

# Lecture 10

## Petrochemicals Engineering

### Phase Separation

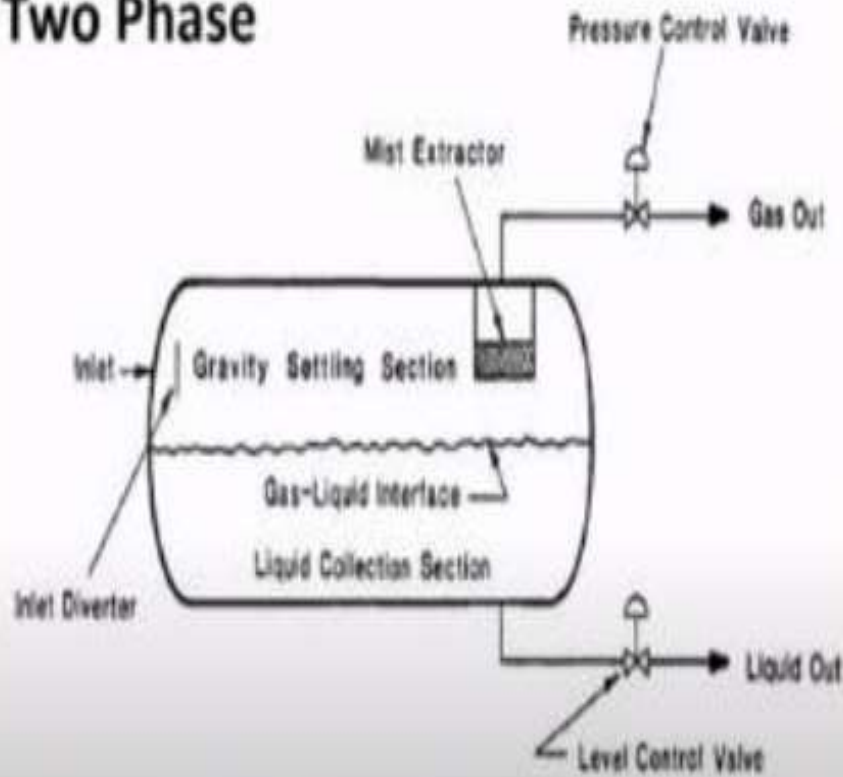
## ► Horizontal separator

- ❖ Is favored for high liquid to gas ratio and for foaming liquids.
- ❖ Has more gas to liquid interfacial area.
- ❖ Lower gas flow rates → increased residence times → provides better liquid dropout.
- ❖ Larger surface area → offers better degassing and more stable liquid level.
- ❖ Is easier to skid mount and stack.
- ❖ Is used for heavy liquid loads or where free liquids are contained in the inlet stream.

