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Optimal Design Refrigeration System for a Mucilage Glue Fiber Factory

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Abstract: In a mucilage glue fiber factory, the design of the refrigeration system takes into account the characteristics of mucilage glue fiber production and fully uses the refrigeration compressor heat to economize energy and reduce the production cost. In this paper, the author introduces different points of this kind of design with conventional design. For efficient use of the compressed heat of the refrigeration system, the designer should calculate the number of condensers according to the changes that the refrigeration system undergoes after using the soft water as cooling water. To economize the investment, the designer should use the refrigeration workshop and the soft water workshop and obtain optimum processing to shorten the duct. Through an economizing energy analysis, the paper demonstrates that an optimum design for a refrigeration system for a mucilage glue factory has a significant energy saving potential.

Key words: Mucilage glue fiber factory、Refrigeration system、Economize energy、 Optimum design

1. INTRODUCTION

The production of mucilage glue fiber is one kind of chemical production. Many chemical reactions in the production process must carry on under the constant temperature and constant humidity condition. The majority of production workshop must carry on the air conditioning, like the original fluid preparation workshop, the spinning workshop, production of cylinder workshop and so on. At the same time, in the production of mucilage glue fiber, some chemical reactions are the exothermic reaction, the part of production equipment need to decrease temperature using the freezing salt water to ensure the chemical reaction can carry on, like etiolating machine and so on. Then separate the sideline production sodium sulfate in the production, and decrease the temperature of Sulfuric acid solution to congeal and Separate out using the freezing salt water, such as mirabilite crystal machine and so on. Thus needs to provide the huge refrigeration system. 10,000 tons production scales, must provide 7,000 ~ 7600KW/h approximately the refrigeration ability, which is the refrigeration system in winter also has 30 ~ 40% load. At the same time, the mucilage glue fiber factory produces the product all needs to be dry, the production also are packed by many papery packing cases, making the packing case also need to dry. The refrigeration system of mucilage glue fiber factory is designed according to the convention. The refrigeration system divides into two systems. One is the freezing salt water preparation system, which is used in the preparation of mucilage glue and separating out of the acid bath and the air conditioning of original fluid workshop. It is the perennial movement system. The other is the air conditioning water preparation system, used in the air conditioning of spinning and reorganization workshop. It is seasonal movement system. Fig 1 show.

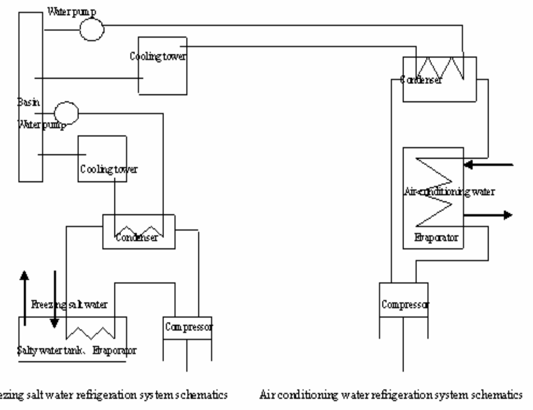

Fig 1 two refrigeration systems of mucilage glue fiber

2. REFRIGERATION SYSTEM SUPERIOR DESIGN PROPOSAL IN MUCILAGE GLUE FIBER FACTORY

2.1 Refrigeration system superior design proposal in mucilage glue fiber factory

Conventional mucilage glue fiber factory refrigeration system design and another enterprise refrigeration system design have no big difference. First, carry on the cold load computation. Then, choose the refrigeration unit according to the cold load. Second, decides the area of condenser and the cooling water quantity according to Unit's refrigeration quantity. Then, choose the cooling tower and the water pump. Third, complete the system design according to the refrigeration flow. The mucilage glue fiber factory refrigeration system superior design must carry on the design calculation and choose the unit according to the conventional design method. The most importance is that carry on the design of refrigeration system according to the production characteristic and the technical process of the mucilage glue fiber factory. This article mainly introduces the difference of the superior design and the conventional design.

