

Table No. 2.3 List of Raw Material & Quantities

Sr. No.	Raw materials	Quantity (MT)
1.	Alpha Pinene	200
2.	Phenol	100
3.	Formaldehyde	100
4.	Dipentene / Carene	85
5.	TEG /PEG	100

The following raw materials will be imported yearly given in **Table No. 2.4.**

Table No. 2.4 Imported Raw Materials

Sr. No.	Raw material	Quantity (MT)	Country(s)
1.	Alpha pinene	5000	China, Indonesia, Brazil , Chile
2.	Dipentene	300	China , New Zealand
3.	Gum Turpentine Oil	3000	China, Indonesia, Brazil, Chile , Vietnam
4.	Gum Rosin	600	China , Indonesia, Vietnam
5.	PTBP	600	Russia, China
6.	Hexamine	500	Saudi Arabia

2.6.1 Mode of Storage of Raw Materials

Raw material storage area which will be around 7 x 60 m in dimension and will house the tanks for the following chemicals:-

- Formaldehyde
- Phenol
- Crude Sulphate of Turpentine
- Local Turpentine
- Dipentene fraction of local turpentine
- Dipentene fraction of imported turpentine

b) Finished material storage which will be around 7 x 60 m in dimension and will house the tanks for the following finished materials:-

- Camphene
- DRT 5004 (Resin)
- DRT 4001 (Resin)
- Pure fraction of Turpentine

c) The plant equipment housing area will be around 30 m x 46 m which will house the equipment's from Ground Floor to the Third (3rd floor)

2.6.2 Source of raw material(s) and mode of transport

The raw materials which will be various chemicals will be transported by trucks from source to the factory site. The auxiliary fuel like High Speed Diesel (HSD) and Heavy Fuel Oil (HFO) will be transported to the factory site by tankers. The Indonesian coal will be purchased from the local vendor and brought to the factory site by covered trucks.

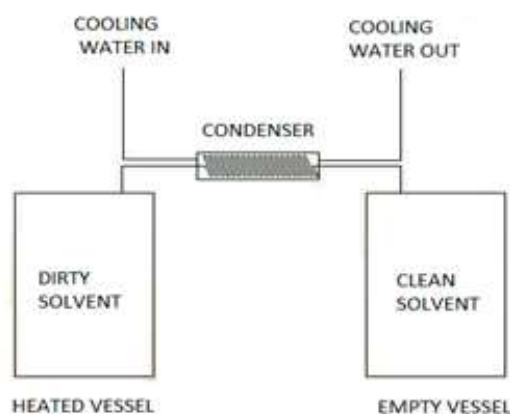
2.6.3 Mode of transport of product

The products will be transported through trucks from the factory premises to the destination.

2.6.4 Detail of Proposed Solvent Recovery System

Process Details: The solvents will be recover and reuse for the process. The fixed volume of Spent solvent shall be charge into the reactor for recovery and heated, to distil out collected in receiver. The residue left in the reactor shall be drained. The small quantity of solid waste material (Tar Type material) may be float on top surface and which will be taken out and collected in drums /containers. The washing effluent shall be drain to E.T.P. for further treatment & the solid wastes are shall be dispose through CHWTSDF.

Figure No. 2.4 Diagram of Solvent Recovery Process



2.7. Process Details

The following products will be manufactured along with the capacities as tabulated below

Sr. No.	Name of the Chemical	Proposed capacity (MT /month)
1.	Alphapinene (95%)	200.00
2.	Polyester Resin	100.00
3.	Phenolic Resin	800.00
4.	Alkyd Resin	300.00
5.	Coating	500.00
6.	Rosin Easter	150.00
7.	Maleic Modified Resin	75.00
8.	Phenolic Modified Resin	75.00
9.	PVC chemicals	500.00
10.	Camphene	200.00
11.	Dipentene	350.00
12.	Ketonic Resin	100.00
13.	Polyamide Resin	100.00

Brief Process Description of Manufacture of Camphor

The process of manufacture of Camphor involves the following steps:

