Degumming and Centrifuge Selection, Optimization and Maintenance

IUPAC-AOCS Workshop on Fats, Oils and Oilseeds Analysis and Production

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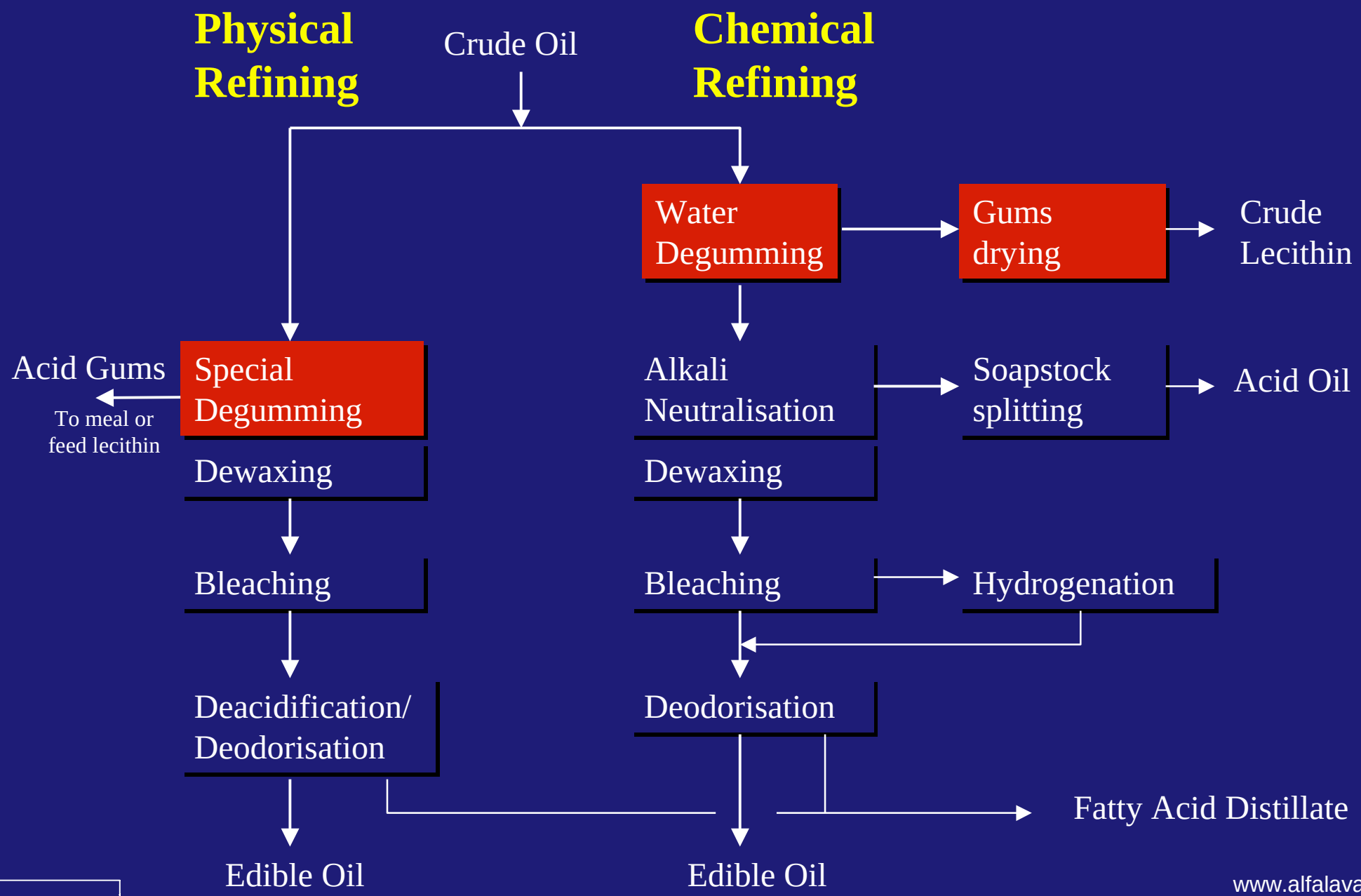
Alfa Laval Copenhagen A/S


Physical Refining
Crude Oil
Chemical Refining
Water Degumming
Gums drying
Crude Lecithin
Acid Gums
To meal or feed lecithin
Special Degumming
Alkali Neutralisation
Soapstock splitting
Acid Oil
Dewaxing
Dewaxing
Bleaching
Bleaching
Hydrogenation
Deacidification/ Deodorisation
Deodorisation
Fatty Acid Distillate
Edible Oil
Edible Oil

