



Vulcanized fiber Characteristics

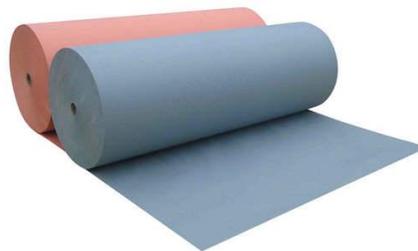
Vulcanized fiber:

- High mechanical strength(The longitudinal tensile strength is similar to that of A5 steel)
- High temperature resistance of 100 ° C, low temperature resistance of minus 40 ° C, oil resistance, wear resistance, corrosion resistance, with high elasticity
- Good processing and molding performance, can withstand all kinds of mechanical processing, such as planing, drilling, cutting, bending, grinding (polishing), etc
- Beautiful appearance, cheap, can replace some metals

The use of vulcanized fiber:

- In the mechanical industry, it is used to manufacture bearing bush, welding protective cover, mine safety helmet and so on
- In the electrical industry, used to do a variety of insulating materials, gaskets, sleeves, lightning arrester, etc
- In the textile industry, it can be used for spinning tampon barrel, spool, transport small car board and so on
- In the aviation industry, steel cardboard is used to make oil tank, sealing ring and so on
- In the automotive industry, do the ignition system in the ignition tube.
- Among other things, use it to make suitcases, door handles, etc.

China well electric make 0.3mm to 60mm roll/sheet vulcanized fiber /fishpaper

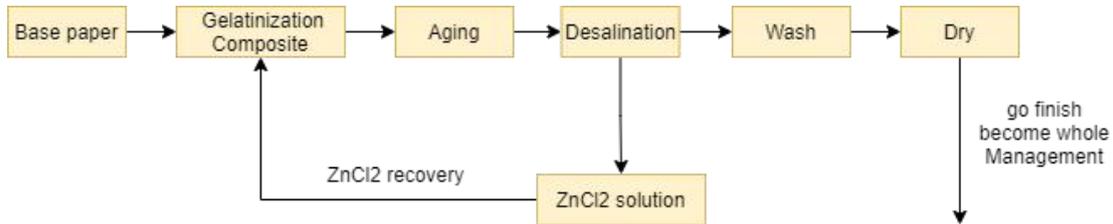




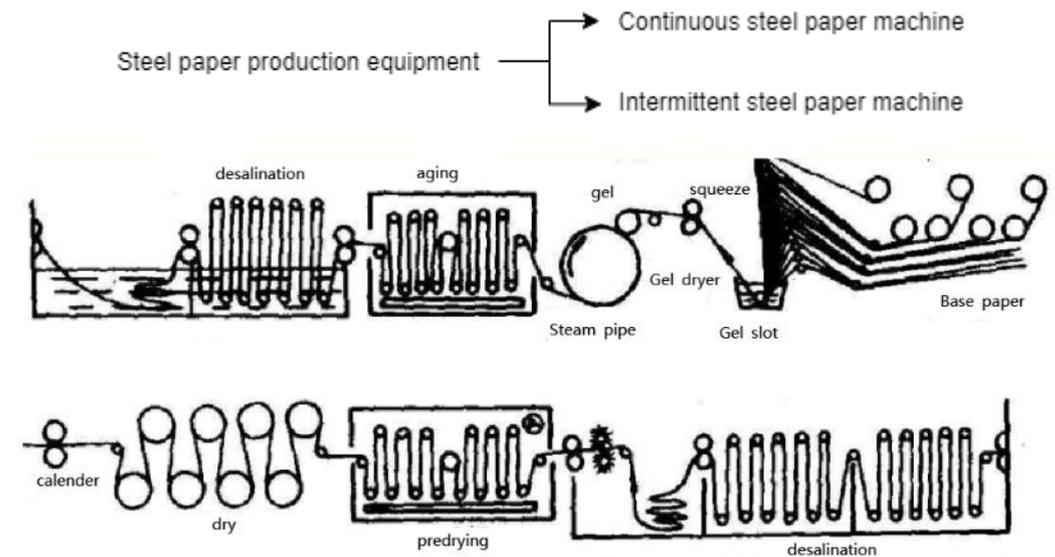
How manufacturing vulcanized fiber ?

