(i) Unit profile

Sree Rayalaseema Alkalies And Allied Chemicals Limited Kurnool

1. ELECTROLYSIS :

Electrolysis takes place in a battery of De Nora membrane electrolyzers (type 1RDD350) operating at a nominal load of 12.5 KA and electrically connected in series.

The electrolytic cells are producing chlorine gas, caustic soda solution at a concentration of 33% w/w and hydrogen that are processed in other sections of the plant.

2. BRINE PROCESSING

Depleted brine, coming from the electrolyzers, contains dissolved chlorine that must be removed in the brine de-chlorination section by air stripping. Before entering the air stripping tower a stream of depleted brine is diverted from the main line and sent to the chlorate reactor where hydrochloric acid is added in order to decompose the chlorate formed in the electrolyzers. A further stage of dechlorination is accomplished by means of sulphite addition. Dechlorinated brine is then recycled to the saturators.

Raw salt is fed to dechlorinated depleted brine by conveyor system in the brine saturators.

The saturated brine is then sent to the brine treatment system composed of brine purifiers placed in series, where chemicals are added in order to precipitate the impurities present in the salt, and a brine clarifier where the precipitates settle down.

The resulting sludges are discharged into the sludge receiver which is receiving also the sludge coming from saturators and from filters washing. The sludges are sent to a filtration system. The clarified brine, overflowing from the settler, is pumped to precoat type filters for the removal of the fine precipitates. Before entering the membrane electrolyzers, brine is passed through a bed of specific ion exchange resins where the residual traces of Ca., Mg., and Sr. Are removed.

Pure brine from tank is pumped to the overhead tank before entering into the cells.

3. CHLORINE PROCESSING :

From the cell the wet chlorine gas passes through a two stage chlorine cooling system.

After the first cooler a blower increases chlorine pressure upto the level required for hydrochloric acid sysnthesis and hypo calcium production. The cooled chlorine then passes through mist separator where sodium chloride mist is eliminated.

Before entering the chlorine drying section, the chlorine is divided into two main streams, one feeding Hcl. Ysnthesis unit, and another being dried, compressed and liquefied.

The chlorine drying is accomplished in three packed towers placed in series where chlorine comes into contact with counter current flow of strong sulphuric acid.

All chlorine coming from the drying section is sucked in a liquid ring compression unit, designed to compress chlorine at a pressure suitable for its liquefaction.

The chlorine liquefaction is accomplished in a chlorine liquifaction unit where compressed chlorine is condensed by vaporising liquid freon.

The liquid chlorine leaving the condenser flows by gravity into the liquid chlorine storage tanks.

By means of air padding, the liquid chlorine can be transferred from the storage tanks to the liquid chlorine filling station.

All the chlorine containing vent gases coming from liquid chlorine storage tanks, compression and liquefaction units, filling station and brine dechlorination are sucked in a chlorine neutralisation section where, in normal operating conditions, commercial sodium hypochlorite solution is produced. In the reaction tower (C-1201 A/B) chlorine is neutralised with a stream of dilute calcium hydroxide solution.

4. HYDROGEN PROCESSING :

Hydrogen coming from membrane electrolyzers is contacted with feeding demineralised water in a packed tower, in order to heat the water. H2 then passes through a cooler before being sucked by the blower, that sends the hydrogen to the hydrochloric acid synthesis unit, to Castor Oil Unit and to a down stream bottling unit.

Excess hydrogen is routed to the boiler for steam production.

5. CAUSTIC SODA PROCESSING :

Caustic Soda solution produced by the membrane electrolyzers at a concentration of 33% (w/w) is collected in receiving tank and then pumped to storage, to reagent tank for brine treatment and to concentration unit.

From the concentration unit 50% NaoH solution is recovered and pumped to a storage tank.

6. HYDROCHLORIC ACID SYNTHESIS :

Chilled chlorine and compressed hydrogen enter the HCl synthesis units in which the reaction, the absorption of the product and its cooling occur.

33% Hcl. Solution produced in synthesis units is collected in a receiving tank and then sent to storage tanks or to the “area tanks” for utilization in brine processing.