Purpose of Degumming

- Commercial Lecithin production
- Prevent crude oil settling during storage or transport
- Waste water (prevent acidulation of gums)
- Physical Refining
- Reduction in neutralisation losses

Physical Refining

Feedstock Parameters

- Seed Oil (Soybean, Rapeseed, Sunflower)
  - FFA ≤ 2%
    - higher FFA indicates low quality oil and may not be suitable for physical refining
  - Phosphorous ≤ 5 ppm, ≤2 desired
  - Iron ≤ 0.2 ppm

Chemical Refining

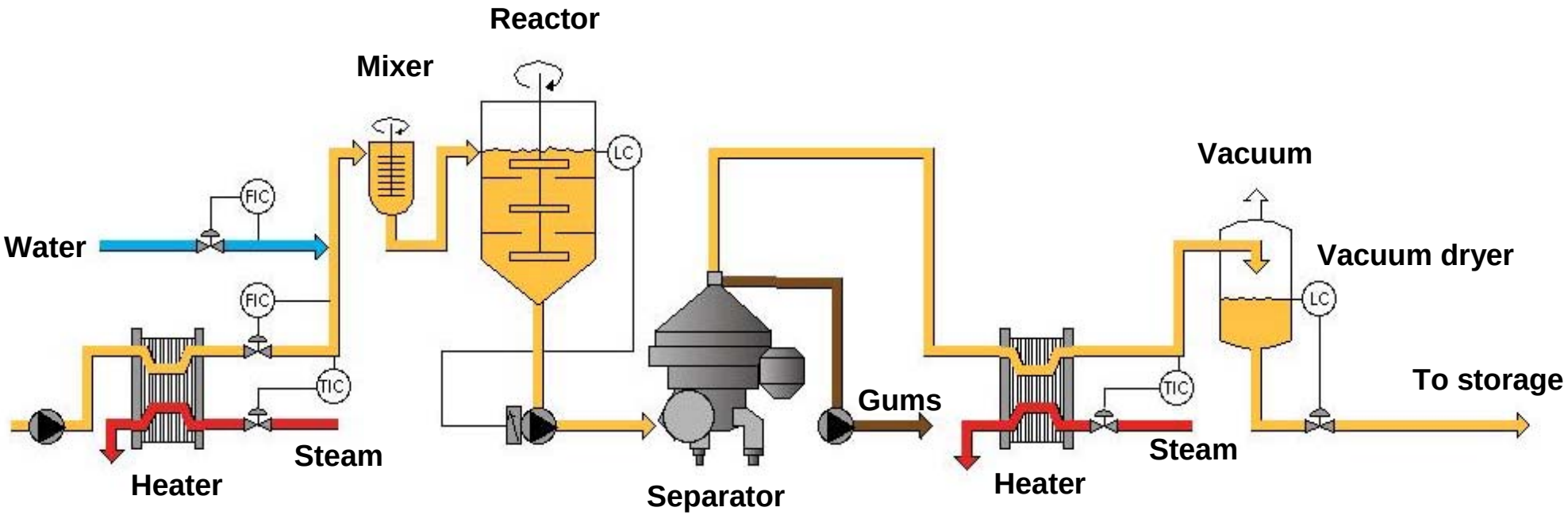
Feedstock Parameters

- Seed Oil (Soybean, Rapeseed, Sunflower)
  - FFA ≤ 3%
  - Phosphorous ≤ 1200 ppm, ≤ 200 ppm desired

Water Degumming Process Steps

- Heat oil to 60 - 70 °C
- Water addition and mixing
- Hydration mixing 30 minutes
- Centrifugal separation of hydrated gums
- Vacuum drying of degummed oil
- Gums - dried for edible lecithin or recombined in meal

