

MATERIAL BALANCE:

The values given in the following balance sheet are in Kg/day

All values to be multiplied by 10^3 to get the actual amount.

FEED: 1101.715 kg/day of spent soap lye.

1) TANK 1:

Assume 50% of feed of HCl is added to the tank

Amount of HCl added to the tank = 550.857

Total material in the tank = $1101.715 + 550.857$
= 1652.572

Total material out of the tank = 1652.572

2) FILTER PRESS 1:

Total input = 1652.572

Assume 60% of filtration is achieved.

Therefore filtered amount = 991.543

Rejected = 661.03

3) TANK 2:

Material entering = 991.543

Assume 50% of feed of soda ash is added.

Amount of soda ash added = 495.771

Total output from the tank = 1487.314

4) FILTER PRESS 2:

Total input = 1487.314

Assume 10% of filtration is achieved.

Therefore filtered amount = 148.7314

Total output = 1338.583

5) EVAPORATOR:

Amount of glycerol present = 7% of 1338.583
= 93.7

Amount of water present = $1338.583 - 93.7$
= 1244.883

Total input = 1338.583

Output from the evaporator:

As crude = $93.7/0.8$

= 117.125

As vapor = 1221.458

Total output = 1338.583

6) STILL

Input to the still:

Glycerol = 93.7

Water = 234.425

Total = 117.125

Amount of open steam introduced = 7230.216

Grand total = 7347.341

Output from the still:

Glycerol = 93.7×0.98

= 91.826

Water = 1.874

Steam = 7230.216

Total = 7323.916

As foots = 23.425

Grand total = 7347.341

7) BAROMETRIC CONDENSER:

Input to the condenser = 1338.583

Amount of water input = 111.6945

Total input = 1450.2775

Output from the barometric condenser:

Assume 90% condensation is obtained in the condenser

Therefore amount of condensation = 0.9×1338.583

= 1204.725

Leaving = condensed vapor + water

= $1204.725 + 111.6945$

= 1316.4195

Non condensed vapor = 22.1635

Total = 1450.2775

8) MAIN CONDENSER:

Input to the condenser:

Glycerol = 91.826

Water = 1.874

Cold water = 2043.1872

Total = 2136.8872

Output from the condenser:

Assume 100% condensation of glycerol vapor

Glycerol = 91.826

Water = 1.874

Circulated cold water = 2043.8872

Total = 2136.8872

9) DEODORISER:

Input to the deodorizer = 93.7 containing 98% glycerol

Assuming 1% of feed is lost

Therefore amount lost = 0.937

Output from the deodorizer = 92.763

10) DECOLORISER

Input to the decolorizer = 92.763

10% of feed of activated carbon is added

Amount of activated carbon added = 0.1×92.763

= 9.2763

Total output from the decolorizer = 102.04

11) FILTER PRESS 3:

Input to the filter press = 102.04

Rejected = 2.04

Output from the filter press = 100