Mucilage glue fiber factory refrigeration system characteristic ----enormous system, annual movement: The production of mucilage glue fiber has another characteristic is that the production of mucilage glue consumes much soft water. 10,000 tons production scales, It consumes the soft water approximately (contain kapok oar dregs production water) 600 tons/hours, more than 300 tons/hours must heat up to about 50 ℃, serve as the concise workshop washing water. More than 100 tons/hours must heat up to about 36 ℃, serve as the spinning workshop to eliminate acid water; The other used in the oar dregs production. The temperature of soft water in the oar dregs production is a normal temperature. But if the temperature does not surpass 50 ℃, it does not have the influence to the oar dregs production quality. The product which mucilage glue fiber production enterprise produces all needs to be dry, the product also needs a great deal of papery packing case to carry on the packing, making the packing case also need to dry.

The most superior design proposal in mucilage glue fiber factory refrigeration system. It is according to the mucilage glue fiber production characteristic, fully use the compression heat which produces in the refrigeration compressor to achieve the goal that recycle waste and save the energy and reduce the cost. The design takes the following plan: First uses the refrigeration compression heat to drying the product packing case. Then, substitute the hard water with the soft water to cooling the refrigeration system using the production water in the concise workshop, the spinning workshop and the liquid dregs workshop. The production soft water obtains the certain elevation of temperature in the concise workshop and the spinning workshop. It can economize the partial steam to heat up these soft water,

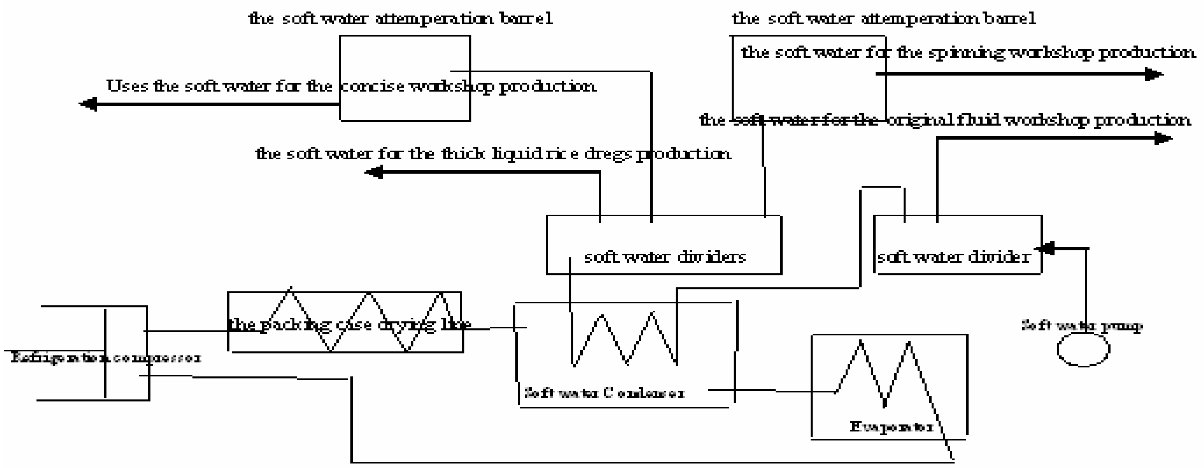

Fig 2 sketch map of using heated soft water as the cooling water

although elevates temperature of the soft water after the condenser could not achieve the production craft requirement, may again deliver these soft water into attemperation barrel to elevate temperature in order to achieve the production technological requirement.

The temperature of soft water in the liquid dregs workshop production slightly high, does not have the influence to the quality, this part of soft water only gets up the cooling effect, achieves the goal that the cancellation cooling system circulating water pump and the cooling tower and saves electrical energies and the equipment invests. This design proposal whether accepted, the most importance is that the process condenser, the quality of soft water cannot go bad; Otherwise it can affect the mucilage glue fiber production quality. Therefore, the topic group passes through the great deal of experiments and has the encouraging result [1] [4]. So long as the condenser uses the stainless steel manufacture. Through condenser soft water, its qualitative index besides the bacterium index have increase, the other index do not have the change. Most superior design proposal like Fig 2 shows.