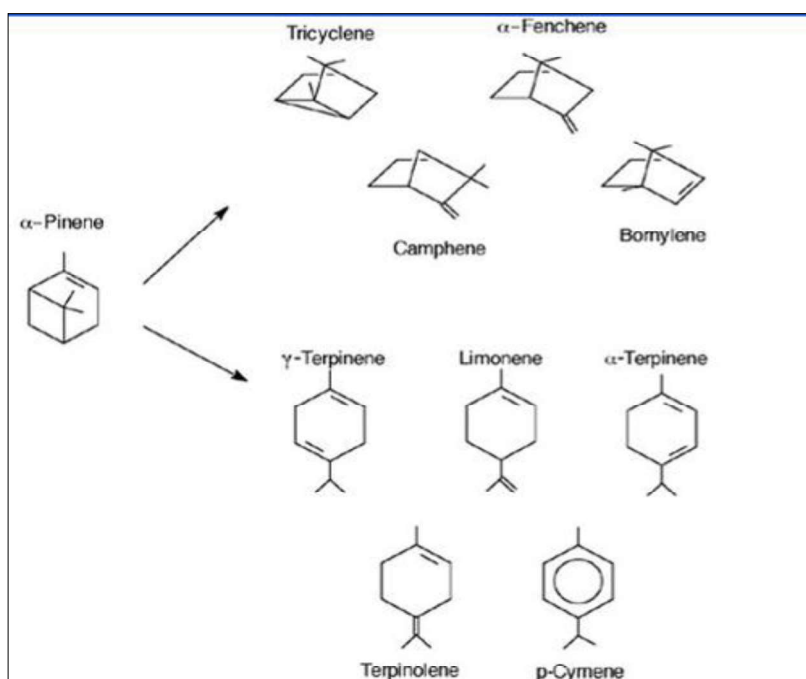
- ❖ Turpentine Oil distillation
- ❖ Isomerisation
- ❖ Esterification
- ❖ Saponification
- ❖ Dehydrogenation

Turpentine Oil distillation: Turpentine oil is subjected to distillation for continuous separation of Alpha-Pinene from the rest of its constituents. Alpha Pinene is obtained as distillate which is stored in storage tanks. Bottom product from this column is distilled in another column for recovery of Carene as distillate and bottoms are collected as Dipentene Residue that is stored in a storage tank.

Isomerisation : Distilled Alpha -Pinene is subjected to isomerization in reactor which gets converted in the presence of TiO₂ as catalyst into different isomers namely Tricyclene and Camphene along with Terpene intermediates under controlled temperature conditions. The crude Tricyclene and camphene (T + C) formed is stored in storage tanks. Crude T + C are then distilled to get purified T + C. The bottoms from the

distillation column are further distilled in a different column to recover Dipentene which is sent to storage as byproduct. Bottoms from this Dipentene recovery column are collected as Dipentene which is sent to storage.

Figure No. 2.5 Products of α - pinene conversion



Esterification: Tricyclene + Camphene (T+C) are subjected to Esterification in reactor. Slow addition is carried out in Esterification reactor, which is reacted with Acetic acid in the presence of Resin catalyst to form crude Iso -Bornyl Acetate. Acetic acid is recovered from crude Iso-Bornyl Acetate in a distillate column and collected in a storage tank. Crude Iso-Bornyl Acetate containing T +C is then recovered in a separate column to produce pure Iso- Bornyl Acetate (IBA), which is sent to storage. Recovered T+C are sent to storage.

Saponification: Pure Iso - Bornyl Acetate is then subjected to hydrolysis by reacting with caustic soda in reactor to form Iso-Borneol and Sodium Acetate Lye. Sodium acetate lye is separated from organics which is used for producing Sodium Acetate Trihydrate in a separate plant, IsoBorneol (IBO) is transferred to dehydrogenation reactor.

Dehydrogenation: IBO is then subjected to dehydrogenation in reactor in the presence of CuO catalyst in which reaction hydrogen is liberated forming crude camphor. Xylene

is added as a solvent. Xylene is recovered from crude camphor in a distillation column. A low boiler along with T+ C present in camphor oil is then separated in another column. Crude camphor is then distilled in another column to get pure camphor which is flaked in a flaker and packed in bags. Residue collected from the bottom of this column is subjected to reclamation for recovering camphor.

