



**Institute of Natural Resources**  
**Department of Fuel Engineering and Chemical Cybernetics**

# Crude oil desalting

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# • Plan

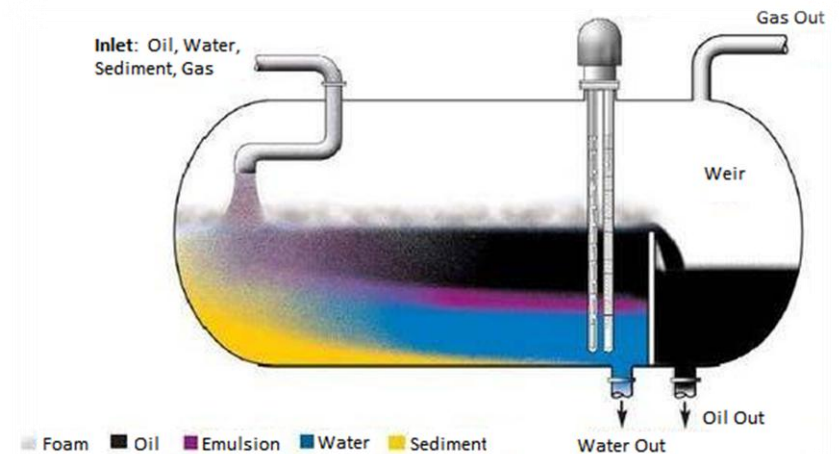
What is desalting?

Methods of crude-oil desalting

Petroleum refinery electrostatic desalters

Electrostatic desalters

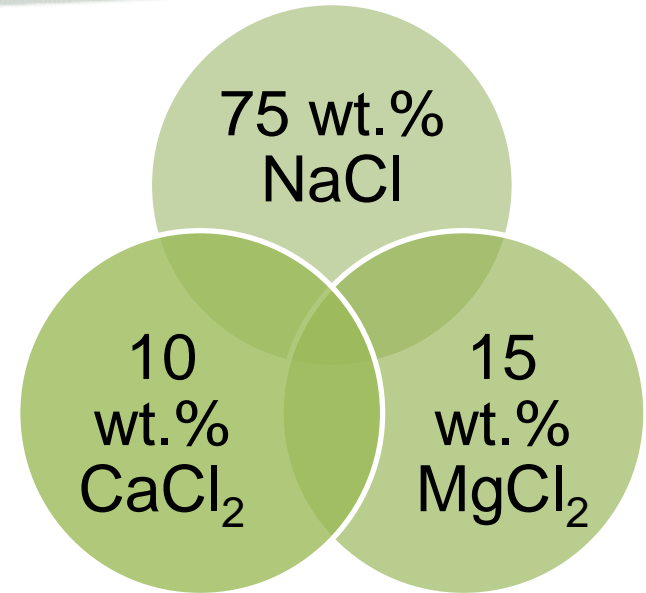
Desalter configurations



# ● What is desalting?

**Crude oil often contains:**

- ✓ water,
- ✓ inorganic salts,
- ✓ suspended solids,
- ✓ water-soluble trace metals.



**As a first step in the refining process**

- ✓ to reduce corrosion, plugging, and fouling of equipment and
- ✓ to prevent poisoning the catalysts in processing units,

**these contaminants must be removed by**

**desalting (dehydration).**



# ● Methods of crude-oil desalting



The two most typical methods of crude-oil desalting are:

## Chemical desalting

- ✓ water and chemical surfactant (demulsifiers) are added to the crude oil,
- ✓ heated,
- ✓ salts and other impurities dissolve into the water or attach to the water,
- ✓ held in a tank where they settle out.

## Electrical desalting

application of high-voltage electrostatic charges to concentrate suspended water globules in the bottom of the settling tank.

### *Continuous methods*

***Surfactants are added only when the crude has a large amount of suspended solids.***

***Less-common method*** involves filtering heated crude using diatomaceous earth



# ● Petroleum refinery electrostatic desalters

The **crude oil distillation unit (CDU)** is the first processing unit in all petroleum refineries.