If the mucilage glue fiber production enterprise does not construct the liquid dregs workshop, the production needs the liquid dregs buys from outside. Then the annually movement refrigeration system replace the cooling water cooling system, The seasonal movement refrigeration system still retain the cooling water cooling system.

After the computation, the soft water condenser and the hard water condenser must parallel installment, and establishment cooling water circulation cooling system in the hard water cools partial. if the soft water used in production which uses to make the cooling water not to be able to achieve the cooling water total quantity the request. This kind of design is simple. The soft water condenser and the hard water condenser can also in line arrangement, take the soft water condenser as the first level of cooling system; The hard water condenser in line arrangement after the soft water condenser makes the second level of cooling system (to see Fig 3).

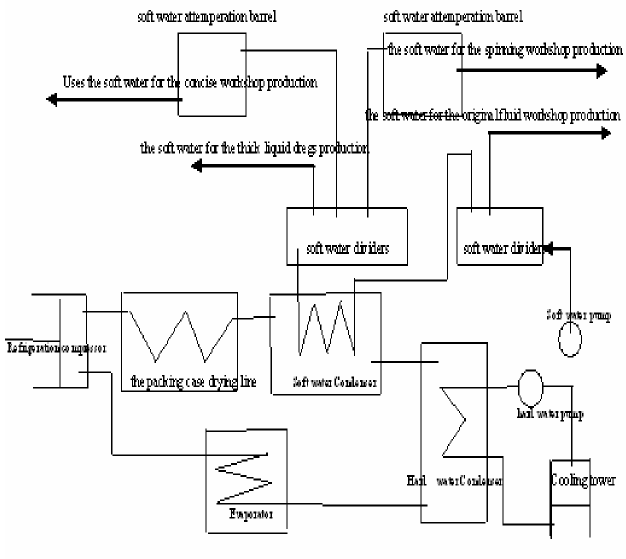

Fig 3 sketch map of using part of heated soft water as the cooling water

The soft water condenser does not use the cooling water circulatory system and Cooling equipment, and the hard water condenser use cooling water circulation and cooling equipment. We must pay attention to that the condenser adopts the way two levels in line arrangement, it is possible to cause the section of streaming refrigeration substance compression vapor diminish, and the refrigerator exhaust pressure advance and the refrigerator performance go bad. Therefore, it needs to calculate the circulation area of two levels of condensers refrigeration substance to ensure the refrigerator performance not to go bad. It is possible increase quantity of the condenser. We can obtain the higher soft water temperature by Series way compared to parallel way. It is worth to be used from the point of refrigerator compression heat. But this design must be more complex.

2.2 production workshops optimized arrangement

The mucilage glue fiber production technical process: Liquid dregs -> Original fluid -> Spinning -> Concise -> Reorganization. In order to fully use the compression heat of refrigerator, reduces the pipeline, Saves the investment. The workshop best arrangement is take refrigeration workshop and the soft water workshop as the center, various workshops around them, chart 4 shows. The condition of various factories is different, cannot according to the following plan to arrange the workshop completely, It is cannot change the design that taking the refrigeration workshop and the soft water workshop as the center. It is different from the conventional design.

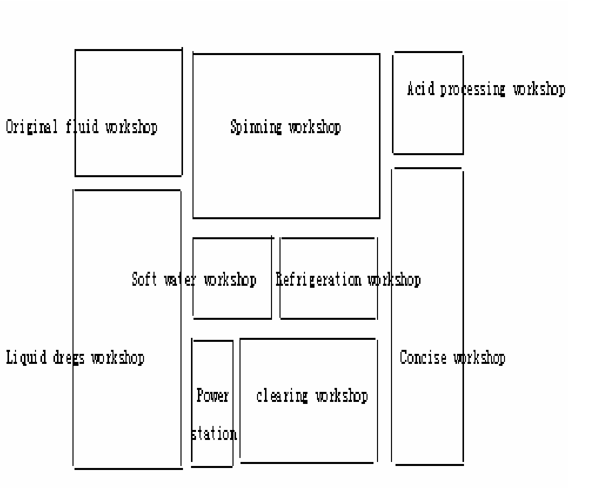

Fig 4 optimization arranged of production workshop

3. THE PACKING CASE DRYING LINE DESIGN AND THE REFRIGERATION COMPRESSION THERMAL UTILIZATION

3.1. The constitution and work principle of the packing case drying line

The constitution of drying line shows in Fig 5.