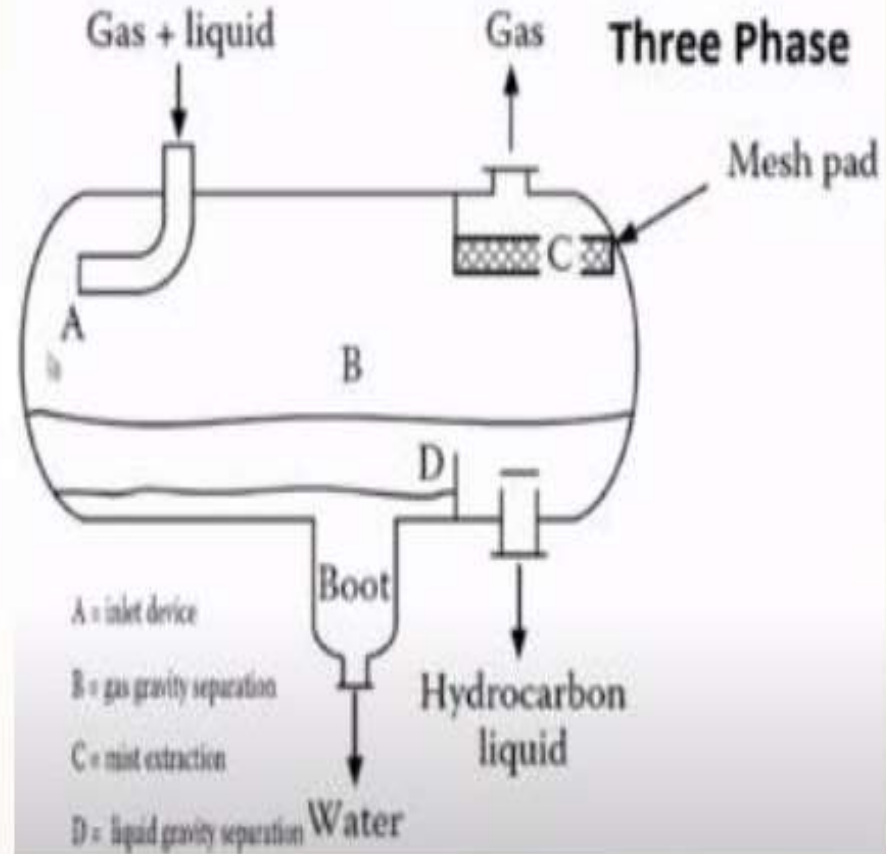


# Horizontal separator

## Two Phase

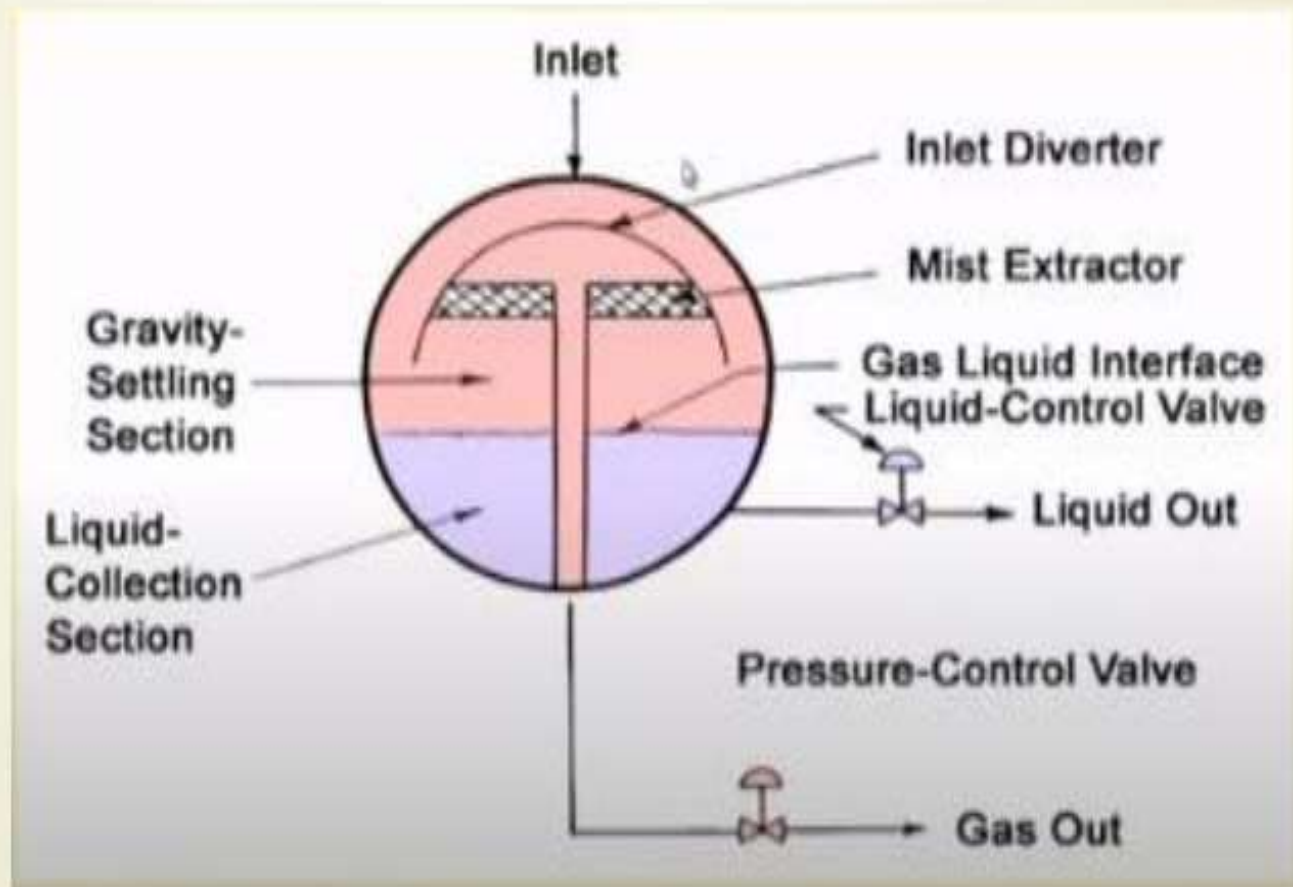


## Three Phase



## ► Spherical separator

- ❖ Is used for high pressure service where liquid volume is low and compactness is required.



