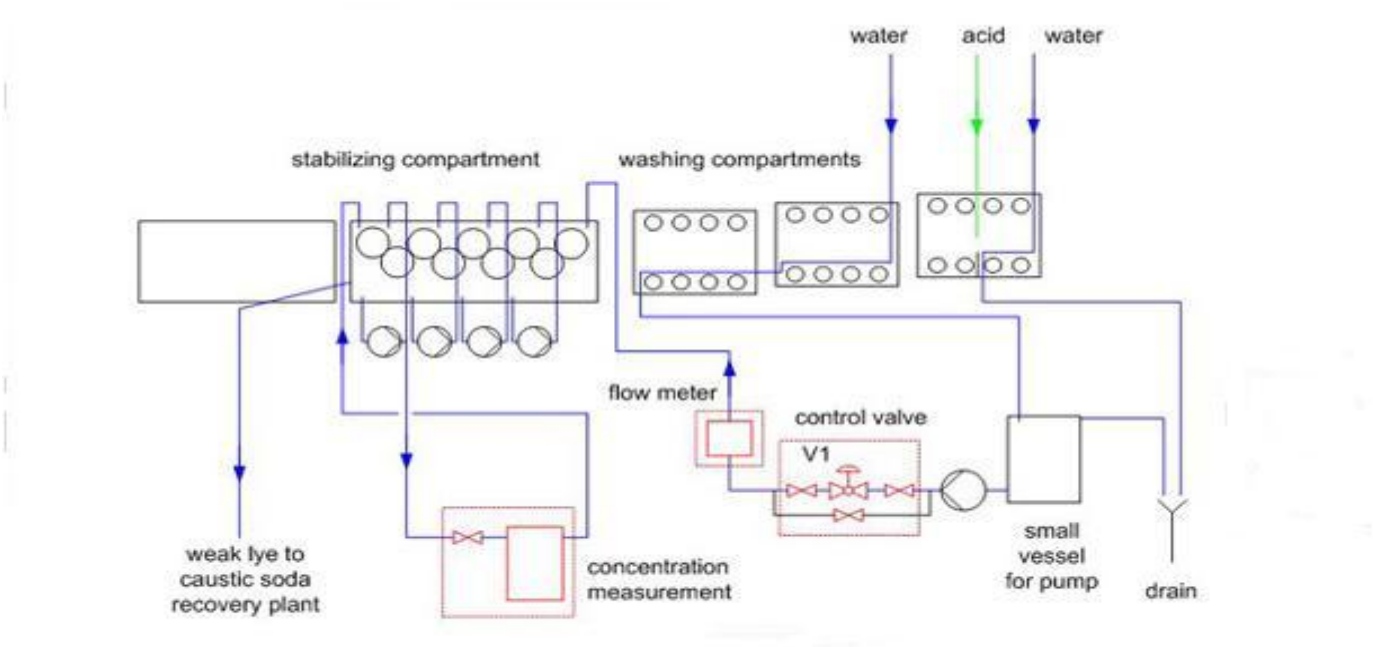
Caustic Recovery Plant
at AL-KARAM TEXTILE MILLS(Private) Ltd.

Overview

Textile industry is one of the most chemical and water consumers. It has the highest capacity for intensive chemical recovery and water recycling options. Both limits about water resources and also waste water regulations make recycling process essential for industries. Recovery and recycling is the final option before treatment application.

During pretreatment of fabric, Mercerizing is a kind of alkaline treatment applied for attaining a permanent shining, to improve the luster, hand and other properties. During this process large quantities of caustic soda are utilized.