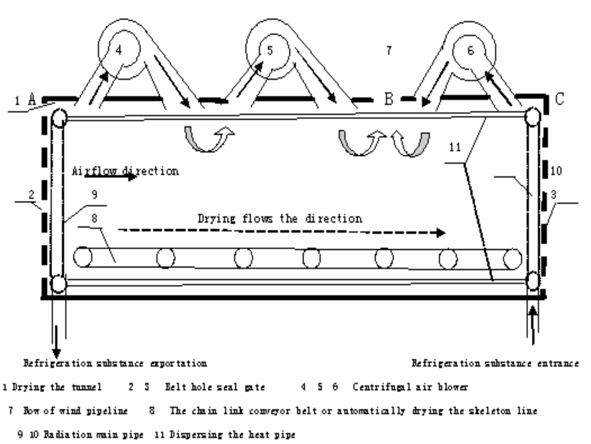

Fig 5 constitution of the drying line

The concrete exterior preservation heat drying tunnel 1, the seal gate with hole around 2, 3, the centrifugal-type air blower 4, 5, 6, the eduction pipe 7, the stepless speed regulation chain link conveyor belt or the drying automatic thrust axis 8, the refrigeration substance radiation main pipe 9, 10, radiation pipe 11 and so on. The drying tunnel AB section is the main drying section. The BC section is the assistance drying section. The centrifugal air blower 4, 5 can decide the quantity according to the dryer length, but centrifugal air blower 6 install one.

The principle of work: The flow direction of refrigeration substance and the thing flow direction are opposite. The flow direction of refrigeration substance is adverse current type. The object advance in drying tunnel, elevate temperature and evaporate moisture to achieve the drying goal; The fresh air from the seal gate which have holes 2, in 3 enters, It is pulled out of the tunnel by the centrifugal air blower. The temperature and the relative humidity of air rise in the host drying section flow process. In the assistance drying section, the temperature elevates, the relative humidity reduces, but in the air the moisture content increase. The drying tunnel uses the characteristic of the air temperature elevating, the relative humidity changing, and the absorption moisture ability to work.

3.2. The main design parameter of drying line

(1) Drying ability

The drying ability of drying line is decided by the refrigeration system providing refrigeration compression heat. Supposing the refrigeration compression heat which refrigeration system each hour provides is Q kw·h. Each hour drying substance (drying ability of drying line) is G kg, its moisture content is d_1, after dried the moisture content is d_2, the air circulation in drying line is M kg. According to the thermal equilibrium obtain:

$$Q=G[1-(d_2-d_1)]C_1(T_2-T_1)+G(d_2-d_1)(C+\gamma)+M(h_4-h_3) \tag{1}$$

$$G=\frac{\alpha Q-M(h_4-h_3)}{[1-(d_2-d_1)]C_1(T_2-T_1)+(d_2-d_1)(C+\gamma)} \tag{2}$$

If moisture content of the dried thing not large, it can be approximate calculation as follows:

$$\alpha Q=GC_1(T_2-T_1)+G(d_2-d_1)\gamma+M(h_4-h_3) \tag{3}$$

$$G = \frac{\alpha Q - M(h_4 - h_3)}{C_1(T_2 - T_1) + (d_2 - d_1)\gamma} \quad (4)$$