## Comparison of various configurations

Parameter	Vertical	Horizontal	Spherical
Usage	For low gas-oil ratio	For high gas-oil ratio	For medium gas-oil ratio
Capacity	Large fluid capacity	Large gas capacity	Low fluid as well as gas capacity
Cost per unit capacity	Average	Least expensive	Most expensive
Installation	Difficult	Average	Easy
Maintenance and inspection	Difficult	Accessible	Average
Separation efficiency	Medium	High	Low





## Types of gravity separator ( based on function)


Two phase

Separate gas from the total liquid stream

Three phase

- 1- Separate gas from the total liquid stream.
- 2- Separate the total liquid stream into its crude oil and water-rich phases ( free water).





Types of gravity separators  
(based on pressure)

```
graph TD; A([Types of gravity separators  
(based on pressure)]) --- B([Low- pressure units  
(10 to 180 psi)]); A --- C([Medium- pressure units  
(230 to 700 psi)]); A --- D([High- pressure units  
(975 to 1500 psi)])
```

Low- pressure units  
(10 to 180 psi)

Medium- pressure units  
(230 to 700 psi)

High- pressure units  
(975 to 1500 psi)





➤ Factors effecting selecting of separators

- ❖ The gas and liquid flow rate
- ❖ Type of natural gas ( indicate by specific gravity)
- ❖ specific quality of oil and water
- ❖ Operating conditions
- ❖ Presence of solid
- ❖ Available ground space etc..





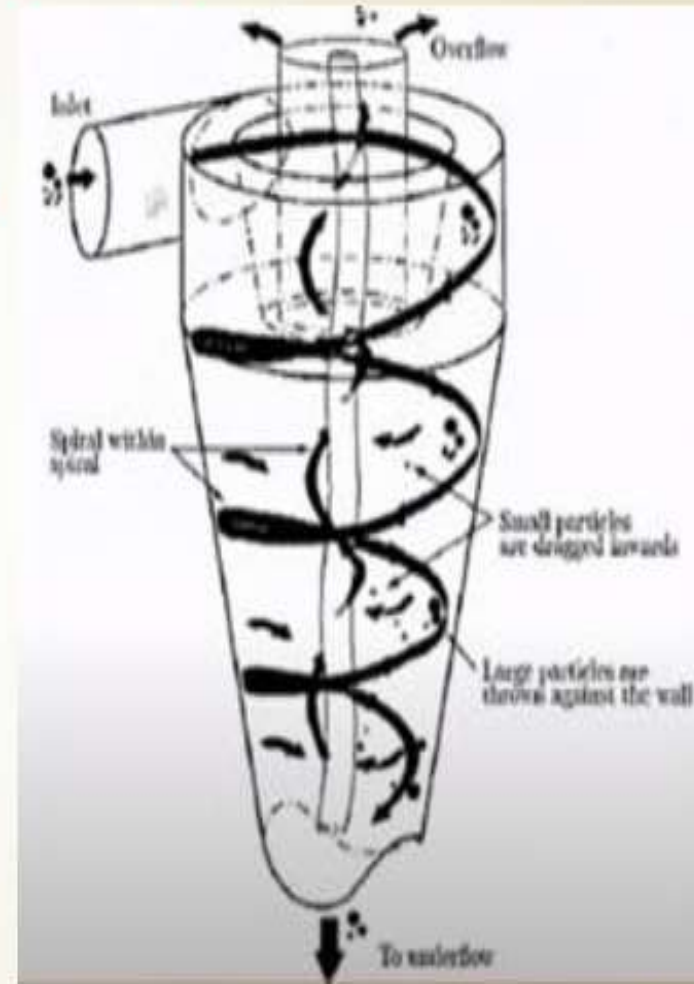
## ❖ Centrifugal separator

- ❖ Used for gas – liquid as well as solid-gas separation
- ❖ Utilize centrifugal action to separate two materials of different densities and phases.
- ❖ More efficient and less susceptible to plugging
- ❖ Useful for gas streams with high particulate loading.
- ❖ Used for removing droplets greater than 100  $\mu\text{m}$  in diameter.
- ❖ Can have a reasonable removal efficiency of droplet sizes as low as 10  $\mu\text{m}$ .
- ❖ Less commonly used because its performance is sensitive to small changes in the flow rate.



## ❖ Working principle of centrifugal separator

- ▶ Pumping of the gas constantly into a cone-shaped rotating container at an angle → creates a spinning vortex.
- ▶ Movement of high-density liquids to the outside, along with any contaminate → displacing the lower-density liquids to the inside (center of rotation)
- ▶ Water, being the more dense liquid, sits on the outside and is removed through a discharge outlet.





Thank you