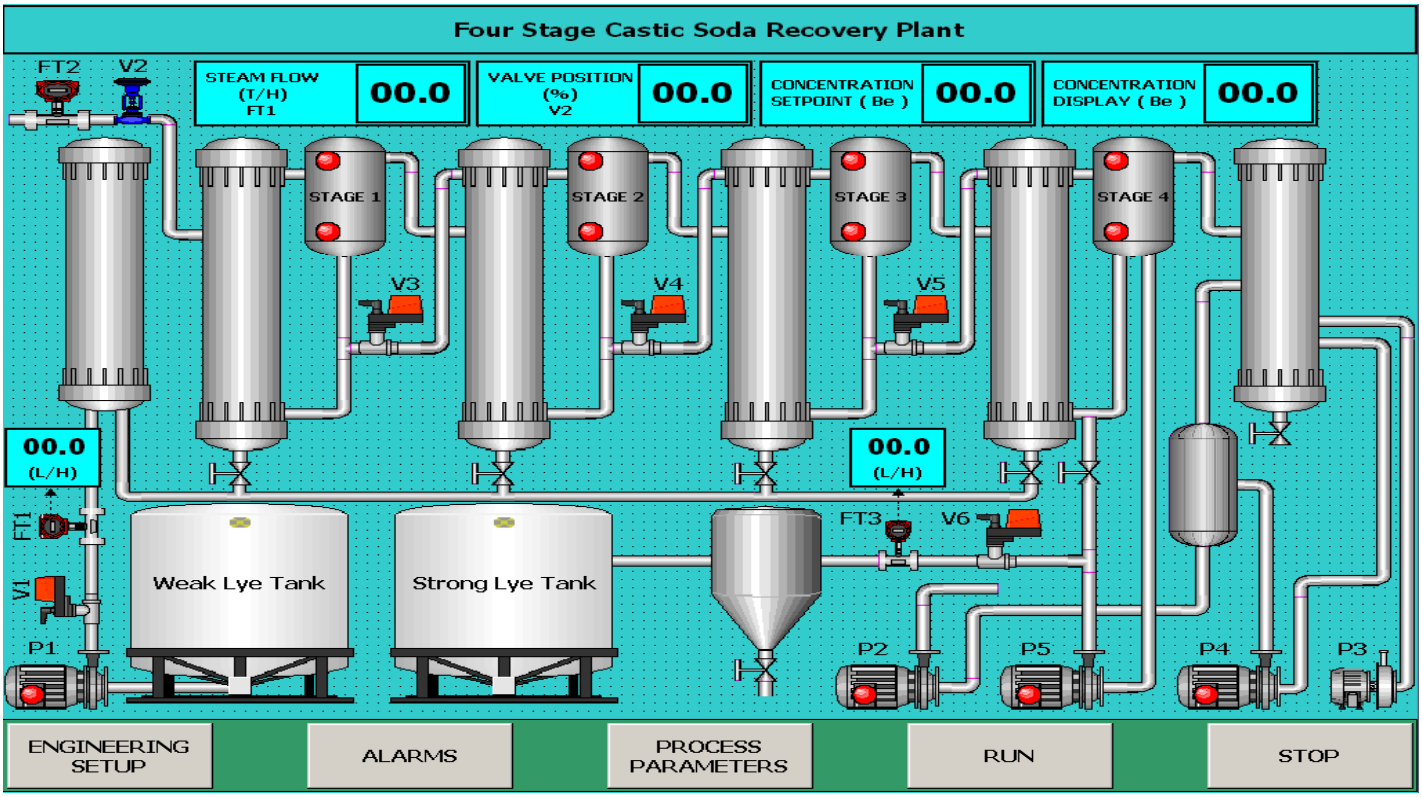


Study

During mercerizing process of cotton,woven knit or yarn, large quantities of caustic soda leaving behind highly alkaline influent. Every 1 kg of cotton requires approximately 240 gms 100% NaOH.80% of this is washed out during stabilizing. This is diluted to 5% concentration. This is drained to sewer or sent to effluent treatment plant to be neutralized before drain.
Al Karam textile Karachi awarded us the contract for manufacturing of Caustic Soda Recovery System.