7. SODIUM HYPOCHLORITE PRODUCTION :

In this plant a hypo solution 100 g/ltr. As active chlorine is produced.
The reaction is performed in an absorption tower, where chlorine is contacted with 12% sodium hydroxide solution. The hypo preparation is carried on in a batchwise mode in the sense that sodium hypochlorite solution is recirculated to the absorption tower until it has reached the requried concentration.
Once prepared, hypo solution is sent to storage tanks and from there to marketing.

8. RECOVERY OF BARIUM SULPHATE :

Part of the sulphate is being recovered as barium sulphate in recovery plant to reduce generation of solid waste during brine treatment.

Part of the depleted Brine, which contains sulphates, is treated with barium salt to precipitate barium sulphate. The Barium sulphate slurry is fed to nautch filter and the material is fed to spin flash dryer. The product is bagged in HDPE bags and sold.

9. CAUSTIC FLAKES.

50% of concentration of caustic from evaporation plant is again evaporated to pre concentrated to 73% by using steam chest (Heat exchanger using steam as a heating medium in shell side) After that it has been pumped to final concentration where the high temperature (420 Deg C) molten salt circulated through shell side of heat exchanger . There by the caustic is heated up to 380 Deg C. So all the water removed from caustic in molted state (anhydrous) collected in receiver from there it taken to flaking machine . where this anhydrous caustic is cooled and formed as a thin layer . It scraped out as a flakes. It is filled in polythene bags as caustic flakes.

II)Energy consumption

The annual energy bill for Sree Rayalaseema Alkalies And Allied Chemicals Limited is given below in the table that follows :

Year	Total Electricity Bill (in Rs. Lakhs)	Total Fuel Bill (In Rs. Lakhs)	Total (in Rs. Lakhs)
2001 –2002	1134.52	2952.38	1707.01
2002-2003	1817.42	3814.03	1815.87
2003-2004	3151.76	3547.86	2111.78

The Management commitment to energy conservation at Sree Rayalaseema Alkalies And Allied Chemicals Limited is reflected by the continued efforts of the Company over the years. The sustained reduction in specific energy consumption per tonne of product is a testimony to this for Sree Rayalaseema Alkalies And Allied Chemicals Limited the annual energy consumption pattern of fuel and electricity is as follows :

Year	Annual Production (MTs.)	Electrical Energy Consumed (in lakh Kwh)	Thermal Energy (in million K.cal)	Kwh/Ton Of product	M Kcal/ Ton of Product	Overall Energy consumed Mkcl / T of product
2001-2002	61700	1454.17	59664	2356	0.967	2.99
2002-2003	66149	1559.79	55896	2358	0.845	2.87
2003-2004	67126	1704.329	56856	2539	0.847	3.03

iii)Energy conservation commitment, policy and set up :

The Chlor-Alkali Industry is a power intensive industry and requires huge quantity of power for the Electrolysis Process. The cost of energy contributes about 55% of the cost of Caustic Soda production. Hence, in our Organisation, the conservation of energy has started since its inception. Lot of care was taken in selection of equipment, technology, and plant layout for achieving lower power consumption. We have selected the latest technology i.e. Bi-polar Membrane Cell Technology, which is the most modern, first time in India, 15% energy saving and pollution free compared to other conventional methods i.e. Mercury and Graphite Technology based Caustic Soda

Industries. We are mentioning below some of the measures taken while designing & selecting the equipment for the project.

1) Careful planning and layout of Electrical Distribution system.

2) Selection of adequate sizes of Conductors & Cables.

3) Avoiding use of higher capcity transformers than required.

4) Selection of On Load Tap Changer Power Transformers for maintaining proper voltage levels.

5) Limiting the length of low tension distribution feeders.

6) Power design & monitoring of Illumination systems.

7) Selection of high efficiency high power factor Induction Motors.

8) Use of Conveyors instead of Blowers for conveying materials

9) To recover heat from fluegases.

10) Providing of Thermal insulation to all steam and chilled water.

11) Use of 90 deg. Long radius bends in suction and delivery lines.

Installation of steam vapour absorption chillers and Hot water fired vapour absorption machines in DG cooling system, coupled with waste heat recovery boilers, with considerable capital cost, waste heat from salt furnace for pre heating boiler feed water, solely to conserve energy, shows the efforts of the Management in this direction.