Water Degumming



Water Degumming

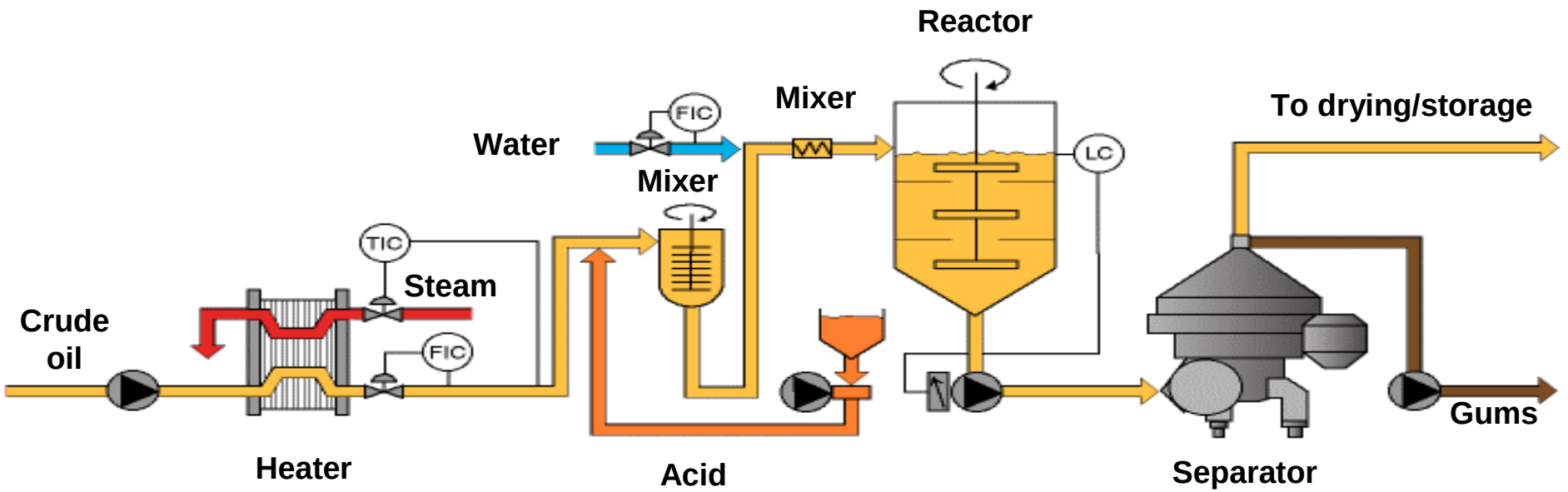
Target Results:

- Phosphorous in oil - 50 to 200 ppm max.
- AI% in dried gums - 65 to 70%.
- Moisture in dried oil - < 0.1%.

Acid Degumming Process Steps

- Heat oil to 60 - 70 °C
- Acid addition and mixing
- Hydration mixing 30 minutes
- Centrifugal separation of hydrated gums
- Vacuum drying of degummed oil
- Gums - recombined in meal

Acid Degumming



Acid Degumming

Target Results:

- Phosphorous in oil - 20 to 50 ppm max.
- AI% in dried gums - 65 to 70%
- Moisture in dried oil - < 0.1%

Major Deep Degumming Methods

- Alfa Laval Special Degumming
- Super/Uni Degumming
- TOP Degumming
- Organic Refining Process
- Soft Degumming
- Enzymatic Degumming

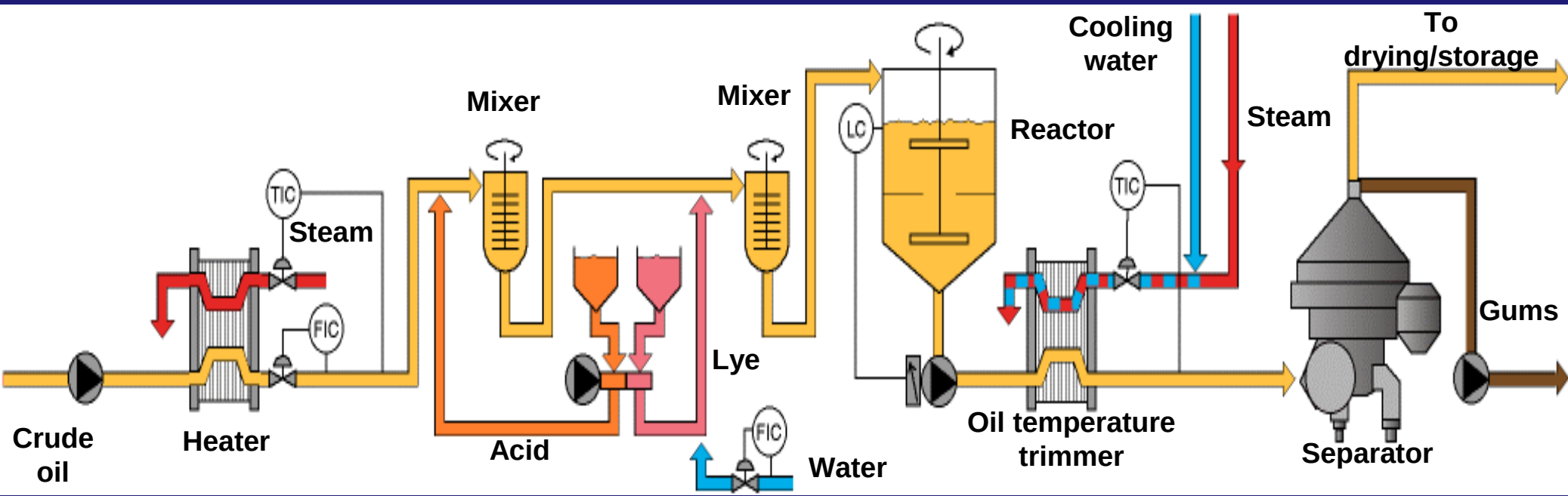
Deep Degumming

- Deep degumming utilizes a reagent like acid to chelate Iron, Calcium, and Magnesium away from the NHP complex. Once the Iron, Calcium, and Magnesium are removed from the NHP complex the phosphatide becomes hydratable
- Enzymatic degumming utilizes an enzyme to modify the NHP into a hydratable form.