Technology

RAFAE Engineering Caustic Recovery System reconcentrates the weak lye generated from the mercerizing machine in multistage evaporation plant. In this way caustic soda as well as hot distilled water is recycled instead of treating as highly alkaline waste water. The waste water volume is reduced thus reducing the effluent treatment plant size. The treatment cost is drastically reduced. RAFAE Engineering designs multistage evaporation plant as per customer's requirement of hot water.
At Alkaram textile low pressure from the waste heat recovery boilers from the Gas Turbine was the heat source to be utilized. Keeping in view the water scarcity in Karachi , 4 stage evaporation plant was designed for a week lye input flow rate 4 tons per hour. The mimic shown below illustrates the principle of operation and flow schematic of the plant.
At the start of the plant the weak lye is fed in the plant up the desired level and switched the plant on auto mode. The required final concentration is set at the operating panel touch screen. Vacuum is applied at the condenser for non condensable. Concentration increases in the successive stages and level is maintained automatically due to pressure and temperature gradient available between first and fourth stage due to boiling point difference. Boiling point of high concentration caustic soda is decreased due to vacuum.


Four Stage Castic Soda Recovery Plant
FT2
V2
STEAM FLOW (T/H) FT1
00.0
VALVE POSITION (%) V2
00.0
CONCENTRATION SETPOINT (Be)
00.0
CONCENTRATION DISPLAY (Be)
00.0
STAGE 1
STAGE 2
STAGE 3
STAGE 4
V3
V4
V5
00.0 (L/H)
00.0 (L/H)
FT1
FT3
V6
V1
Weak Lye Tank
Strong Lye Tank
P1
P2
P5
P4
P3
ENGINEERING SETUP
ALARMS
PROCESS PARAMETERS
RUN
STOP

Return on investment calculation Caustic Recovery System

www.rafae-engineering.com **Customer** **AL KARAM Textile**

Operating Costs

Steam	15.29	USD/t		
Caustic Soda	0.47	USD/kg	100	%
Acid, H2SO4	0.20	USD/kg	100	%
Soft Water	0.01	USD/m³		
Electric Power	0.12	USD/kWh		
Personnel	0.58	USD/h		
H2O2- Costs		neglected		

Currency	USD	
Exchange rate	1.43	USD = 1,00 €
Investment	120,000	€
	171,600	USD
Production time	16	hours / day
	20	days / month

SAVINGS due to CRS

Lye							
Mass flow rate, inlet	4000	kg/h	95% Recovery				
Concentration, inlet (weak lye)	5.2	%	4000 kg/h x 5.2 % x 95 % /	=> 198 kg/h (100 %) x 0.47 USD/kg	92.87	USD/h	
Concentration, outlet (strong lye)	23.55	%					
Acid							
Ratio Acid / Lye	1.22	g/g	198 kg/h x x 1.22 g/g / 100 %	=> 241 kg/h (100%) x 0.2 USD/kg	48.21	USD/h	
Cooling Water							
Flow rate	14	m³/h	14 m³/h Use	Heating up of cooling water:			
Temperature inlet	35	°C	14 m³/h x 4,18 kJ/kgK x (55 - 35)K / 2085 kJ/kg	=> 0.56 t/h steam x 15.29 USD/t	8.58	USD/h	
Temperature outlet	55	°C		(1 kg steam = 2085 kJ)			
Vapour condensate, slightly alcaline							
Flowrate	3116	kg/h	3.1 m³/h Use	=> 3.1 m³/h soft water x 0.01 USD/m³	0.03	USD/h	
Temperature condensate	35	°C		Heating up of soft water:			
Soft Water temperature inlet	90	°C	3.1 m³/h x 4,18 kJ/kg x (35 - 90)K / 2085 kJ/kg	=> -0.34 t/h steam x 15.29 USD/t	-5.23	USD/h	
total							**144.47 *USD/h***

COSTS for the operation of a CRS

Steam							
Flowrate	973	kg/h		0.973 t/h x 15.29 USD/t	14.88	USD/h	
Labour							
Proportionate personnel time	10	%		0.1 x 0.58 USD/h	0.06	USD/h	
Electricity							
Electric Power f. the Plant	10	kW		10 kW x 0.117 USD/kWh	1.17	USD/h	
Hydrogen Peroxyde							
Ratio to strong lye flow rate							
total							**16.11 *USD/h***

POSITVE BALANCE per year **(144.47 - 16.11) USD/h x 16 hours/day x 20 days/month x 12 month/year =** **492,937 USD/year**

Pay-back time **0.35 Years or 4.2 Month** ***Saving*** **31,055,012 PKR/year**

Case Study

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