Manufacture of Sodium Acetate Tri Hydrate

Sodium acetate lye received from camphor plant is collected in a reactor and neutralized. Neutralized lye is subjected to carbon treatment. After carbon treatment lye is heated in an evaporator to evaporate water and subsequently to obtain a requisite specific gravity. The resultant lye is charged into crystallizer for crystallization. In crystallizer Sodium Acetate lye is cooled slowly to obtain crystals. The wet crystals are further centrifuged to remove mother liquor. The resultant crystals obtained is Sodium Acetate Trihydrate which is packed in bags.

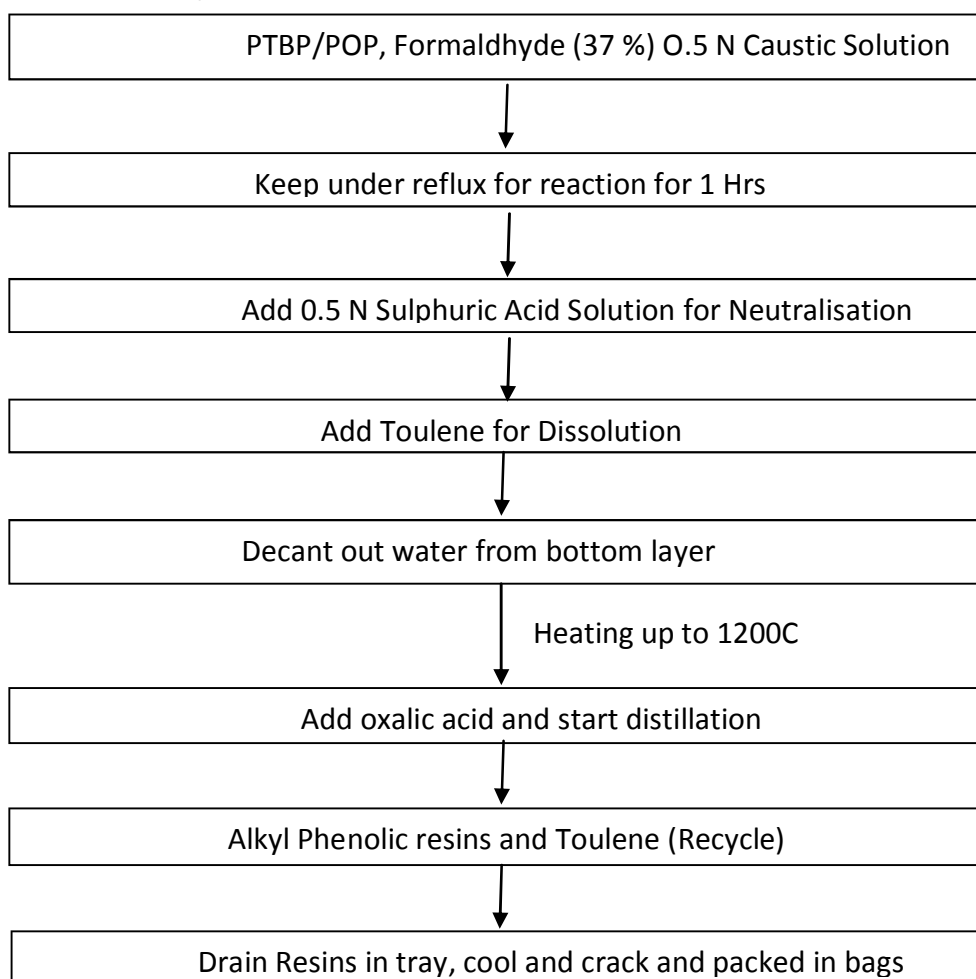
P.F Resin Powder Procedure: Hydrated liquid phenol, formaldehyde (37%) and oxalic acid charged into the reactor and stirred well to mix. pH of the mixture is 1-1.2. Slow heating is applied just to reach temperature upto 60-65°C and then the heating is stopped. The reflux temperature is allowed to reach 100 to 105°C by itself. As the reaction is exothermic in nature, cooling is applied to control the vigorous reaction to proceed smoothly under reflux.

The reaction is continued under reflux for about 4 hours till F.F.C is below 1%. Again the heating is started and distillation of water is continued till the temperature of resin reaches upto 160°C. The vacuum is applied to remove the unreacted phenol from the reaction mixture and get the required properties as per customer. Then the resin is discharged into the shallow trays, allowed to cool naturally, removed from trays; mixed with the required quantity of hexamine, fed into the ACM mill for fine grinding. The resin is then transferred to ribbon blender; blended well and packed into bags.

