MerOx Sweetening Process.

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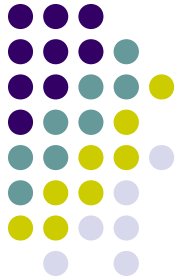
Engineer Operations

SWEETNING

- Conversion/Removal of Mercaptans (RSH), H_2S and elementary Sulfur present in Hydrocarbon stream.

Types Of Sweetening



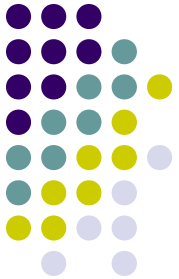
- **Removal Process :** Removal of Hazardous Sulfur and sulfur containing compounds is called Desulfurization.

- **Conversion Process:** Conversion of Mercaptans through Oxygen is called Oxidation and the Process is called Conversion.

Mercaptan's Disadvantages

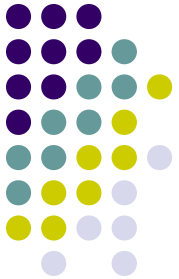
- Impart foul smell.
- Reduce Octane Number by reducing its susceptibility to MMT.
- Elementary Sulfur and Presence of Mercaptans Cause Corrosion.
- Pollute Environment.
- Dangerous to Human Health.

MerOx



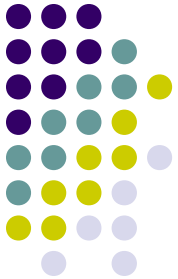
- Stands for Mercaptans Oxidation.
- Mercaptans are Alkyl sulfide Halides (RSH)
- MerOx is Oxidation of Mercaptans to Alkyl disulfides.

Types Of MerOx



- Fix Bed Process.
- Fix Bed Continuous Catalytic Process.
- Liquid/Liquid Counter Current Flow Process.

Liquid / Liquid Sweetening



- Hydro Carbon (containing Mercaptans), Air and Caustic Containing dispersed MerOx catalyst are simultaneously contacted in a mixer.
- Counter current flow of Caustic containing Dispersed MerOx Catalyst (coming down) and hydrocarbon (moving upward) in Reactor.

Fixed Bed Sweetening

- H_2S free feed from Pre-Wash comes in contact with Air in the presence of Catalyst in Reactor.
- Reactor contain Fix Bed of activated Charcoal along with catalyst placed on Johnson Retaining Screen.

Process

- MerOx Process completed in Three main Vessels.

- Vessel I (Pre- Wash).
- Vessel II (Reactor).
- Vessel III (Settler).

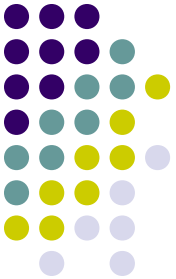
PRE-WASH (Vessel I)

- Contains Caustic Solution of Strength 3 to 5 mole percent.
- 50 to 60 percent level of Caustic Solution in Pre-Wash.
- Product obtained from Pre-Wash, called Caustic Washed Product.

Why to use Caustic (NaOH)???

- It has ability to dissolve low molecular weight Mercaptans.
- It can dissolve H_2S gas.
- It convert Mercaptans to Sodium Mercaptide which is the intermediate Product.