1.1 vulcanized fiber production process and equipment

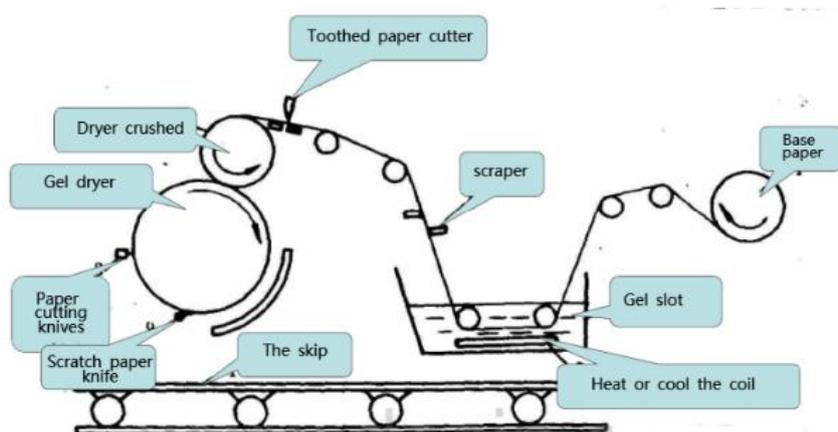
1.1.1 vulcanized fiber production process



1.1.2 vulcanized fiber production equipment

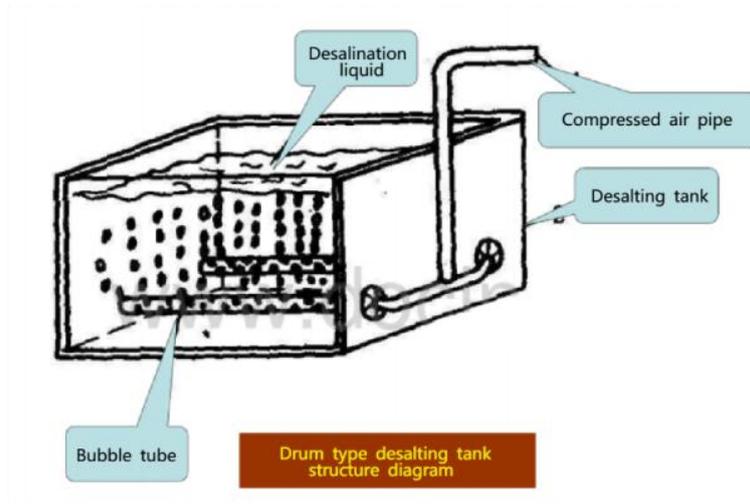


Due to the aging, desalination and drying process of vulcanized fiber are slow, continuous vulcanized fiber machine is only suitable for the thickness of less than 2mm thin vulcanized fiber, for thick vulcanized fiber, can use the bonding method, made into compound products.