Further to the above, after commissioning the Plant, an Energy Conservation Committee has been formed for watching constantly the energy consumption's and establishing reliable energy reporting system. The function of the Energy Conservation Committee is not only to watch energy consumption levels but also to find out and invite suggestions for further measures in energy consumption levels but also to find out and invite suggestions for further measures in energy conservation and implementation of the same within a short period , as ones "ENERGY LOST IS LOST FOR EVER". In order to bring awareness among all the working persons in the plant, the Management has introduced MONTHLY AWARDS SCHEME for the best three suggestions on energy conservation's. The committee also organizes IN HOUSE TRAINING CLASSES for the employees on energy conservation and importance on energy conservation. For understanding the importance of energy conservation at lower levels of working personnel, Posters & Slogan Boards exhibited in English language & in local language in all places of the plant.

Further the Committee will take daily rounds of entire plant to observe and control the steam leakages / water leakages in the pipeline, proper functioning of steam traps, thermostats, storage & handling of fuel oil, recovery of condensate, level switches, unnecessary running of equipment, etc.

Last, but not least, to mention the company has installed 5 MW Wind Power Farm at Ramagiri for generation of power by harnesting Wind Energy, which is Eco-friendly and Pollution free operation.

OTHER RELEVANT INFORMATION :

The T.G.V. Group, a modern industrial conglomerate is renowned for setting impeccable quality standards and rendering committed services. The activities of the Group span a range of industries and services, with the commitment to bring out quality products and services through pioneering innovations, imbued with a singular vision and purpose to grow and reach the pinnacle of success.

The motivation and inspiration for the Group springs from Shri T.G.Venkatesh, a visionary who heads this Group.

Gifted with a sharp business acumen, Shri T.G. Venkatesh has rich experience of over two decades in the Chemical Industry. He is the Chairman of the Rs.500 Crore asset based TGV GROUP, which includes industries in various fields such as chemicals, petrochemicals, power generation, finance, bulk drugs, floriculture, aqua foods, hospitals and hotels. This part, he has also served as the Chairman of the Andhra Pradesh State Trading Corporation Limited, a Government of Andhra Pradesh Undertaking. The Government of India, as well as industry have recognised his outstanding achievement as a pioneer of the latest and eco-friendly technologies.

The Flagship Company, M/s. Sree Rayalaseema Alkalies and Allied Chemicals Limied, is the first to set up Bi-polar Membrane Cell Technology based Chlor-Alkali plant in India. The company was incorporated on 24th June, 1981, in the State of Andhra Pradesh and started its commercial production from Dec., 1987. The main products are caustic soda lye, chlorine, hydrogen and hydrochloric acid. The plant is most stragegically located and there is not other caustic soda unit within a radius of 500 Kms, giving the company competitive edge over its competitors.

The production of standard quantity Alkali, Chlorine and hydrogen has gone up significantly due to periodic expansion of the electroliser capacity to meet with ever increasing customers need.

Our constant pursuit for perfection, particularly in the areas of quality and Human Resource Development and energy conservation and utilization of waste products is helping the company to march into the 21st Century with a much stronger vigor.

Several prestigious and highest awards like the National Award for Safety, National Award for up keeping clean environment, National award for best R&D efforts to recover Chemicals from Effluents and Award of IInd prize for Excellence in Energy Conservation and Management from Ministry of Power, Government of India for the year 1998-99, have been received by us from the Government of India.

The Company is certified with ISO-9001:2000 Series for Quality in the year 1998 and ISO-14001 for Environmental Management System in the year 1999. The Company is certified with ISO-18001 for Occupational Safety and Health Hazard Management System in July 2003. TPM and TQM are under implementation.

BRIEF DESCRIPTION OF THE PLANT

Caustic soda lye is the main product produced in this plant along with liquid chlorine, Hydrochloric Acid and Sodium Hypochlorite as by-products.

Caustic soda is being produced by latest technology of bi-polar membrane calls which is adopted for the first time in our country on commercial scale. The technical know-how for our plant has been given by M/s. Denora Permalec of Italy, who are the pioneers in the field of caustic soda plants based on membrane cell technology. Thus our plant has taken leading role in bringing this latest

technology to our country at a much higher project cost as compared to conventional mercury and diaphragm cell process. The main advantages of this technology even mercury/diaphragm process are given below :

This process is free from hazards of mercury and asbestos pollution.