Reactions at Pre-Wash

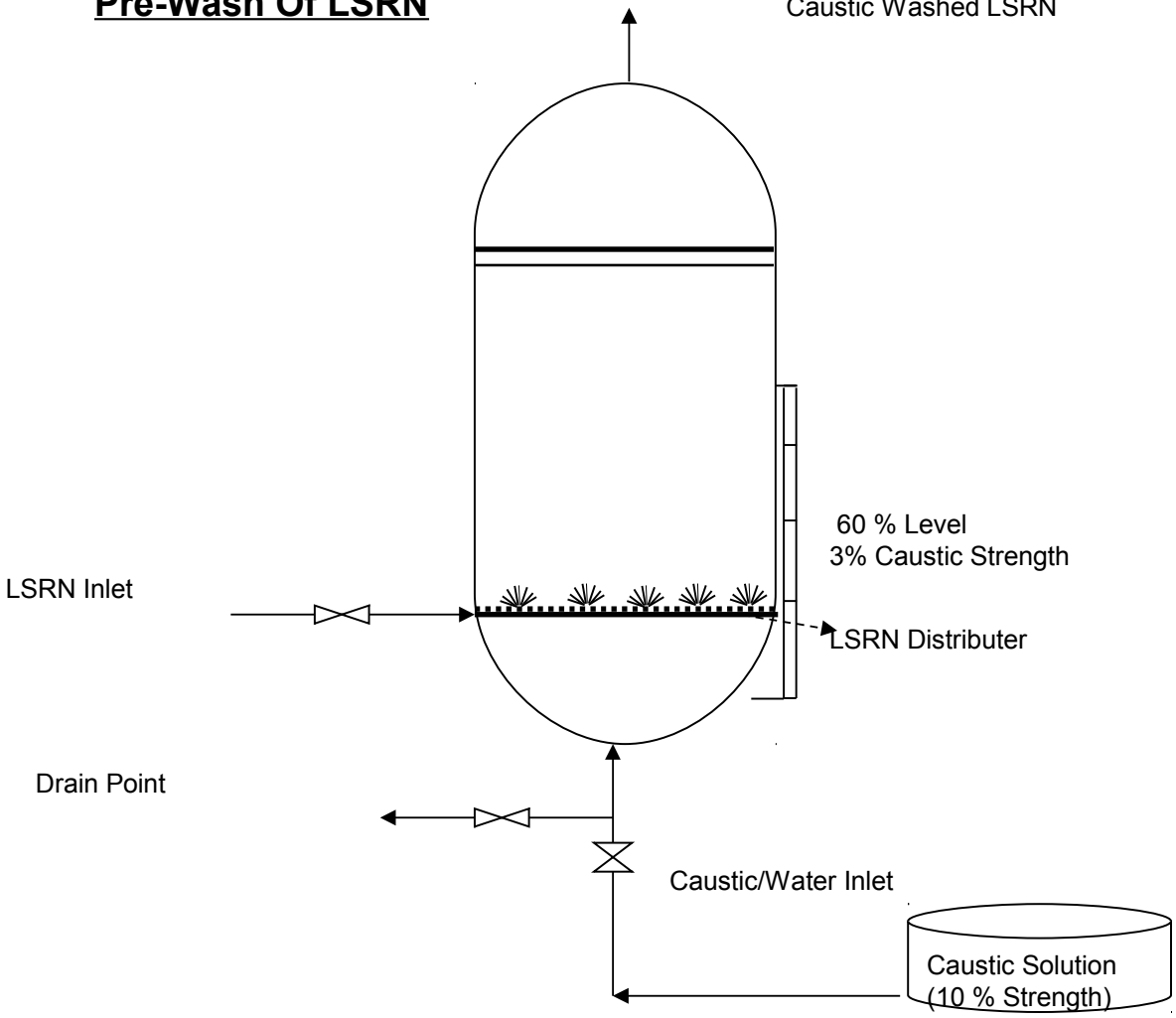


- $RSH + NaOH \longrightarrow NaSR + H_2O$

- $H_2S + NaOH \longrightarrow Na_2S + H_2O$

  $Na_2S + H_2S \longrightarrow NaHS$ (Sodium Hydrosulfide)

Pre-Wash Of LSRN

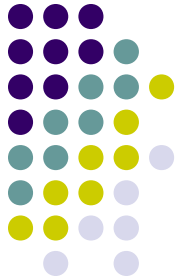


REACTOR (Vessel II)

It contain:

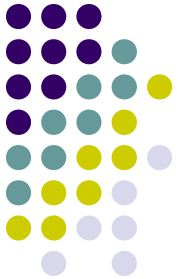
- Catalyst.
- Activated Charcoal.
- Bed Retaining Screen (Johnson Screen).
- Air.