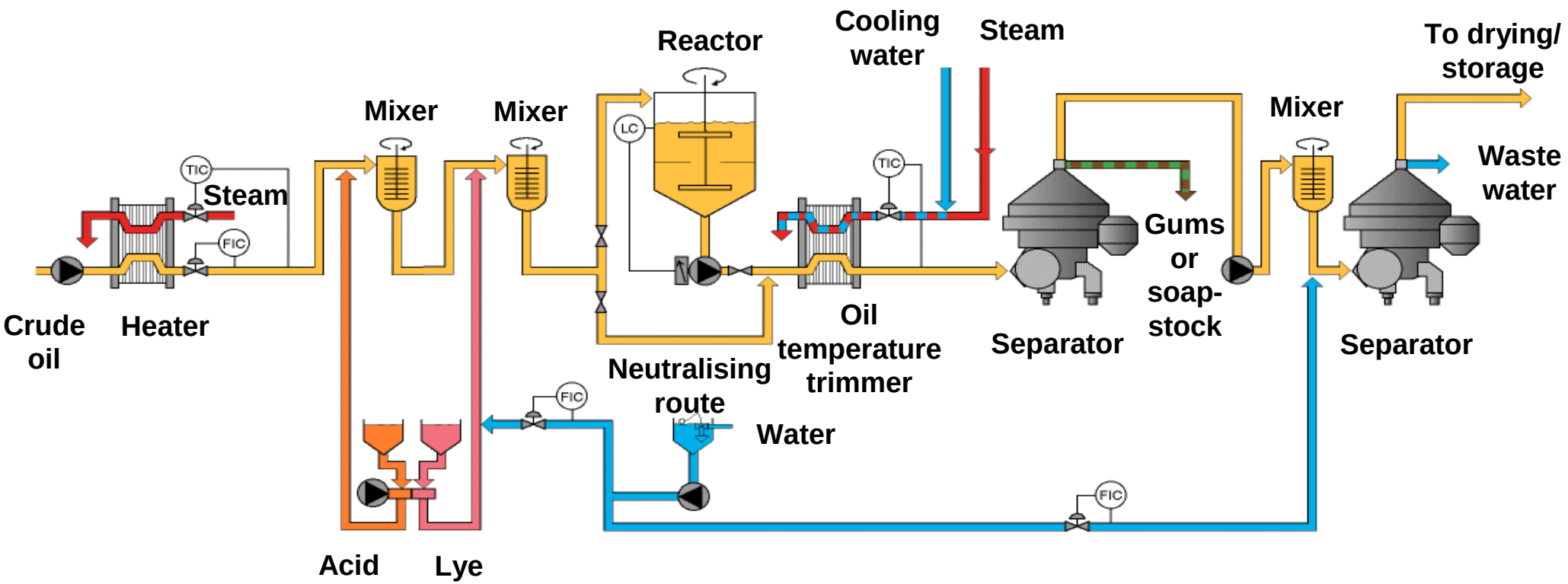
Alfa Laval Special Degumming

- Heat oil to 60 ^{o}C
- 0.05-0.2 % Phosphoric Acid with intensive mixing
- Partially neutralise with dilute lye (hydration water)
- Gentle mixing and holding for 60 minutes
- Gums centrifugation
- Optional water wash step for lower phosphorous
- Oil drying