**Desalter** is typically installed in the heat exchange train.

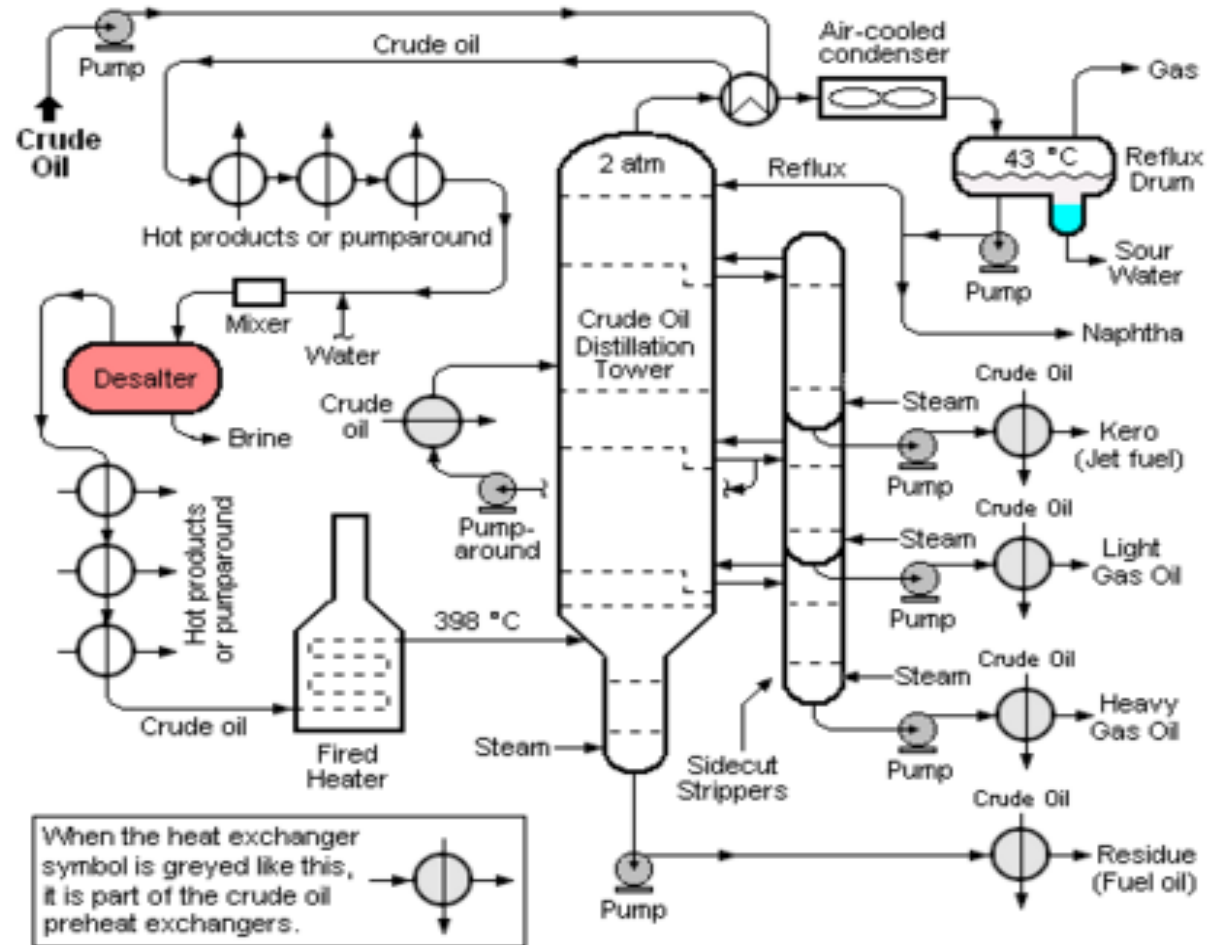


Figure 1. Schematic flow diagram of a typical crude oil distillation unit (CDU)