Catalyst



- Metal (Iron) Chelate used as catalyst.
- Iron Chelate, catalyst to Rate of Reaction and inhibitor to gum and peroxides formation.
- Per oxides formed due to reaction between Metals and oxygen.
- Increase in catalyst concentration speed up the Process.

Activated Charcoal

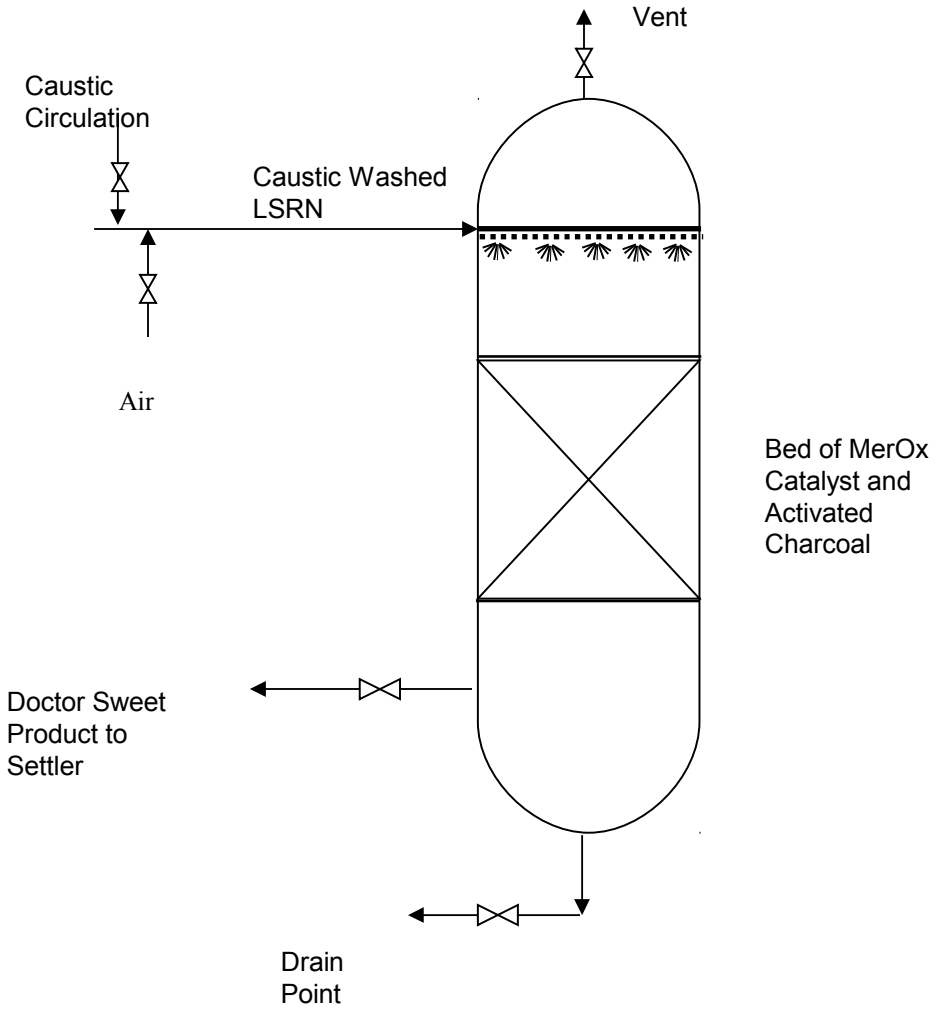


- It is used for bed formation.
- Iron Chelate diffuse on surface of Activated charcoal to increase its surface area.
- Maximum exposure of Catalyst possible.
- Contact time increased.

Air (Oxygen)

- Air as a source of Oxygen.
- Air introduce at the inlet of Reactor along with Caustic Washed Product.
- Air flow maintained according to Pre-Treatment Graph.