Alkyl Phenolic Resin Procedure: PTBP formaldehyde (37%), Toluene and caustic lye charged into the reactor. It is stirred well to mix. The pH of the mixture is 8- 8.5. Slow heating is applied just to reach temperature up to 50 -55°C and then the heating is

stopped. The reflux temperature is allowed to reach up to 85-90°C by itself. As the reaction is exothermic in nature, cooling is applied to control the vigorous reaction to smoothen under reflux. The vacuum cooling is applied up to 70°C and then acid and toluene is added. The temperature is adjusted to 70 – 75°C; mixed for 30 minutes and the agitator is stopped. The reaction water is removed from bottom valve of the reactor. About 1000 kg of water is added temperature adjusted to 70 -75°C. The mixture is mixed for 30 minutes and then the agitator is stopped. The pH is checked whether it is in the range of 2.4 – 2.6. The first wash water is removed from bottom valve of the reactor and the pH is checked whether it is in the range of 2.6 -2.9. The distillation is started by applying heat up to 120°C. The vacuum is applied to remove the un-reacted phenol from the reaction mixture and the desired properties are obtained as per the customer. The resin is then discharged into the shallow trays, allowed to cool naturally and removed from the tray and packed in the bags with net weight of 25 kgs and sealed

Alkyl Phenolic Resins Process Flow Chart



P.F. Resin Liquid Procedure: Hydrated Liquid phenol, formaldehyde (37%) and oxalic acid are charged into the reactor; stirred well to mix and the pH is maintained to 1-2. The slow heating is applied just to reach the temperature up to 60 – 650C. Then the heating is stopped. The reflux temperature is allowed to reach up to 100 – 1050C by itself. As the reaction is exothermic in nature, cooling is applied to control the vigorous reaction to smoothen under reflux. The reaction is continued under reflux for about 4 hours till F.F.C is below 1%. The heating is started again and distillation of water continued till temperature of the resin reaches upto 1600C. The vacuum is applied to remove the un-reacted phenol from the reaction mixture and required properties are obtained as per the customer. The solvent addition is started to get the required viscosity and solid content along with cooling. The final product is then cooled to room temperature and filled in the M.S drum with 200 kg net weight with proper labeling.

Terpene Phenolic Resin Procedure: Hydrated phenol and toluene are charged and heating started to remove the water. The cooling is done up to 250C. Then BF₃ acetate is added. The isotherm is checked externally by addition of dipentene is lab. The addition of Dipentene is started under chilling to avoid the raising of temperature above 400C. The reaction is continued for 6 hours @ 55 -600C. The washing is started to get the required acid value less than 1. The distillation is started and steaming is applied with vacuum till required softening point is obtained. The required resin is discharged into the shallow trays, allowed to cool naturally, removed from the tray. Then the resin is filled into bags with net weight of 25 kg with proper labeling and sealed.

Resin Derivative Procedure (Easter gum) : The rosin is charged into the reactor and melted to 1700C in presence of nitrogen gas. The agitator is started and glycerol / penta, catalyst (anthraquinone and antioxidant) added. The temperature is gradually raised to 2650C in 3-4 hours and held there till required properties (Acid value and softening point) attained. The BHT is added when temperature reached to 2500C. The TPP is added @ 2600C and maintained for 1 hour. The live steam sparged into the mass for 2 hours keeping heating off. The resins is then discharged into the shallow trays and allowed to cool naturally, removed from the tray. The resin is filled into the bag with net weight 25 kg with proper labeling and sealed.

Rosin derivative procedure (Maleic resins) : The rosin charged into the reactor and melted to 1700C in presence of nitrogen gas. The agitator is started and cooled to 1500C. The maleic is added in 1 hour's duration. The temperature is gradually raised to 2000C and maintained for one hour for completion of adducts. The glycerol / pentais added in 1-2 hours duration. The temperature is gradually raised to 2700C (maintained at 265-2700C) till the required properties are attained. The temperature is cooled to 2500C and discharged into the shallow trays to cool naturally and then removed from the tray and then filled into the bags with net weight 25 kg with proper labeling and seal.