In the formula: α is the effective use factor of the drying line refrigeration compression hear. Consider the factor that drying line radiation and lack of the vaporing moisture in drying line assistance section and so on, taking α=0.95. T_1 is the ambient temperature □; T_2 is the ambient temperature □; C_1 is the ratio heat capacity of dried substance, the unit is $\frac{kw \cdot h}{kg.°C}$; C is the ratio heat capacity of water, the unit is $\frac{kw \cdot h}{kg.°C}$; γ is the latent heat of vaporization of water, the unit is $\frac{kw \cdot h}{kg}$; h_4 is the enthalpy when the temperature of the air is T_2 and the relative humidity is φ_2, The unit is $\frac{kw \cdot h}{kg}$; h_3 is the enthalpy when the temperature of the air is T_2 and the relative humidity is φ_2, The unit is $\frac{kw \cdot h}{kg}$; the marks like forecited.

$$Q = W(T - T_0) + (1 - X)\gamma_0 \quad (5)$$

In the formula: W is the current capacity of refrigeration substance in refrigeration system, kg/h; T is the temperature □ when the refrigeration substance enter drying line dispersion heat pipe; T_0 is the condensing temperature □ of the refrigeration substance; X is the percentage of not the refrigeration that working substance in dispersion heat pipe; γ_0 is the latent heat of vaporization of refrigeration substance, The unit is $\frac{kw \cdot h}{kg}$.

(2) Wind amount computation of centrifugal air blower

When the ambient temperature is T_1 □, the air relative humidity is φ_1, the air and the dried substance enter the drying tunnel, it leaves the drying tunnel when temperature is T_2 □, in order to use effectively the refrigeration compression heat, suppose the air relative humidity is 90%, we can find out the air initial absolute moisture content is d_3 kgby the air enthalpy wet chart, the final state absolute moisture content is d_4 kg, by wet balances:

$$M(d_4 - d_3) = G(d_1 - d_2) \quad (6)$$

$$M = \frac{G(d_1 - d_2)}{d_4 - d_3} \quad (7)$$

We must pay attention to, because the temperature difference between the summer air temperature and drying line exhaust amount is small, unit quality air absorption moisture content is few, Thus, the air current flux is big, in design calculation, using the summer air parameter to calculate drying line air flow, It is the main basis to choose drying line centrifugal air blower. Take 1.05 time of air currents flux as the air blower amount. The air blower is chose result in the current capacity is determined. We must use the winter temperature to calculate that heat quantity needed in drying line.

(3)The total area of dispersion heat pipe

The total area F of dispersion heat pipe is decided by that the heat quantity transmission of dispersion heat pipe and the heat of the drying capacity need in the drying line design. By thermal equilibrium:

$$KF\Delta T_m = G[1-(d_2-d_1)]C_1(T_2-T_1) + G(d_2-d_1)(C+\gamma) + M(h_4-h_3)$$

$$F = \frac{G[1-(d_2-d_1)]C_1(T_2-T_1) + G(d_2-d_1)(C+\gamma) + M(h_4-h_3)}{K\Delta T_m} \quad (8)$$

In the formula:: F is acreage of dispersion heat pipe, The unit is m^2; K is transfer heat coefficient of the dispersion heat pipe, the unit is $\frac{kw}{m^2 \cdot °C}$; ΔT_m is computation average temperature difference of the dispersion heat pipe, The unit is $°C$, or calls the logarithm average temperature difference, the formula which is educed by the related literature[2] is:

$$\Delta T_m = \frac{\Delta T' - \Delta T''}{\ln \frac{\Delta T'}{\Delta T''}} \quad (9)$$

(4) The length of drying tunnel

The length of drying tunnel is decided by the total area of dispersion heat pipe F, the size of the dispersion heat pipe, and installation factor space and so on. The size of dispersion heat pipe is decided by the cross-section S that the cross-section of dispersion heat pipe subtracts the cross-section of the main pipe of the refrigeration substance compression steam transportation.

$$\frac{n\pi d^2}{4} \geq S \qquad (10)$$

$$d \geq \sqrt{\frac{4S}{n\pi}} \geq 15(mm) \qquad (11)$$

In the formula: n is the number of duct. The number is determined by the installation space 0.07~0.1 m of each pipe. The length of the dispersion heat pipe is calculated based on the follow type:

$$l \geq \frac{4F}{n\pi d} \qquad (12)$$

The length L of drying tunnel is 1.2 time of the length of pipe.