Reactor Of LSRN



Reactions at Reactor

- $NaSH + O_2 \longrightarrow Na_2S_2O_3$(Sodium thiosulfate)
- $2NaSR + \frac{1}{2} O_2 + H_2O \longrightarrow 2NaOH + RSSR$

Caustic Regeneration

- In Reactor:

$$NaSR + \tfrac{1}{4}\, O_2 + \tfrac{1}{2}\, H_2O \longrightarrow NaOH + RSSR$$

Favorite Conditions for Regeneration of NaOH;

- High Temperature
- Increasing Amount of Air (according to Pre-Treatment Graph)
- Increasing contact time.
- Increasing catalyst concentration.

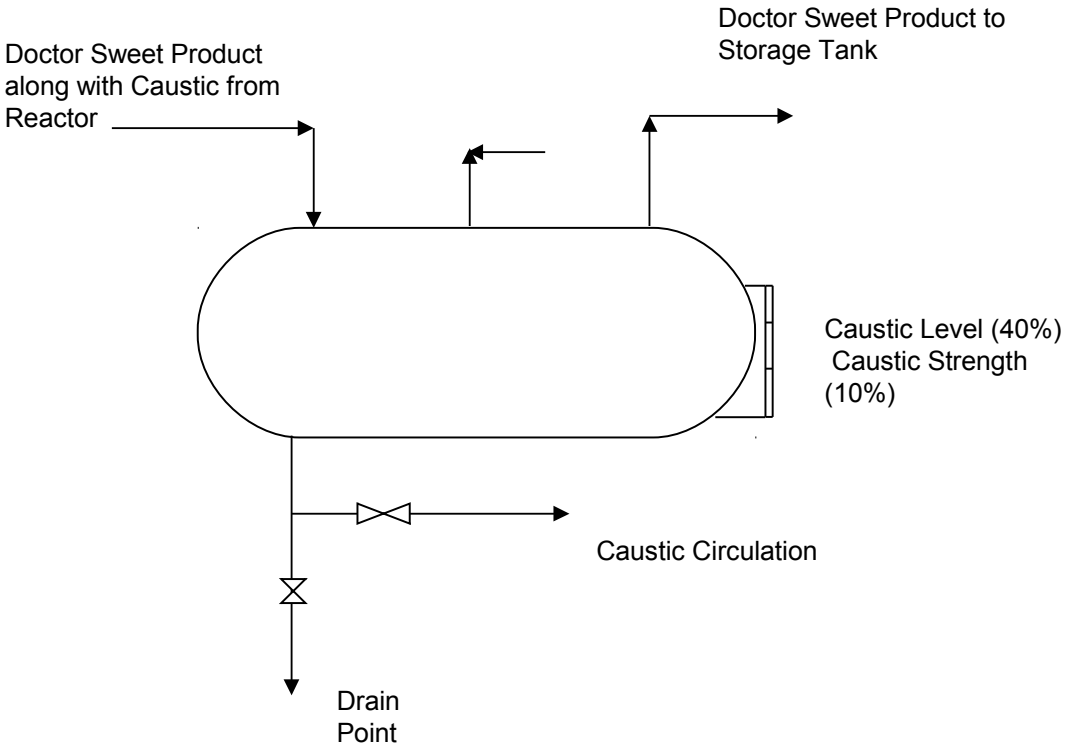
Overall Reactions

- $RSH + NaOH + O_2 \longrightarrow RSSR + H_2O + NaOH$
- $H_2S + NaOH + O_2 \longrightarrow Na_2S_2O_3 + H_2O$