Alfa Laval Special Degumming



Alfa Laval 2-stage Special Degumming



Alfa Laval Special Degumming

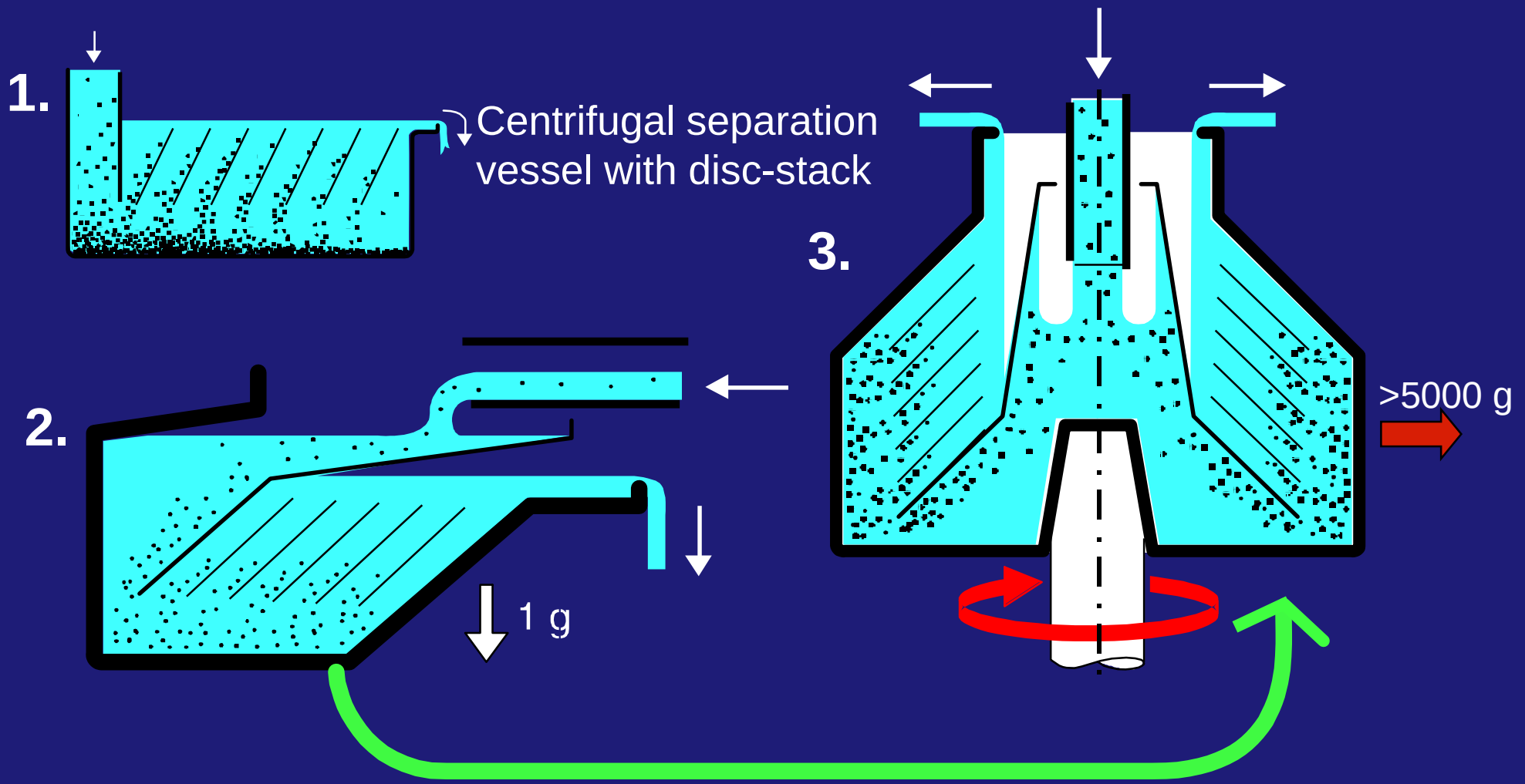
Target Results:

- Phosphorous in oil - 20 to 30 ppm max.
- Phosphorous in oil - 8 to 10 ppm max. with washing
- AI% in dried gums - 50 to 60%
- Moisture in dried oil - < 0.1%