Rosin Derivative Procedure (Phenolic resins) : The rosin is charged into the reactor and melted to 1700C in presence of nitrogen gas. The agitator is started and cooled to 1500C and then Bisphenol is added in 30 minutes duration and allowed to mix well for 60 minutes and magnesium oxide is added. The para-formaldehyde is added at 1350C in about 2 hours and allow to mix for one hour. The temperature is gradually raised to 1700C and maintained for 2 hours for completion of reaction. The temperature is gradually raised to 2000C and add glycerol / penta is added in one hour. The temperature is raised to 2700C in 4 hours and TPP is added when temperature reaches to 2500C. The reaction is continued at 2700C till the required properties are attained. The resin is cooled to 2500C and discharged into the shallow trays, allowed to cool naturally and removed from the tray. The resin is then filled in bags of net weight 25 kg and labeled and sealed properly.

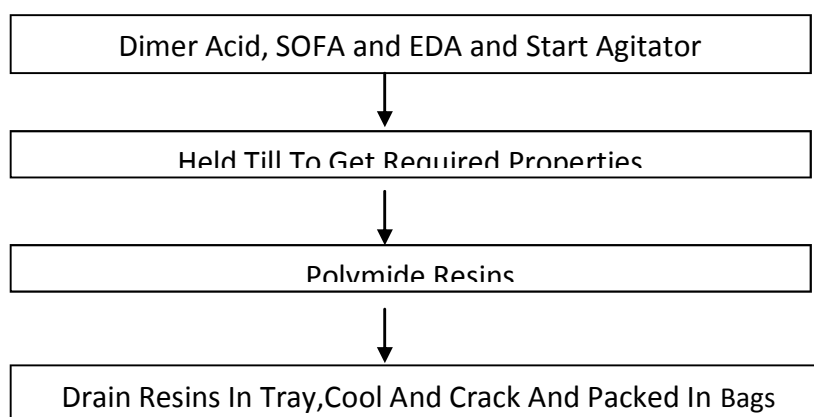
Rosin Derivative Procedure (Zinc -Calcium rosinate) : The rosin is melted to 2000C in presence of Nitrogen gas and agitator started. The temperature is raised to 245 - 2500C. Zinc oxide and calcium hydroxide is added slowly and temperature is maintained to 245-2500C in about 3 -4 hours. After that the temperature is raised to 255 - 2600C and maintained till properties attained. The resin is allowed to cool to 245 -2500C and discharged in tray. The resin is cracked and filled into bag with net weight 25 kg with proper labeling & seal.

P.F Resin Liquid Procedure : Hydrated liquid phenol, formaldehyde (37%), Cardinol, CNSL, and oxalic acid and charged into reactor. It is stirred well to ensure proper

mixing. The pH of the mixture is maintained at 1 -1.2. The slow heating is applied till the temperature is just reaches to 60-650C, then the heating is stopped. The reflux temperature is allowed to reach 100 -1050C by itself. As the reaction is exothermic in nature, the cooling is applied to control the vigorous reaction to smoothen under reflux. The reaction is continued under reflux for about 4 hours till F.F.C is below 1%. The heating is started again and the distillation of water continued till temperature of the resin reached up to 1600C. The vacuum is applied to remove the unreacted phenol from the reaction mixture and the required properties are obtained as per the customer. The solvent is added to get the required viscosity and solid content along with cooling. The resin is then cooled to room temperature, filled in MS drum with 200 kg net weight with proper labeling.