$$L = 1.2l \qquad (13)$$

3.3. The value of using of the refrigeration compression heat that the packing case drying line

Take the drying line of paper packing case in mucilage glue fiber factory as the example to analysis value of using of the refrigeration compression heat. In 10,000 tons mucilage glue fiber factory, the refrigeration ability is 6500 kw. Every 15 kg production, needing a packing case, the weight of each packing case is 1.25 kg, the quality of the production in whole year according which in 11th month to calculated, the quality G of packing case needed in each hour is 105 kg. In the processing process, if the moisture content of is 18%, the moisture content of packing case dried is 10%. the air computation temperature in summer is 28, according to the relative humidity as 70% to calculate, the air computation temperature in winter is 5, the relative humidity according to 80% calculate, air temperature leaving from the drying tunnel is 40, relative humidity is 90%. We can get d_3=50.5g/kg, d_3=15.5g/kg by looking up the summer air enthalpy wet chart. We can also get $h_4 = 1.069 \times 10^{-2} kw \cdot h / kg$, $h_3 = 1.1108 \times 10^{-3} kw \cdot h / kg$ by looking up the winner air enthalpy wet chart. According the formula (7) to calculate the air current capacity M=24000. The ratio heat capacity of paper is $C_1=3.332\times10^{-4}$ kw·h/kg·℃. The ratio heat capacity of water is C=11.6267×10-4 kw·h/kg·℃. The latent heat of vaporization is γ=0.6682 kw·h/kg. According the formula (1) to calculate Q=1427.7 $kw \cdot h$. It is occupying the total quantity of refrigeration compression heat. $1427.7 \Big/ 6500 \times 4/3 = 16.46\%$

4. THE COOLING SYSTEM DESIGN AND THE VALUE IN USE OF REFRIGERATION COMPRESSION HEAT

The proportion of soft water condenser and hard water condenser are decided by the cooling capacity of soft water, which used the follow formula to calculate.

$$Q_1 = W(t_1 - t_2)\,C \qquad (10)$$

In the formula: Q_1 is the cooling capacity of soft water, in kw; W is the consumption of soft water, in kg/h; t_1 is the soft water maximum temperature of condenser export in Summer; t_2 is the soft water maximum temperature in summer, in ; C is the ratio heat capacity of water, in $\frac{kw \cdot h}{kg.°C}$.

The proportion Γ of soft water condenser is

$$\Gamma = \frac{Q_1}{Q(1-\alpha)} \quad \ldots\ldots \qquad (11)$$

In the formula: Γ is the proportion of the soft water condenser

4. 1 The computation of condenser

In order to ensure the quality of soft water has no change after passing condenser to raise temperature, the part of condenser direct contact with water like (envelop, row duct, plank) use the stainless steel to manufacture. It both may ensure the soft water quality, and may enhance the use and the safety. It is advantageous in the condensation heat transfer and the mucilage glue fiber the quality of production. The cooling water changes the hard water to the soft water. In the condenser, there has few incrustation on the row duct. The heat transfer efficiency will enhance. We can accord the follow formula to estimate the enhanced heat transfer efficiency η in condenser:

$$\eta = \frac{q_1 - q_2}{q_2} = \frac{\dfrac{(t_{f1}-t_{f2})\pi d}{\frac{1}{\alpha_1}+\frac{\delta}{\lambda}+\frac{1}{\alpha_2}} - \dfrac{(t_{f1}-t_{f2})\pi d}{\frac{1}{\alpha_1}+\frac{\delta}{\lambda}+R_j+\frac{1}{\alpha_2}}}{\dfrac{(t_{f1}-t_{f2})\pi d}{\frac{1}{\alpha_1}+\frac{\delta}{\lambda}+R_j+\frac{1}{\alpha_2}}}$$

$$= \frac{\frac{1}{\alpha_1}+\frac{\delta}{\lambda}+R_j+\frac{1}{\alpha_2}}{\frac{1}{\alpha_1}+\frac{\delta}{\lambda}+\frac{1}{\alpha_2}} - 1 \quad \ldots \quad . \quad (12)$$