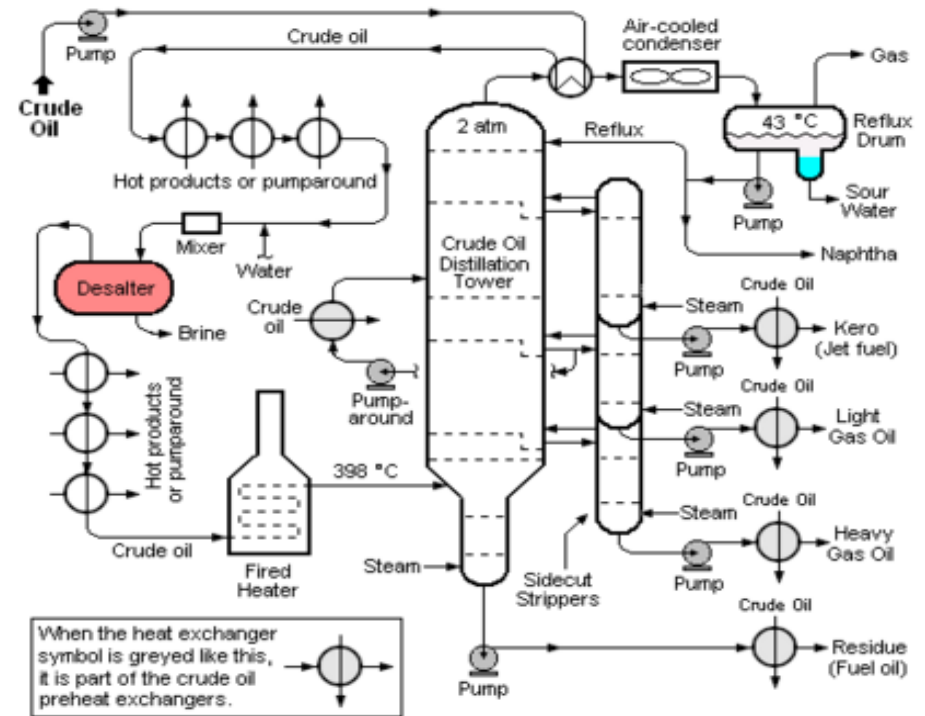
# ● Petroleum refinery electrostatic desalters

**Desalter** is located at the point where the incoming **crude oil** has been **heated to about 100-150 C.**

## At that point:

- ✓ wash water is injected and mixed into the continuous flow of crude oil;
- ✓ the resulting oil-water emulsion then continuously enters the electrostatic desalter.

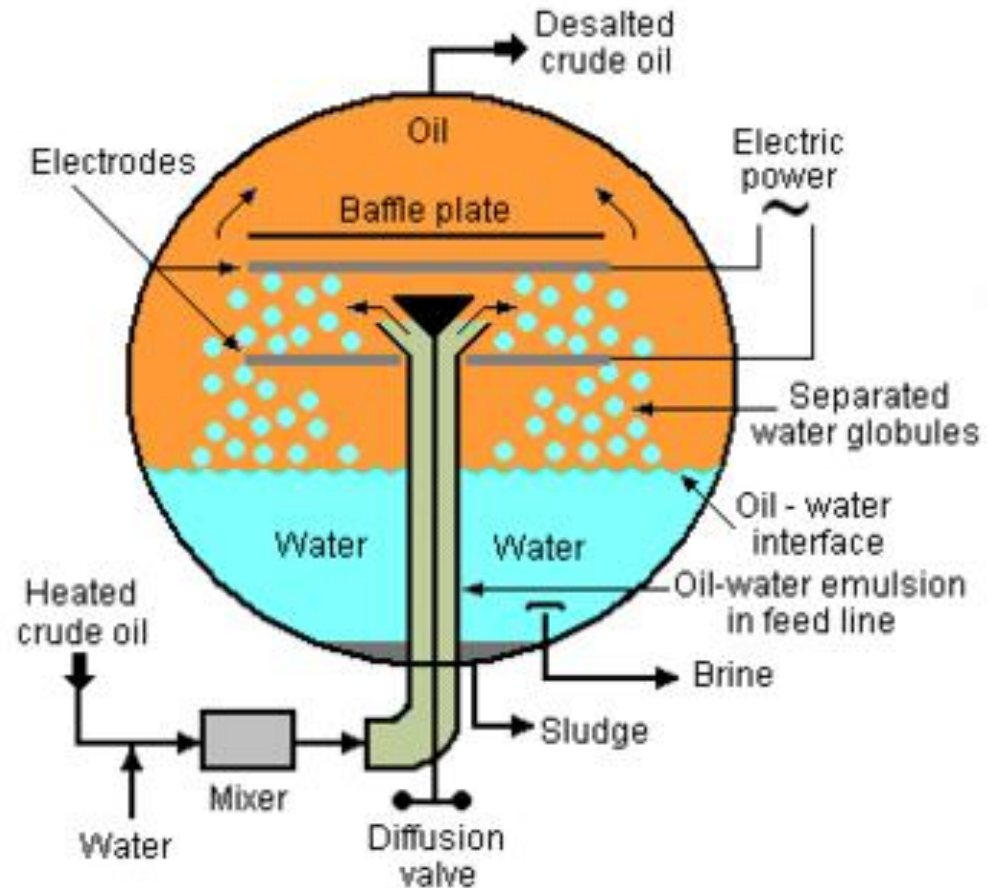
The **rate of wash water** required is about **4-10 vol.% of the crude oil rate.**