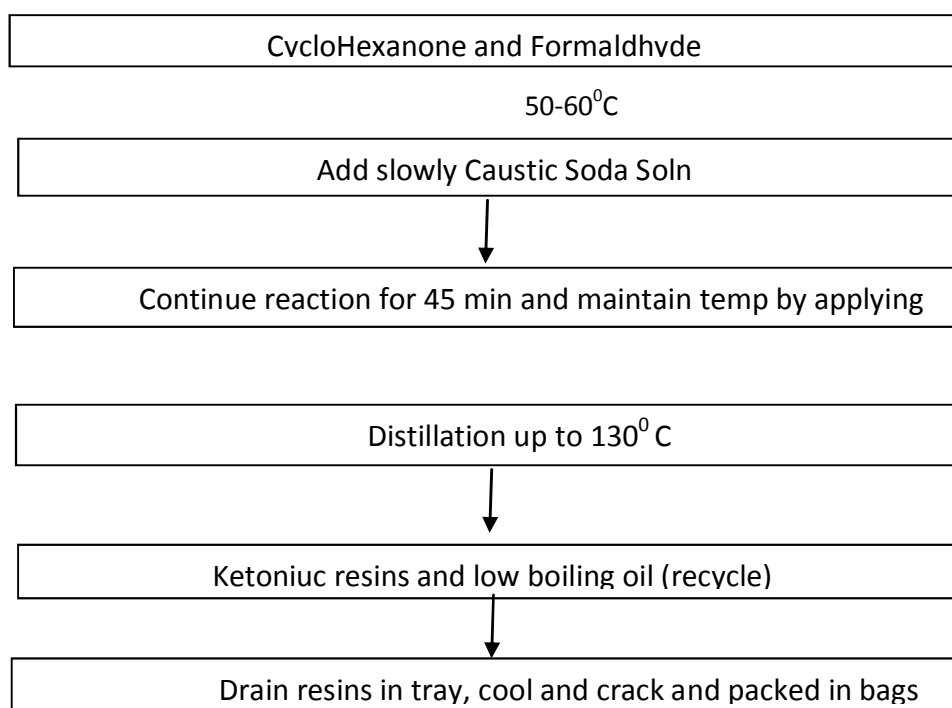
Polyamide Resin : The Dimer acid and SOFA are charged into the reactor and EDA is added and stirred. The temperature is raised slowly to 1300C and held for 45 – 60 minutes. The mixture is further is heated to 190 – 1950C and BHT is added and held for 30 minutes. The temperature is raised to 220 -2250C and held till the required properties are obtained. The resin is discharged into shallow trays, allowed to cool naturally and removed from tray. The resin is cracked and filled into the bag with net weight 25 kg with proper labeling and sealed.

Polyamide Resin Process Flow Chart



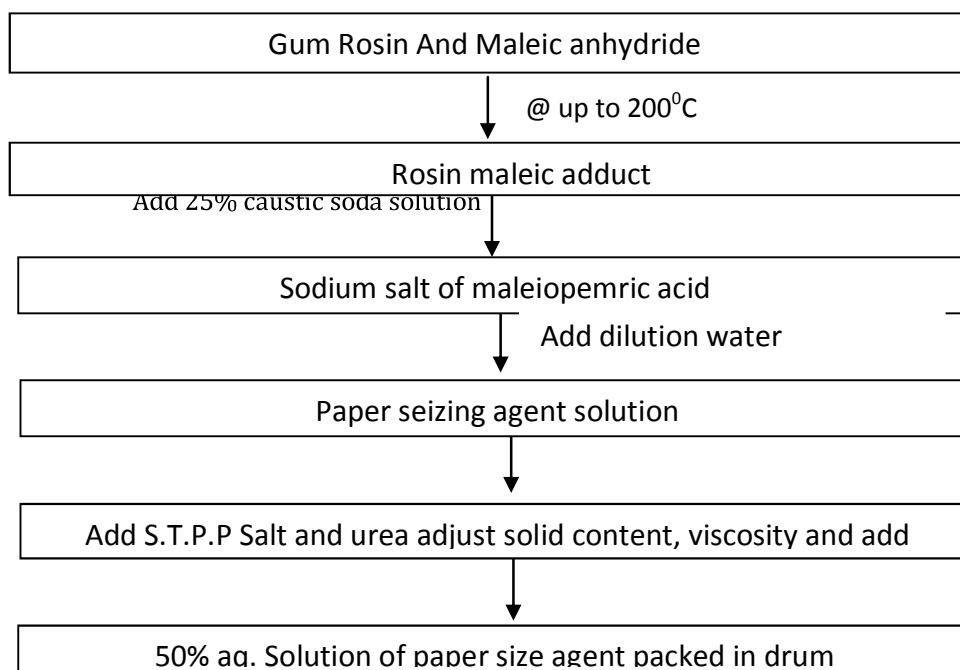
Ketonic Resin: Cyclo-hexanone, formaldehyde, para- formaldehyde and BHT are charged and the agitator is started. The caustic soda is added slowly in 3 -4 hours duration and the temperature maintained to 55 -60°C by applying cooling as and when required. The temperature is raised to 80- 85°C and maintained to 2 hours for completion of reaction. The reaction mass is allowed to settle for 30 -40 minutes and aqueous layer sucked off from the top. The washing continued with fresh water till pH of about 6.0 – 6.5 attained. The final distillation is started in presence of inert gas till the temperature reaches to 130 -135°C. The vacuum is applied and temperature is raised to 140°C for 1.5 -2.0 hours. When the required properties are attained the material is discharged in shallow trays.