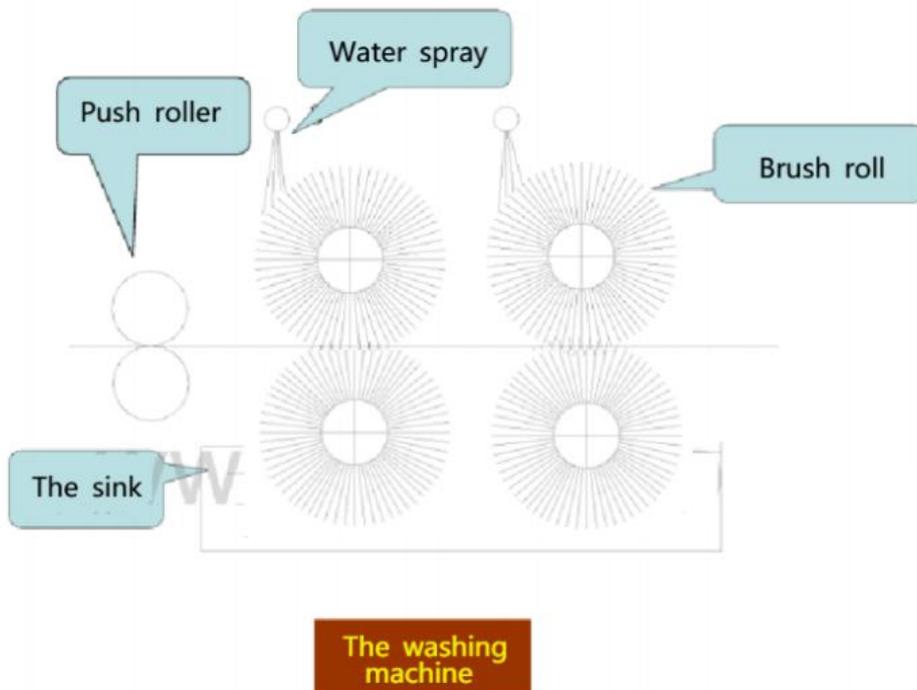




After the base paper passes through the gelatinizing tank, it is wound on the gelatinizing dryer in multiple layers. When the thickness reaches the required, the paper is cut off by the cooperation of the paper cutter and the paper cutter, and then falls onto the lower hopper and is sent to the aging process.



After aging, the vulcanized fiber is placed in the bubbling desalting tank for desalting, after desalting, it is washed by the brush washer and finally sent to the tunnel dryer for drying.

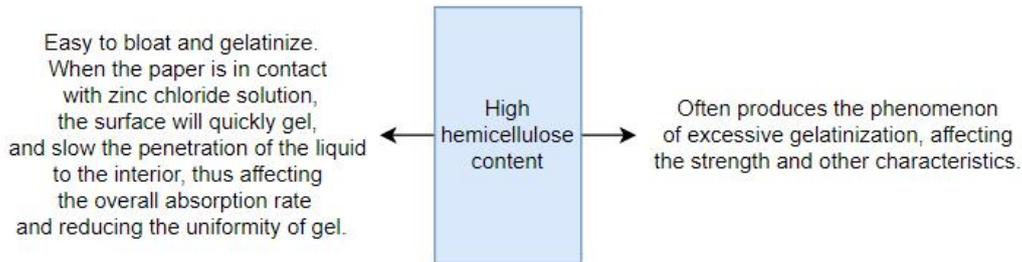




Which will factors influencing of Vulcanized fiber on the production process ?

1.1.3 the influence of base paper

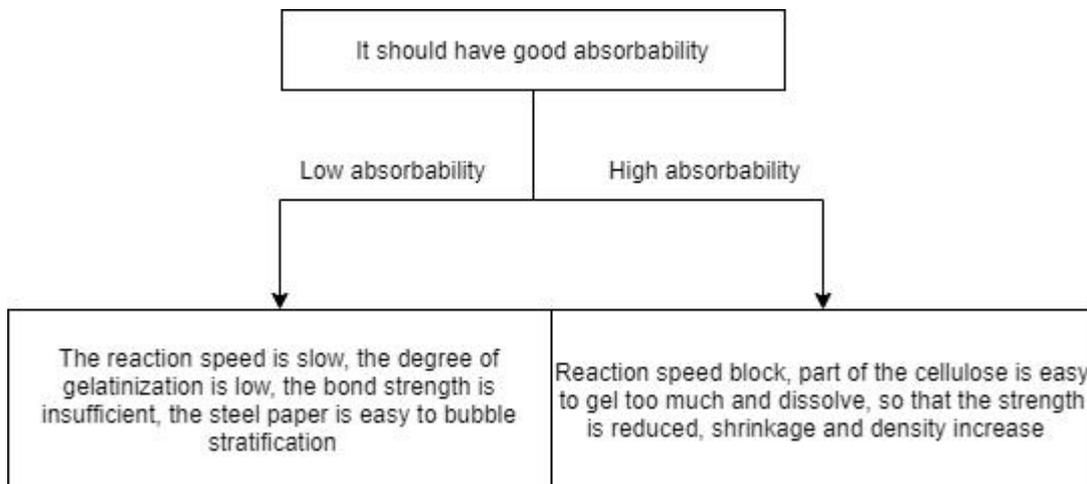
(1) Composition of base paper: hemicellulose content should not be high



Therefore, the cellulose purity of the base paper pulp is high. For higher grade vulcanized fiber, it is best to use 100% bleached cotton pulp, and for general vulcanized fiber, can be matched with 10%~20% bleached wood pulp.

(2) Absorbability of base paper

The general absorptive capacity is controlled at 35~45mm



(3) The intensity of base paper

The strength of the base paper will affect the operation of the impregnated pages and affect the strength of the final product, so a certain strength of the base paper is required.