**Figure 1. Schematic flow diagram of a typical crude oil distillation unit (CDU)**

## ● Electrostatic desalter

Externally viewed, the typical **electrostatic desalter** is a horizontal, cylindrical vessel.

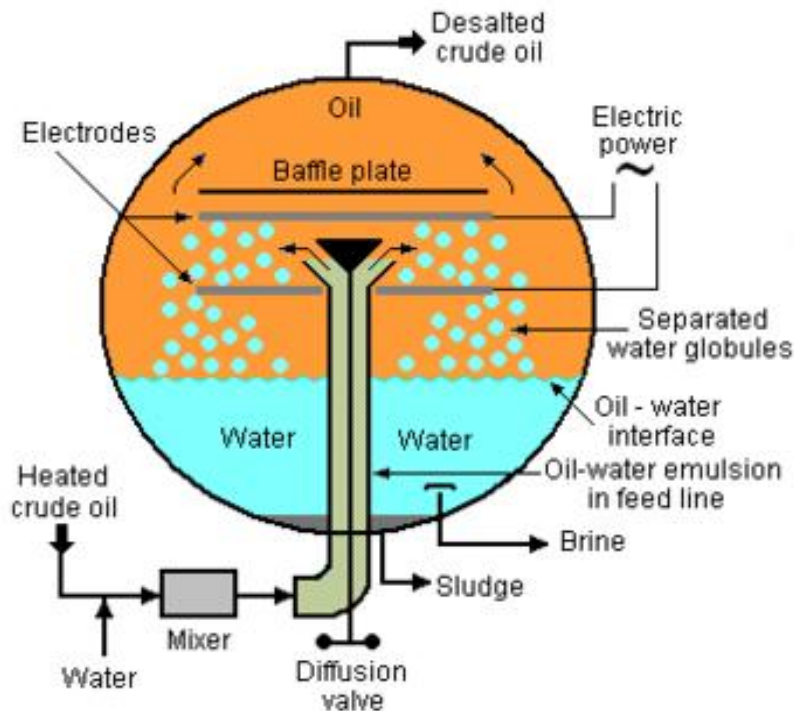


*Figure 2. Cross-sectional end-view diagram of a horizontal, cylindrical crude oil desalter*

## ● Electrostatic desalter

**Oil-water emulsion** is a mixture of two non-miscible liquids consisting of:

- ✓ **continuous phase** - the crude oil;
- ✓ **dispersed phase** - water in the form of very small droplets.