The process consumes about 30% less power per tonne of products, thus savving the valuable energy.

The quality of the products are superior to those produced by the other two processes.

BRINE PREPARATION AND PURIFICATION SECTION :

Raw salt is added to the depleted brine (from cells) in a saturator by means of bucket elevator. The resulting brine containing calcium, magnesium sulphate impurities is purified by adding sodium carbonate, sodium hydroxide and barium chloride respectively. From the sludge containing calcium carbonate, magnesium hydroxide and barium sulphate, we have developed a method to recover barium sulphate as a by product and is being marketed. The remaining sludge cake, mostly insoluble in water is being used for land filling in our own land. Lab scale experiments are in progress in collecting the valuable chemicals from the sludge which is now being disposed.

The clarified brine is passed through filter and ion exchange tower for further purification.

ELECTROLYSIS SECTION :

The purified alkaline brine is neutralised and sent to fourteen “DE-NORA MEMBRANE” Electrolyzers, when high voltage direct current is applied, electrolysis of brine takes place inside the cells forming chloride ions and sodium ions. The chloride ions move towards anode zone forming chlorine gas which is being collected in a chlorine header. The sodium ions pass through the selective membrane towards the cathods zone, further reacting with wate liberating hydrogen gas and sodium hydroxide. The hydrogen gas is collected in a hydrogen header.

The dilute caustic (of around 33%) is sent to evaporators for increasing the concentration to a level of 48%. A part of hydrogen gas produced in the cells is sent to boiler as a fuel for steam generation.

Part of Hydrogen gas is sent to hydrochloric acid plant, where it is burnt with chlorine gas to form Hcl. Gas, which is further absored in D.M. Water in absorption towers to produce 32% concentrated hydrochloric acid.

The chlorine gas formed in cell house, a part is diverted to drying and liquefaction and a part to hydrochloric acid plant.

DECHLORINATION SECTION :

The depleted brine from electrolyzers, containing dissolved chlorine is expelled by acidification, and part of the excess acidity is neutralized by sodium hypochlorite addition. The dechlorinated brine, after neutralization is sent to saturator where raw salt is added. The chlorine gas expelled from the depleted brine is sent to chlorine liquefaction and residual chlorine from air stripping tower is diverted to sodium hypo preparation plant.

CHLORINE GAS DRYING AND LIQUEFACTION SECTION :

The wet chlorine gas from cell house is dried by passing through 98% sulfuric acid. It is then further compressed and liquified by refrigeration. The sniff gases of chlorine from liquefactor are diverted to Hcl. Unit to recover chlorine is stored in horizontal tanks from which it is sent to chlorine filling section.

HYDROCHLORIC ACID SECTION :

The wet chlorine gas and the hydrogen gas are burnt in graphite furnace to produce Hcl. Gas. This gas is absorbed in process condensate /demineralised water to get 32% concentrated hydrochloric acid. The vent gases from the furnace are scrubbed in water and the lean acid is again recycled to absorber.

CHLORINE GAS EMISSION CONTROL SECTION (CHLORINE GAS NEUTRALISATION SECTION) :

The sniff chlorine from diferent chlorine handling sections is collected under suction and sent to chlorine neutralisation plant by means of chlorine blower for making sodium hypochlorite. The chlorine gas is scrubbed in dilute sodium hydroxide solution in two absorption towers to make sodium hypochlorite, and the resultant product is marketed.

POTASSIUM CHLORIDE (KOH):

The KCL salt is being disolved into a saturated solution 320 gpl .Then it undergone the primery treatment to remove SO4 ,Ca and Mg hardness.The dissolved solids prepares, taken & removed by settling then filtered. It passed through Ion exchanger coloumn to remove the tracing of hardness. After PH adjustment it passed to electrolysers. Then DC current applied by that way , KOH, Chlorine , Hydrogen produced . The KOH (33%) collected in tank . Chlorine is burnt in HCL plant to produce HCL . Hydrogen is connected to common system .Then it is utilised as a fuel to the boiler .Hydrogen preparedness in caster oil plant .