Disc Stack Centrifuges

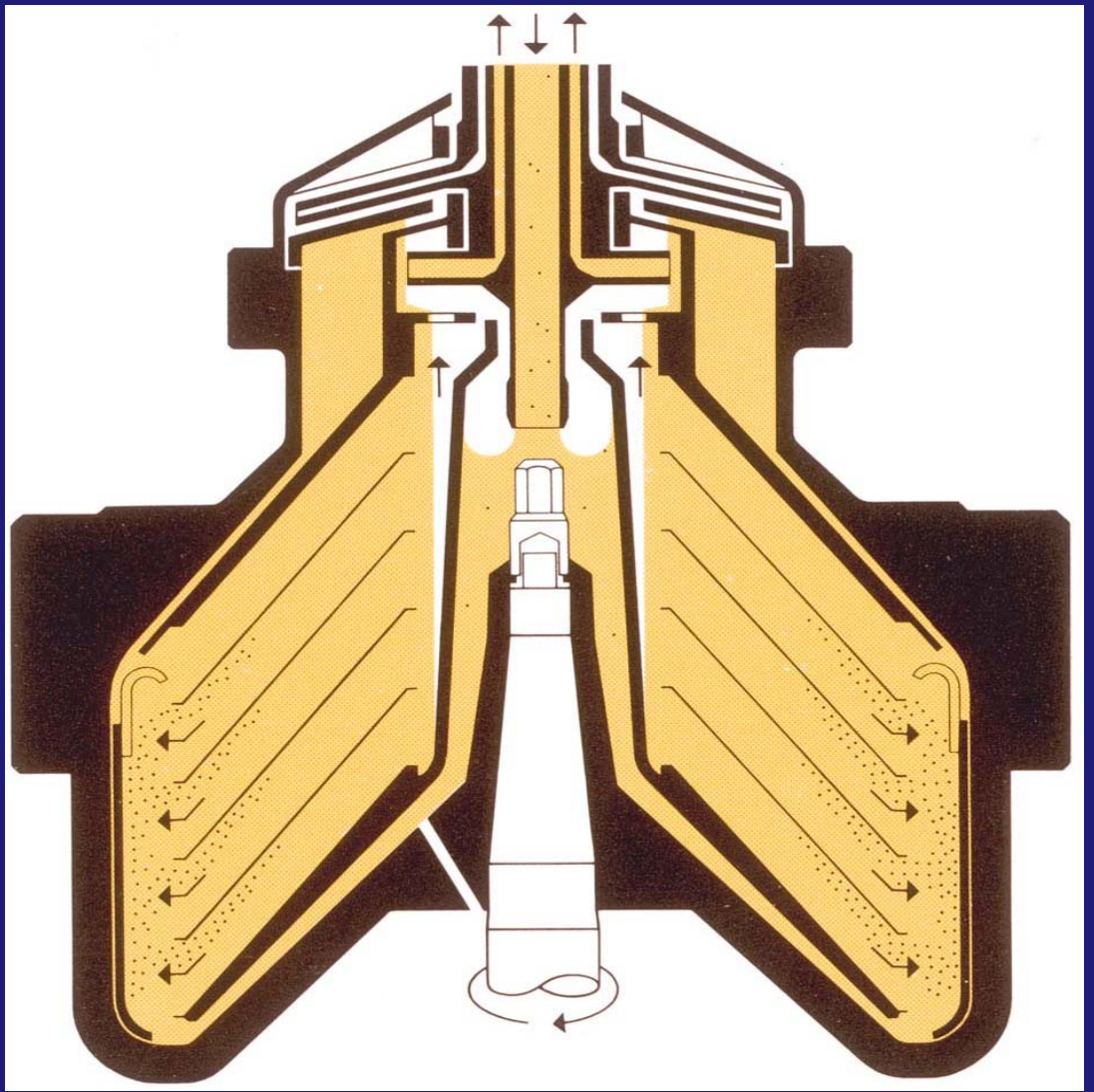
Alternative name: High Speed Separators (HSS)

