



# Lecture - 15



# PETROLEUM REFINING TECHNOLOGY

## WHAT IS CRUDE OIL ?

Crude oil consists of hydrocarbons varying in boiling range from methane to asphalt

# WHAT IS THE AIM OF CRUDE OIL DISTILLATION ?

The aim is to fractionate the crude oil into the light hydrocarbons ( $C_1$  to  $C_4$ )

# IMPURITIES IN CRUDE OILS

Two kinds of impurities are found :

- 1) Oleophobic : Insoluble in crude oils
- 2) Oleophilic : Soluble in crude oils

## Oleophobic (insoluble)

- Salts- mainly Cl & Sulphates of Na, Ca & Mg
- Sediments – silts, sand, drilling mud, iron oxide, iron sulphide etc
- Water – present as soluble, emulsified/ finely dispersed water

## Oleophilic (soluble)

- S compounds
- Organometallic compounds containing Ni, V, Fe, As etc
- Naphthenic acids compounds
- N<sub>2</sub> compounds

## PROBLEMS CAUSED BY OLEOPHOBIC IMPURITIES

Corrosion in the atmospheric distillation (caused by HCl )

Increased consumption of  $\text{NH}_3$  to neutralise the HCl

Erosion of crude oil pumps, pipelines & valves (by abrasive action)

Plugging of equipment & fouling of heat transfer surfaces

Product degradation, like high ash content in fuel oil

Trace metals in distillate, which act as catalyst poisons



## SALT IN THE CRUDE OILS

- To a greater or lesser extent all crude oils contain salt water together with sediments depending upon the area from where the oil is produced as well as the manner in which it is handled before sending it to the refineries
- Salt content is reported as pounds of sodium chloride per thousand barrels of oil (PTB)
- The range of salt content generally varies from 10 to 200 PTB

## **NEED FOR DESALTING OF CRUDE OILS**

- Crude oil can get contaminated by salt water when shipped in tankers
- Ballast water often becomes mixed into the crude during shipment and may be emulsified with the crude while it is being pumped to shore installations

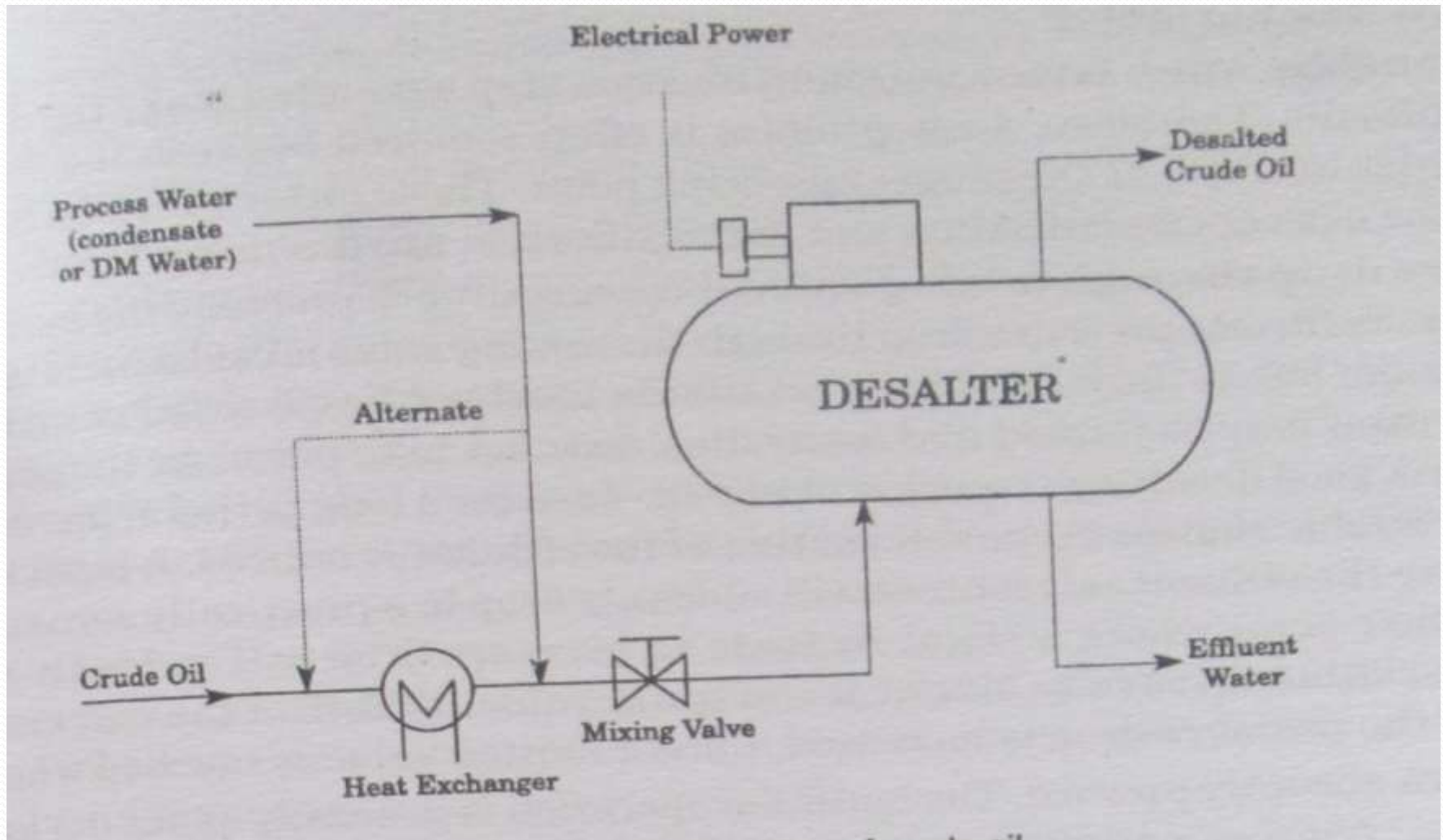
# METHOD USED FOR DESALTING OF CRUDE OIL

## Electric Desalting of crude oils

It consists of two steps :

- 1) Forming an emulsion of crude oil and water
- 2) Demulsification process in which the emulsion of crude oil and water formed in the first step is broken by means of an electrical field

# PROCESS DESCRIPTION



# PROCESS VARIABLES

Variables which favour the emulsification step very often make the demulsification step more difficult. Therefore, a compromise is often required between the two steps of the process in order to arrive at the proper operating point.

Factors which have an important bearing on the ease of emulsification and demulsification are discussed below :

- 1) Pressure drop through mixing valve
- 2) Chemical addition
- 3) Water injection
- 4) Conductivity
- 5) Voltage
- 6) Desalter temperature
- 7) Desalter Pressure
- 8) pH value
- 9) Solids at water-oil interface

# TYPICAL OPERATING CONDITIONS

Process variables	Haldia refinery	Gujarat refinery
Desalting temperature, °C	125-130	126-130
Desalting pressure, kgf/cm <sup>2</sup>	8.3-8.5	10
Pressure drop across mixing valve, kgf/cm <sup>2</sup>	1.35	1.3-1.5
Water injection rate, vol% of crude	1.3-1.9	4.5-6.0
<b>Salt contents</b>		
Inlet salt content, ppm	20-30	-
PTB	-	6-20
Outlet salt content, ppm	4-8	-
PTB	-	2-4



Thank You