For high quality vulcanized fiber, its vertical and horizontal fracture length should be greater than 3.5km and 2.1km respectively.

For ordinary vulcanized fiber, it should also be greater than 2.4km and 1.8km respectively.



(4) Else

- a. The organization of the base paper should be uniform, there should be no embossing, pulp and other obvious uneven phenomenon.
- b. Dust should not be too much, otherwise it will affect the uniformity of absorption and gelation, reduce the binding force between layers, easy to produce stratified foaming phenomenon, but also easy to make the surface uneven.
- c. Metal ions are easy to reduce the insulation of vulcanized fiber, so that paper brittleness, stratification, elasticity is reduced.
- d. The water content of base paper should not be too high, generally more than 10%, the vulcanized fiber after gelatinization is too soft, the elasticity is reduced, and even is crushed, and the vulcanized fiber is not made.
- e. The base paper is usually dyed gray, black or pink with dyes. The dyeing should be uniform, and the dyes should not react with zinc chloride solution.

1.1.4 glue of base paper

It is the web of base paper continuously through the gelatinizing tank containing gelatinizing agent, let zinc chloride immersed in the base paper, the fiber in the base paper swelling and gelatinizing, and then the multilayer gelatinized paper in the rolling dryer or gelatinized drying cylinder upper layer. It is the most important process in the production of vulcanized fiber, and it is very important to control the process conditions.

main influence factors:

(1) Concentration of zinc chloride solution

For absorbance of different base paper, its concentration should be different. The absorbance of 45mm base paper, the concentration of 1.96~1.98 is more suitable. Concentration too low, insufficient gelatinization, low strength. Concentration is too high, excessive gelatinization, strength is also reduced. When the absorbability of base paper is low, the strength, bonding force and density of vulcanized fiber increase with the increase of zinc chloride solution concentration. When the absorbability is high, the above indexes also increase at the initial stage of concentration increase, but when the concentration reaches a certain value, the fiber is too damaged and the strength begins to decrease.

(2) Gelation temperature

Refers to the temperature and ambient temperature of the gelling liquid and gelling dryer. At different temperatures, the base paper absorbs different amounts of zinc chloride solution. If the temperature range is appropriate, the strength of vulcanized fiber will increase with the increase of temperature.

- Ambient temperature: it should not be higher than 35 °C in summer and 50 °C in winter, in order to avoid excessive swelling and glue dissolution of paper, resulting in broken ends and reduced strength of vulcanized fiber.



- The temperature of the gelatinizing liquid should not be too low, 20-40 °C, otherwise, the strength of the paper will be reduced after gelatinizing.
- The temperature of the gelatinized dryer also needs to be controlled. In summer, when it is higher than 70°C, the vulcanized fiber after gelatinization will become soft and easy to produce paper diseases such as stripping; The temperature of the drying cylinder is too low, the vulcanized fiber is very hard after gelatinization, and the zinc chloride solution on the surface of the vulcanized fiber is not pressed, which is easy to produce paper diseases such as sticking, wrinkling and stratification.

(3) Gelation time

This includes the period from the start of impregnation of the base paper into the gelatinizing tank to the end of compounding on the forming dryer or gelatinizing dryer. Too long gelatinization time, fiber dissolution, excessive damage; Gelatinization time is too short, fiber swelling and bad gelatinization. Gelatinization time should be determined according to the specific situation, generally in 2~ 2.5s.

- ① The absorbability of general base paper should be shortened
- ② The high gel temperature should shorten time
- ③ If the thickness is large, it should be prolonged
- ④ High concentration of zinc chloride ,high viscosity, the time should be extended.

(4) purity of gelatinizing agent

- Impurities in the gelatinizing liquid: not conducive to gelatinizing and papermaking strength. When calcium, iron and copper chloride exists, especially calcium salt, affect the internal bonding force of vulcanized fiber, which affects the strength, easy to layer foaming, but also affect the electrical insulation of vulcanized fiber.
- Free acid: Industrial zinc chloride often contains a small amount of free acid, which also affects gelatinization and paper strength. Sodium carbonate is generally used in production to adjust.