Ketonic Resins Process Flow Chart



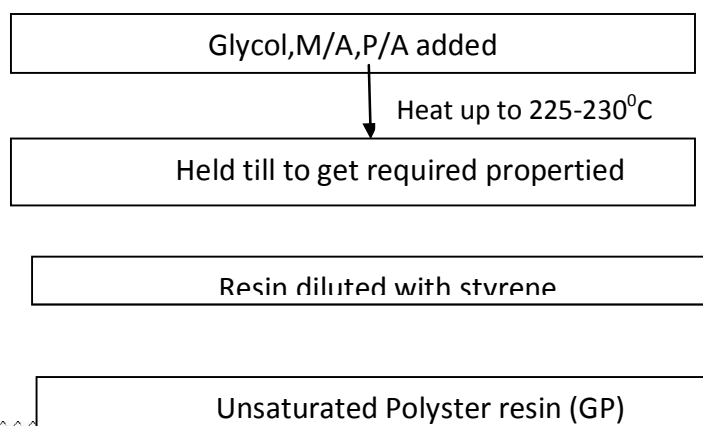
Paper sizing chemicals: The rosin is melted to 175 – 180°C and the agitator is started and nitrogen purged. Maleic anhydride is added and temperature raised to 200°C and maintained for 2 hours for completion reaction. The reaction mass is cooled to 140 - 145°C and caustic soda solution (25%) added gradually in 1 – 1.5 hours. The dilution with water is done in 2 hours. Add STPP, salt, urea and stabilizers. The properties like viscosity and solid content adjusted and discharged through filter to storage tank.

Paper Sizing Agent Process Flow Chart



Polyester Resin: Glycol, DEG, MEG Pthalic anhydride and maleic anhydride are charged into reactor. The nitrogen gas is added and agitator started. The heating is started to reach 170 – 175°C and held for some time or distillation to start. The gradual heating is started to reach 210 – 215°C. The reaction temperature is maintained till a required property (acid value) is attained. The vacuum is applied till the final properties are attained. The reaction mixture is cooled to 175 – 180 °C, add Hydroquinone (catalyst) and discharged into the blender where mixture is mixed with Styrene. The viscosity and acid value etc is adjusted and then the resin is stored in storage tank.

Polyester Resin Process Flow Chart



Alkyed Resin: The vegetable oil is charged with nitrogen gas and the agitator started. The Glycerine and Penta is added. The temperature is raised to 250°C, the catalyst is added and maintained for about 2 hours to get alcohol tolerance 1:3. The reaction mass is cooled to 230°C and balance glycerine / penta and phtalic is added. The temperature is raised to 260°C and maintained till required properties achieved. Then the reaction mass is cooled to 170°C and mixed with MTO for making solution (50- 55%). The final product is cooled to room temperature and stored in storage tank.

Manufacturing of PVC compounds: PVC Resin is used as main basic Raw Materials. It gives desired properties i.e. (Flexibility, Resistance to Thermal degradation, Flame retardancy by compounding the base PVC Resin with a variety of Additives – Plasticizers, Heat Stabilizers and Flame retardants at an elevated temperature. Although each individual PVC Compounder uses its own property mix of additives, they all employ a similar PVC compounding process.

PVC compounds are prepared in a batch process using blenders that allow precise temperature control the compounding process involves high intensity blending of PVC Resin and additives to form a dry blend powder which is then compounded using compounding equipment such as Farrell continuous Mixer, a buss kneader or twin screw and other machines. The compounded Mixture is then pelletized. The pellets are Spherical or Cylindrical with diameters averaging 1 to 5 mm.