In the formula: q_1 is the capacity of heat transmission of soft water and stainless steel pipe in condenser; q_2 is the capacity of heat transmission of hard water and carbon steel pipe in condenser. α_1 is the heat-transfer coefficient of inner condenser pipes; α_2 is the heat-transfer coefficient of flank condenser pipes; δ is the thickness of condenser pipes; λ is the heat transfer coefficient of condenser pipes; R_j is the transfer thermal resistance incrustation in the pipes. Looks up from the related literature [2]:

α_1 = 4000～6000 J/m^2.s.□； α_2 =1300～2300 J/m^2.s.□ ； δ =0.002 m ； λ = 45.3J/m^2.s.□

R_j =0.0001～0.00015 m^2.s.□/J

Using the above data and the formula (13) we can get η＝9.4~23％.Using the above data and the formula (13) we can get = 9.4 ~ 23%. After In other words, after using soft water as cooling water, the number L of condenser or condensation area S of new design condenser which has the reduction. Uses the follow formula to calculate:

$$L = \Gamma \frac{L_1}{1+\eta} \text{（integer）} \quad (13)$$

$$S = \Gamma \frac{S_1}{1+\eta} \quad \ldots(14)$$

In the formula: L_1 is the total number of condenser according to the hard water as cooling water to design.

S_1 is the total condensation area of condenser according to the hard water as cooling water to design.

If decided to adopt the soft water condenser and the hard water condenser in line arrangement. In mucilage glue fiber factory, no matter which has constructed the thick liquid dregs production workshop, which use the fewer soft water, needs the fewer soft water condenser; Or which has constructed the thick liquid dregs production workshop, uses the more soft water, use the more soft water condenser, uses the fewer hard water condenser. In this situation, consider when the refrigeration substance compression steam through the soft water condenser pipe or the condenser lateral section. Because the circulation area is small that can raise the pressure, which can causes the refrigerator performance to go bad. In order to avoid the refrigerator performance going bad, ensure the refrigeration substance compression steam through the condenser pipe and the lateral section of condenser is bigger than lateral section of the transportation refrigeration substance compression steam. Under when design should satisfy the follow formula:

$$\sum_{i=1}^{n} S_i \ge \sum_{i=1}^{n} SS_i \ge \sum_{i=1}^{m} S_i \ge \sum_{i=1}^{m} SS_i \ge S_A \quad (15)$$

In the formula: n is the number of soft water condenser which plans to design, S_i is the lateral section area when the refrigeration substance compression steam through the condenser pipes; m is the number of the hard water condenser which plans to design, $m = \Gamma \cdot L_1$; SS_i is the lateral section area, which is a half of lateral section area of condenser subtract the lateral section area of row ducts occupied. S_A is the lateral section area of the refrigeration substance compression steam transportation the main pipe.

The number of the condenser is limited by SS_i and S_i which is defined before. When in $\sum_{i=1}^{n} S_i$ or $\sum_{i=1}^{n} SS_i$ and $\sum_{i=1}^{m} S_i$ or $\sum_{i=1}^{m} SS_i$, there is a lateral section area which is smaller than S_i which is the refrigeration substance compression steam transportation the main pipe, The number of condenser in series are more than parallel connection. Satisfy the follow formula:

The number L of soft water condenser

$$L = \Gamma \frac{L_1}{1+\eta} \geq \frac{S_A}{S_i} \text{ and } L = \Gamma \frac{L_1}{1+\eta} \geq \frac{S_A}{SS_i} \quad (16)$$

The number $L^`$ of hard water condenser

$$L^` = \frac{L_1}{1+\eta} - L \geq \frac{S_A}{S_i} \text{ and}$$

$$L^` = \frac{L_1}{1+\eta} - L \geq \frac{S_A}{SS_i} \quad (17)$$

In fact, the hard water condenser series behind the soft water condenser, the major part refrigeration substance steam already liquefied, can smaller than the formula (17) computation value; But the soft water condenser series before must satisfy (16) the formula condition. Special in the situation that soft water condenser few.