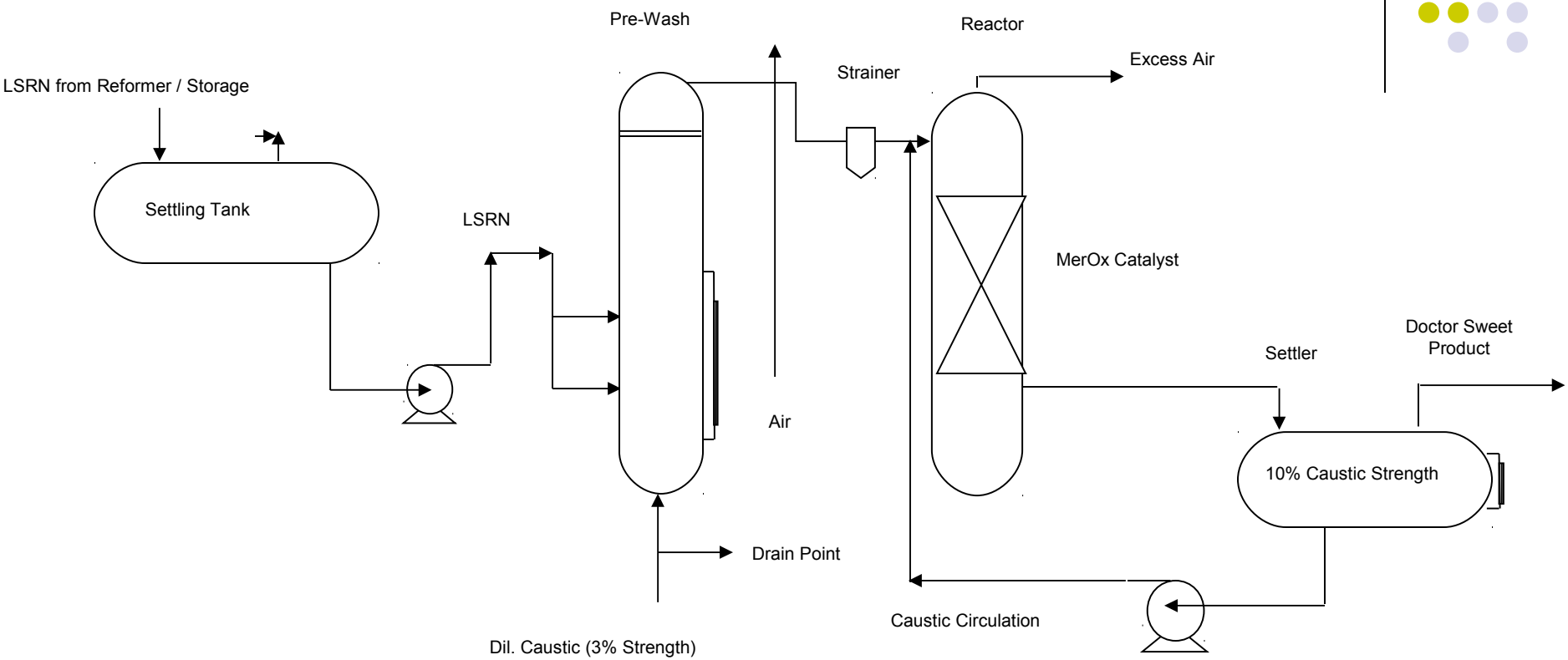
SETTLER (Vessel III)

- Settling under gravity.
- Caustic level from 30 to 40 Percent.
- Caustic Strength from 10 to 12 mole Percent.
- Strength maintain for long because of Regeneration of Caustic in Reactor.

Settler Of LSRN



Process Flow Diagram of MerOx



Doctor Test

Take sample of sweet product in the tube.
Add approximately same amount of doctor solution (Sodium plum bite).
Add small amount of Sulfur powder.
Shake the tube well.
If there is brownish color then the doctor test is positive .
If the color of sulfur crystal remains unchanged then the Test is Negative.

Steps in Case of Off Spec. Product

- Circulation of caustic from Settler to Reactor should be carried out for at least half an hour.
- Darin exhaust Caustic from Pre-Wash and Settler as and when required.
- If required Renew Caustic completely in both Settler and Reactor.
- Hot Water Wash should be carried out.
- Re-Impregnation.

Thanks

Q & A