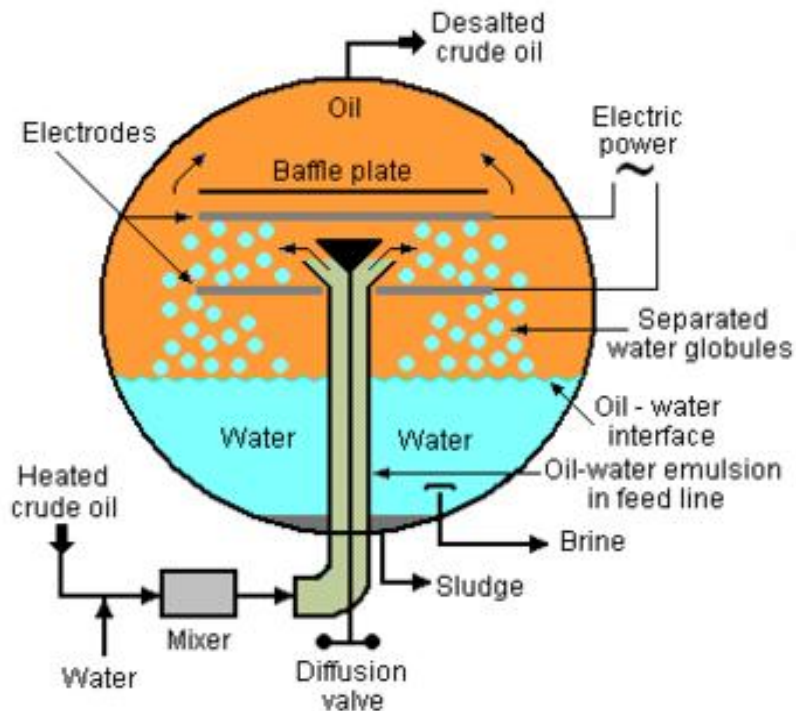


**Asphaltenes** and finely divided sediment solids are **stabilize the emulsion.**



## ● Electrostatic desalter

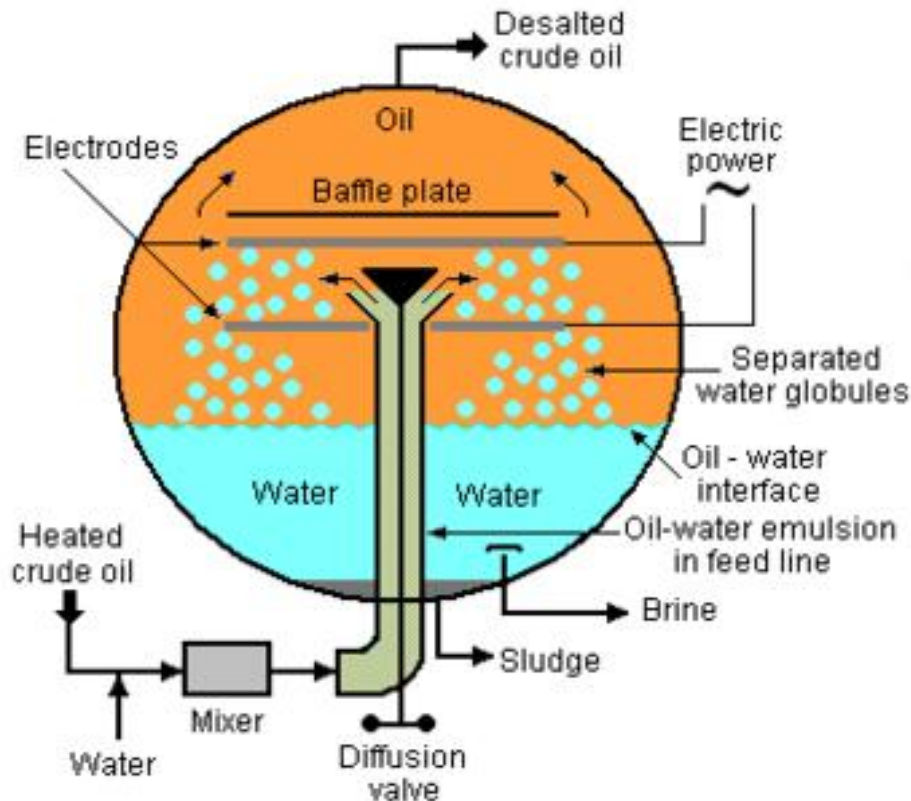
An **electrical system** connected to the electrodes within the desalter generates an electrostatic field (6,000-20,000 volts) induce dipole attractive forces between neighboring droplets of water.



**Electrostatic field cause the droplets to coalesce** because of the attractive force generated by the opposite charges on neighboring droplets.

## ● Electrostatic desalter

The resulting **larger water droplets** (globules), along with water-insoluble solids, then **settle to the bottom** of the desalter.



*The settled sediment at the bottom of desalter is withdrawn as a sludge.*

# ● Desalter configurations

- ✓ **Single-stage desalter.**
- ✓ Flowing the crude oil through **two stages** in series and **recycling part of the brine** from the second stage for use as wash water to the first stage.
- ✓ Flowing the crude oil through **two stages** in series **with no recycle of brine** from the second stage.
- ✓ Using **multiple electrostatic fields** in a single vessel to create, in effect, two or three stages of desalting within that single vessel.