Gravitational to Centrifugal Force



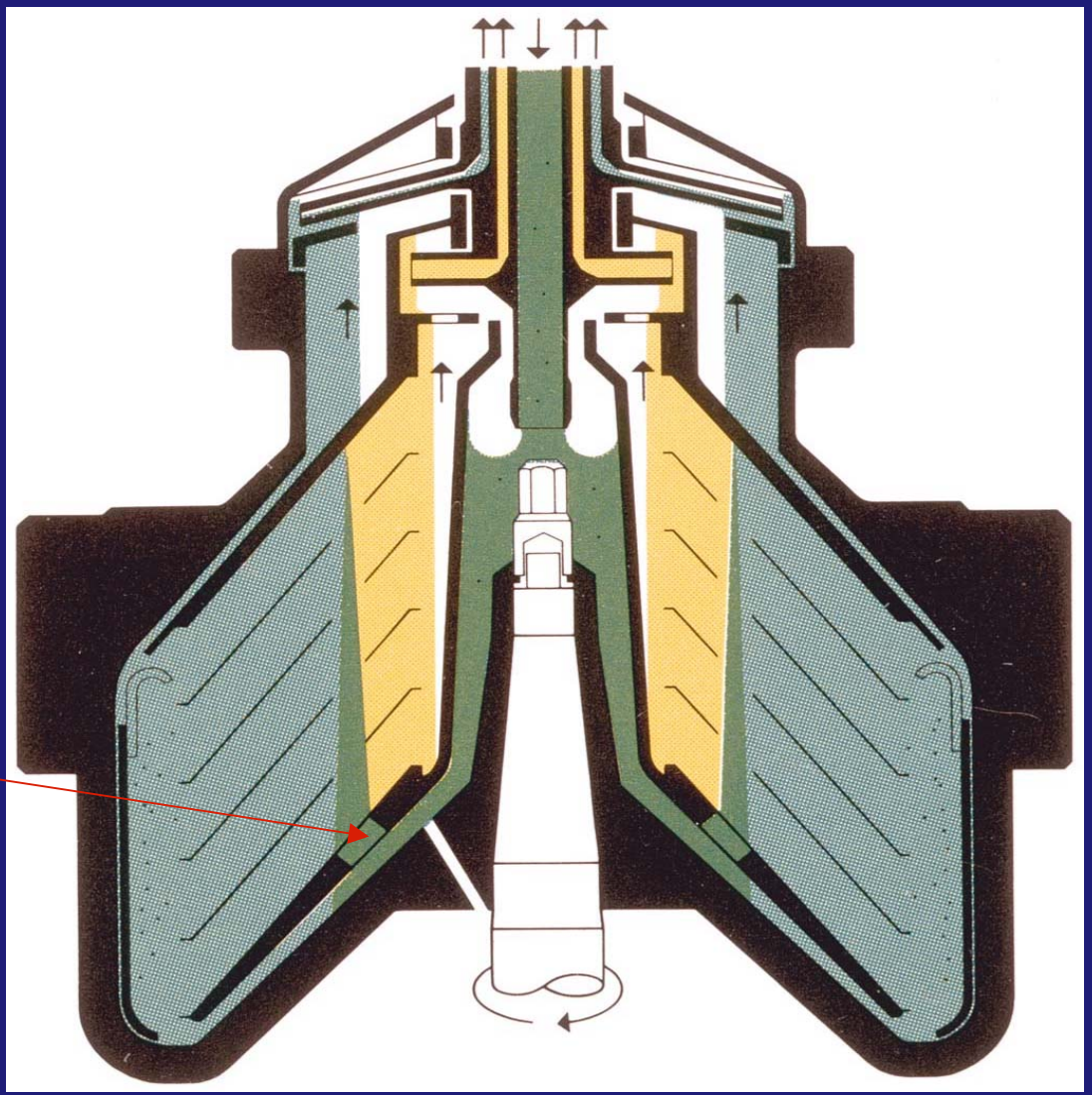
Clarification

- Removal of solids phase from a mixture of liquid and solids



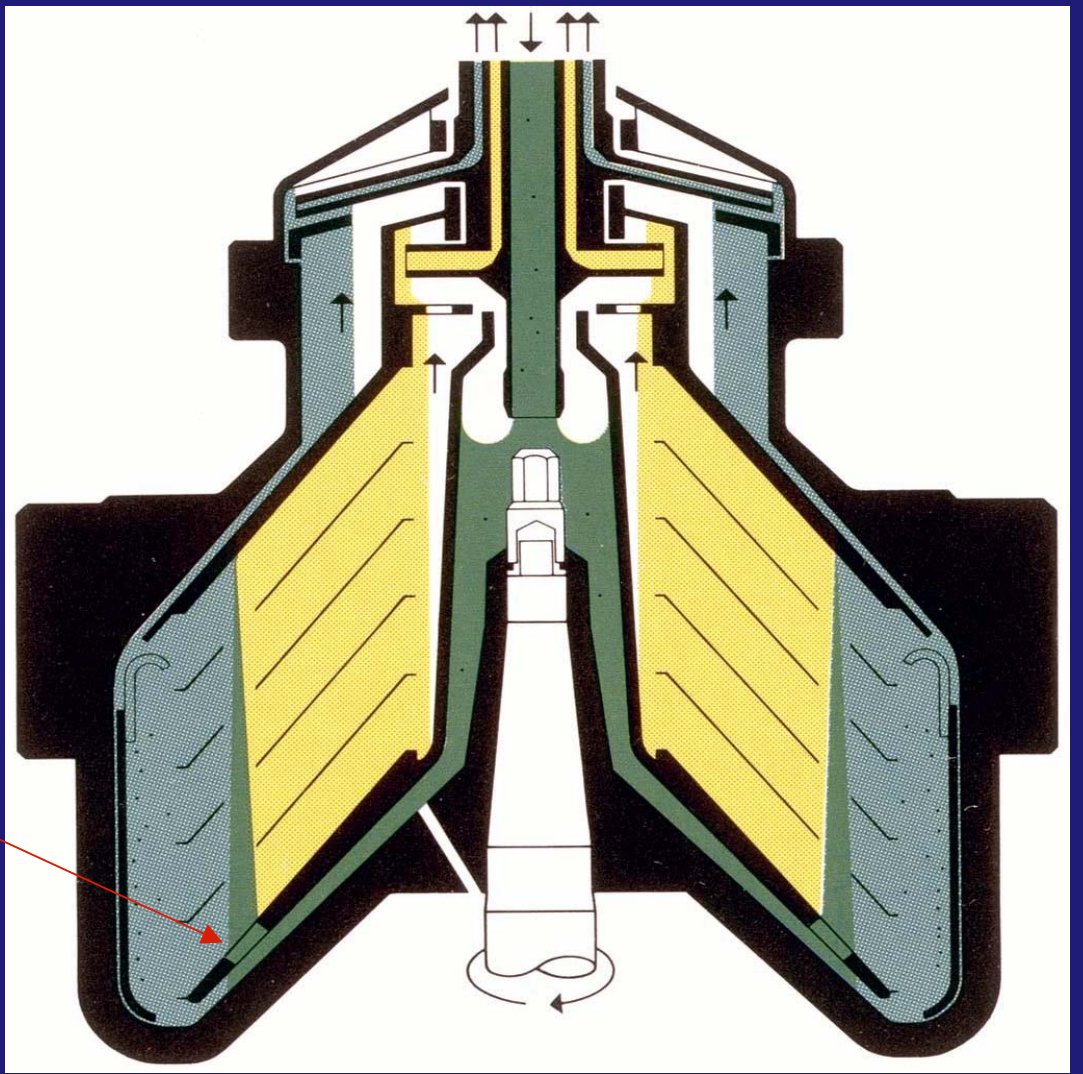
Concentration

- Liquid/liquid separation (also solids if present)
- Maximum cleaning of the **heavy** phase
- Therefore **holes** in disc-stack closer to the **centre**

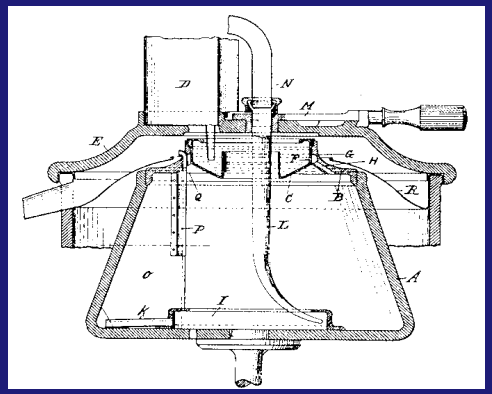


Purification