(5) rolling dryer line pressure and rolling time

The line pressure of rolling dryer has an important effect on the interlayer bonding and tightness of vulcanized fiber for intermittent operation. General line pressure 1.2-1.5*10..... It is advisable to 4 n/m. There is less continuity. Time is proportional to thickness.

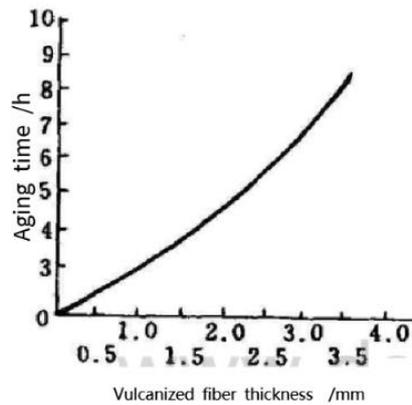
1.1.5 Aging and desalination

Aging refers to the process of gradual cooling of vulcanized fiber in the air after gluing. **The effect of aging:** in the aging process, the paper is not gelatinized fiber gradually reduced, the degree of gelatinization gradually increased. The paper tends to be uniform, the binding force between layers is enhanced, the insulation performance is improved, and the absorption rate decreases correspondingly. **Aging time:** should be determined according to the thickness of the paper, too long will have the opposite effect. **Aging temperature:** room temperature in summer, 30~40°C in winter.



Desalination refers to the process of leaching out the excess zinc chloride inside vulcanized fiber with zinc chloride desalting solution of lower concentration. **The effect of desalination:** improve the insulation of vulcanized fiber, make the paper layer more compact, and recover the part of zinc chloride. After desalting, zinc chloride content in vulcanized fiber should be less than 0.2%. **The principle of desalination:** it depends on the concentration difference between the paper and desalting solution, so that zinc chloride diffuses and dissolves. If the concentration difference is too large, the osmotic pressure will be high, easy to cause bubbles in the paper, resulting in paper layer.

Countercurrent washing is generally used to ensure the concentration difference of zinc chloride inside and outside the paper. Start with a concentration of 30%~ 40% zinc chloride solution to wash, gradually reduce the concentration of the lotion each time should not be too large, finally with clean water to 0. 2% below. **The temperature of lotion:** related to the season, generally 36~40 °C . The final water temperature is 40~60 °C . Thick cardboard first 1-4 times about 25 °C , to prevent stratified bubbles. **Desalting time:** depending on the thickness of vulcanized fiber.



vulcanized fiber thickness and aging time diagram

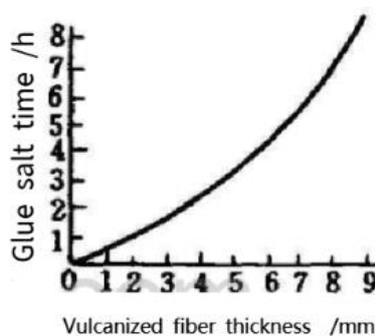


Diagram of relation between vulcanized fiber thickness and desalting time



For the intermittent vulcanized fiber machine, the vulcanized fiber removed by the glue machine is cut into a certain specification according to the need, drilled at one end, hoisted to the desalting rack, and immersed in the desalting tank, two pieces of vulcanized fiber spacing 10~20mm. For continuous vulcanized fiber machine, according to the countercurrent washing principle, the desalting liquid in the desalting tank should be regularly replaced, and the concentration should be reduced successively. Generally, the thicker the vulcanized fiber, the longer the desalting time, the more times of liquid change, the longer the interval time of liquid change.

1.1.6 vulcanized fiber drying

The tightness of vulcanized fiber, small porosity, water is not easy to spread out, drying is more difficult. The shrinkage rate of vulcanized fiber drying is large, longitudinal: 13%~15%, transverse: 23%~26%, thickness direction: 50%. It is easy to appear uneven drying, severe warping deformation phenomenon.

For the continuous vulcanized fiber machine, the drying chamber and the drying cylinder can be combined. The temperature of the drying room should not exceed 60°C, so that the paper is pre-dried under moderate conditions to ensure that the water in the paper diffuses outward. then it is dried by the dryer. The temperature of the dryer should not be too high. After drying, the paper can be kept in a good flat state.

