_4 - T_3)$ T_1&T_2&T_3&T_4-Temperatur

As from the collected data to prove entire balance of refinery from various equipment should be equal to basic termed design values.



DENSITY CONTOUR-1



PRESSURE CONTOUR - 2

TURBULANCE EDDY DISSIPATION

Imperialist Competitive Algorithm(ICA)

Genetic Algorithm

These two algorithm area helpful to reduce heat transfer. The above algorithms basic method which suggested to improve heat transfer from heat exchangers.

SUGGESTIONS AND MODIFICATIONS

1. Shell and tube heat exchangers as per design factors.
   a. Imperialist Competitive Algorithm(ICA)
   b. Genetic Algorithm
2. Raw material from cooling tower is to be replaced with de-mineralized plant.
3. Material consideration need to be changed based on cost effectiveness towards requirements of the plant.
4. Better to fix JALSOFTER to storage water tank cost and place requirement will be less compare de-mineralized plant.

5. A stand by cooling water can be introduced to ensure uninterrupted cooling water supply and as well to reduce the load on the existing cooling tower so as to ensure greater cooling efficiency by the cooling water generated.
6. The naphtha generated can be processed for gasoline reforming (catalytic and thermal) by introduction of naphtha reformers in the plant to reduce the surplus naphtha production the country.
7. A pilot burns pre-furnace fuelled by the excessive gas fland can be setup to process even the crude containing HIGH AMOUNTS SALTS SO THAT THE DESALTER CAN BE INTRODUCED. Before stage1 pre-heading of crude feed to avoid the any possible means of equipment corrosion by scaling following the desafter.

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