- Liquid/liquid separation (also solids if present)
- Maximum cleaning of the **light** phase
- Therefore **holes** in disc-stack closer to the **periphery**



HSS – Bowl Development



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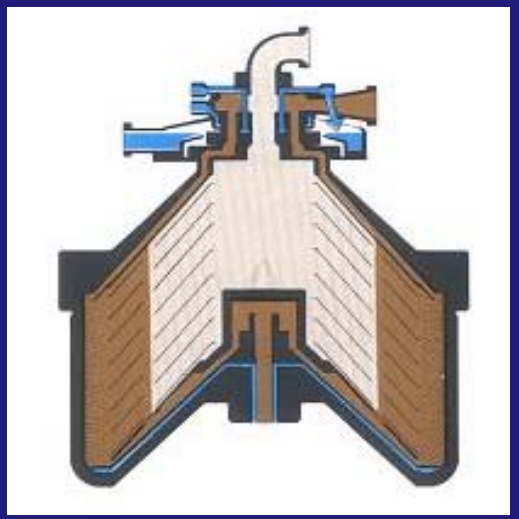

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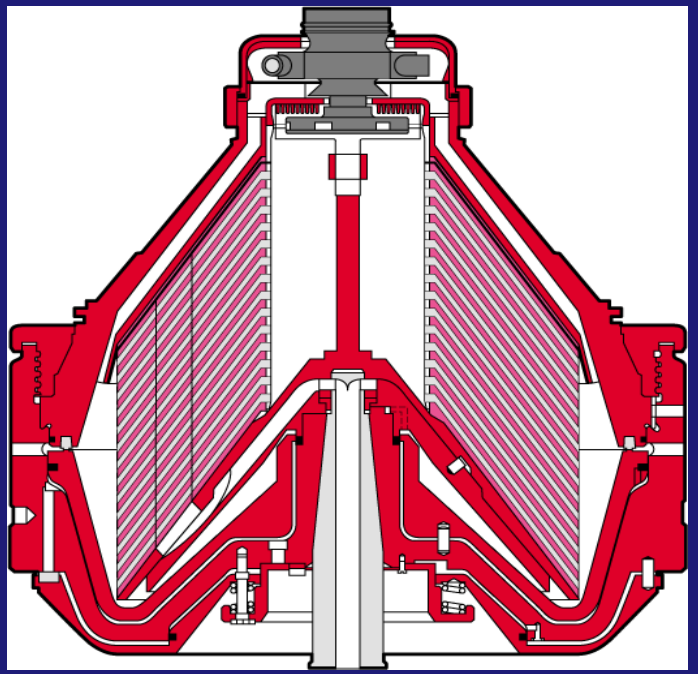

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HSS – Unit Capacities