For intermittent vulcanized fiber equipment, corridor dryer can be used to hang the vulcanized fiber indoors and dry slowly at a low temperature (60°C), but the drying speed is slow and the efficiency is low. Tunnel dryer can also be used to hang the vulcanized fiber on the car, pushed into the dryer, using 90~100°C hot air drying. In order to improve the drying efficiency, for thick vulcanized fiber, the maximum temperature can reach 120°C.

1.1.7 plastic vulcanized fiber

(1) plastic vulcanized fiber

Shaping is the dry twisted vulcanized fiber for water immersion, water balance, flattening or calendering treatment. The role of plastic: dry vulcanized fiber is warped uneven, especially intermittent production of vulcanized fiber, so must be plastic.

(2) Shaping method:

- a. vulcanized fiber must be soaked back to moisten before shaping, so that the plasticity is enhanced. The water immersion temperature is 70°C, and the water content after water immersion is 16%~20%. The immersion time depends on the thickness of the vulcanized fiber, the thicker the longer the time.
- b. Water-immersed vulcanized fiber, its plastic enhancement, can be stacked on the high pressure weight, placed 18~30h, on the one hand to balance the water, on the other hand to make it preliminary leveling.
- c. The moisture absorbed by the vulcanized fiber is needed to be balanced drying in the drying room. The temperature is 60~70°C, and the moisture is 8%~ 10%. The drying time varies according to the thickness of the vulcanized fiber.



- d. After balance drying, still need to be placed for 3 to 6 days. The paper moisture and environment balance, to ensure that no deformation after flattening.
- e. After the balance of moisture, the vulcanized fiber was placed on a hot press to flatten. The hot press heated the plate at a temperature of 110~120°C and a pressure of 3.5mpa. The hot pressing time varied according to the thickness of the vulcanized fiber, increasing by about 5min for every 1mm thickness.
- f. Pressing can be calendered to improve the smoothness and tightness of the surface. The calendering system adopts the common double roller calendering machine for paperboard calendering, which can reciprocate calendering for many times as required.





2. Recovery and purification of zinc chloride

2.1 The necessity and method of recycling

Necessity:

zinc chloride, which is required for the gluing of vulcanized fiber, will be leached out during the desalination process. Leaching zinc chloride must be recycled to reduce costs and eliminate pollution.

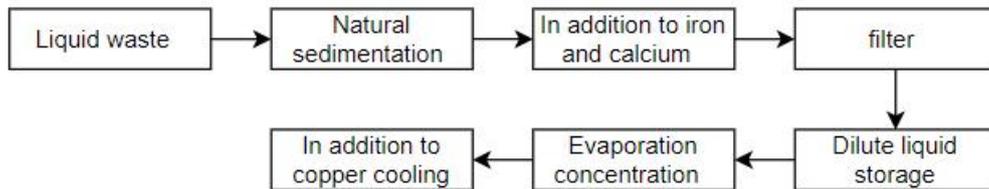
There are many ways to recycle:

Precipitation method: Add Na₂CO₃ to zinc chloride solution, generate ZnCO₃ precipitate, separate precipitate, add hydrochloric acid regeneration.

Electrolysis method: Electrolyzing ZnCl₂ solution to generate Zn(OH)₂ precipitation, H₂ and Cl₂, and the HCl generated by the combustion of the latter two can be regenerated by interaction with Zn(OH)₂.

In China, evaporation and concentration method is relatively economical and feasible.

2.2 Evaporation concentrate



Natural sedimentation is to remove impurities such as fibers mixed in the production process, and then remove calcium and iron by chemical method.

Add ZnSO₄ to remove calcium:



Add KClO₃ or K₂CrO₇ to remove iron:



After this reaction is completed, the alkalinity of the zinc chloride solution is adjusted according to the need. At pH 4.5, the ferric ion is hydrolyzed into Fe(OH)₃ precipitate, so that the removal of iron and the regulation of alkalinity are completed simultaneously.

The CaSO₄ and Fe(OH)₃ precipitates can be removed by filtration. Then, the basic purification of dilute liquid is evaporated and concentrated to the required concentration (70%~72%). After cooling, zinc flakes are added to replace the copper in the solution:



The standard content of impurities in ZnCl₂ solution is: Fe < 0.024%, Ca < 0.4%, Cu < 0.025%, if this limit is not exceeded, it is not necessary to purify.

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