4. 3. The efficiency of energy conservation

(1) The value in use of refrigeration system compression latent heat

The refrigeration system compression latent heat in the normal condition to be equal to the soft water quantity which needs to heat up in production and ratio of the cooling water total quantity in cooling refrigeration system.

$$\eta_1 = \frac{\sum_{i=1}^{n} W_i}{W+G} = \Gamma \frac{\sum_{i=1}^{n} W_i}{W} \quad (18)$$

In the formula: W_i is the quantity of soft water which needs to heat up in the I_{th} workshop (t); W is total quantity of soft water in the cooling refrigeration system（t）；G is total quantity of hard water in the cooling refrigeration system（t）.

In the original Shaoyang chemical fiber (5,000 tons productions scales), we use the above formula according the situation that the use of soft water and the use of after heating to calculate, The effective of the value in use of refrigeration system compression latent heat is 36.997％[3].

(2) The efficiency of saving electricity

In the revolution of refrigeration system energy conservation, besides use refrigeration system compression heat, but also saving the massive electrical energies by the stopped original cooling system equipment. Use the follow formula to calculate the efficiency of saving electricity:

$$\eta_2 = \frac{\sum_{i=1}^{F} N_i T_i - \sum_{j=1}^{E} N_j T_j}{\sum_{n=1}^{k+l} N_n T_n} \ldots \quad (19)$$

In the formula: $\sum_{i=1}^{F} N_i T_i$ is installing efficiency multiply the running time of refrigeration cooling system equipment (water pump, cooling tower) which is canceled F of according to convention methods to design; $\sum_{j=1}^{E} N_j T_j$ is installing efficiency of electrical machinery which in order to increase the pressure of soft water needing to increase E soft water pump electrical machinery multiply the running time; $\sum_{n=1}^{k+l} N_n T_n$ is installing efficiency multiply the running time of using the convention methods design in the whole refrigeration system have *K* + *L*, in Kw·h;

Carries on the analog computation to the original Shaoyang chemical fiber refrigeration system according to the advantage design, we can get the saving electricity situation according to the above formula to calculate, the rate of saving electricity is 12.533 %[3]. According to the advantage design the refrigeration system of mucilage glue fiber factory. Compares with the conventional design, energy consumption in the refrigeration system reduces 50%. It has a broad prospect in mucilage glue fiber. It is one of effective ways that reduces the energy consumption and cost in mucilage glue fiber. It has the significant value.

4.5 Reduce the investment estimation according the advantage plan to design the refrigeration system

It can reduce half above the cooling water recycle unit and the cooling equipment according the advantage plan to design refrigeration system, such as the water pump, the cooling tower and the pipe, the power distribution facility and the tank and so on. In the condenser, deduct the increase expense of envelop,row duct and plank which the low-carbon steel replaced by the stainless steel, It can save the equipment investment.

5. CONCLUSION

The refrigeration system of mucilage glue fiber factory carries on the design according to the most superior design. Compares with the conventional design, in the refrigeration system, the effective value of compression heat is 53%; the saving Electricity is 12.5%, The reduction cooling system equipment investment accounts for the total investment is 15～20 %; A more significance is in saving the energy. It is equal reduces 60% energy consumption in the refrigeration system. It has a broad prospect in mucilage glue fiber, It is one of effective ways that reduces the energy consumption and cost in mucilage glue fiber.

REFERENCES

[1]Tan Chaoyi, Utilization of Recovery Energy of ammonia Refrigeration System on Mucilage Glue Factory[J]. Fluid Machinery, 2003,31(4):54-56.

[2] TianJing Unversity, TongJi University, Xi'an Institute of Metallurgy & Construction Engineering, heat transfer, Beijing: China Architecture & Building Press.

[3] Analysis on Saving Energy Efficiency and Investing Benefit of Air Conditioning Refrigeration System in Shaoyang Chemical Fiber Factory[J]. Fluid Machinery, 20043, 32(1): 37-40.

[4]Tan Chaoyi. Experiment Study on the Quality Changed As the Soft Water Used a Cooling Water of Refrigeration System. Synthetic Fiber, 2005, (6): 38~39.