

CURRENT SITUATION AND DEVELOPMENT TREND OF CHINESE GRINDING WASHING REFINING SALT MANUFACTURING TECHNIQUE

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Abstract: This article summarized the history of manufacturing refined salt by comminute and wash method, objectively analyzed the current situation of grinding washing refining salt, elaborated the technique and equipment of production, researched on the mechanism of grinding and washing in the processing of crude salt, presented a possible idea on comminute and wash method and proposed the development trend of this industry. This paper has directive significance in the industry.

Key word: refined salt comminute and wash process equipment

INTRODUCTION

There are two kinds of methods of production of edible refined salt in China. One way of production is using vacuum evaporation crystallize method. Raw material may directly enter the evaporator to start evaporation and crystallization through processed brine, or may also enter the evaporator to start evaporation and crystallization after dissolving the end product of crude salt. Another method is grinding the raw salt by appropriate method, then washing it with different kinds of washing method. It also can produce practical refine salt, which is in accordance with the national standards. The previous method is rapidly developing in domestic. The year scale amounts to hundreds of thousands of tons even over million tons. The latter method is also very common, more than dozens of

factories is using it. The scale generally is below 150,000 tons. Two methods have their own characteristics respectively. In the present situation of energy shortage, using comminute and wash method to product practical refined salt has the possibility of latent market.

DEVELOPMENT HISTORY OF PRODUCTION TECHNOLOGY OF GRINDING WASHING REFINING SALT IN CHINA

The grinding washing refining salt is the refined salts manufactured by comminute and wash method. It came from the original grinding and washing salt. The production process of grinding washing salt is that let the solarization crude salt grinding, washing, centrifugal dewatering and packing without

drying. At last the final products are obtained. The specific production process has two ways:

(1) After solarize on the beach the crude salt is transported to grind, dewater and packing the product though pipeline transportation.

(2) After solarize on the beach the crude salt is transported to a fixed position to to grind, dewater and packing the product.

Request of particle size of comminute and wash salt is not very strict, generally needs to be controlled below 3 millimeters. Because the lower limit does not have the strict request, therefore varies comminuting equipments could be used, such as rolling hammer machine, hammer mill, control, cage type hammer machine and so on. Some manufactories take use of WG-800 or WG1200 horizontal scraper centrifugal machine may also grind the material during discharging process. The main problem of grinding method mentioned above is the granularity is non-uniform. The used wash equipment mainly is screw washing, but washing through the pipeline hydraulic conveyance process is also contained.

Manufacture refined salt by comminute and wash method started for early 80s in the last century. For example, Changlu salt area started manufacturing refined salt by comminute and wash method, the main technical process is as follows:

Raw material storage → transport feeding → ball mill grinding → countercurrent washing two times → pusher centrifuge dewatering → fluid bed drying → measurement packing

Products manufactured base on the above process could achieve the national second-level refined salt standard. The main problem is the grinded salt lost too much. The main reason is the selection of ball mill equipment, because there is no choice during grinding process, then as a result, a mount of grinded salt is generated.

Later on same types the production line is constructed in domestic, the main technological process is almost same. Inner Mongolia Ejizhuoer salt plant has the representation. Its technological process is:

Direct-reverse screw aggregate

→transportation → store materials → transportation → screw washing → vibration screening (removal sand) → transportation → horizontal stirred tank →countercurrent washing 1→ countercurrent washing 2→ centrifuge dewatering → fluidized drying →screening → measurement packing

During this period, the main problem existed is the grinded salt lost too much. The main reason is that there is not suitable comminuting equipment. At the same time, domestic industries researched on various types of comminuting equipment, such as blade crusher, creaction pulverizer and so on.

The end of previous century, China introduced production line of grinding washing refined salt from overseas. It promoted the development of this area, like north salty area has introduced two production lines from Spain, take the Hangu salt field as an example, the main process is as follows:

Store materials → ration feeding →transportation → first comminute → transportation →zonal spiral washing 1 → wash again → zonal spiral washing 2 → transportation → countercurrent washing → dewatering → second grinding → fluidized drying → probability screening →measurement packing

This production line has both advantages and disadvantages:

(1) The installment of quantitative screw feeding equipments may control the production rhythm and guarantee balanced production, so production load is equal on all the equipments in production line.

(2) The selection of roller couple grinder with dentiform can control production rhythm, guarantee production balance and even all the production load of equipments on production line.

(3) The feeding device of roller couple grinder is not ideal, it can not guarantee uniform feeding and blocking run phenomenon is occurred frequently.

(4) The use of vibration probability screen as classifier can not guarantee the accuracy and homogeneity of particle size classification.

(5) Because the crude salt is belongs to certain degree of hardness material, on the

production line, the spiral conveyer is adopted as the transportation equipment is obviously inappropriate. The screw blade and the shell are worn quickly.

At the end of previous century, according to the experiences of domestic and foreign, Beijing Taiweian Drying Equipment Technology Develop-

ment Company has carried on a research in this area, which made certain progress on the technique of production and the production equipment. Its technique of production achieves advanced levels at home and abroad, but because of the gap between domestic and abroad in the materials and equipment fabrication technology, there is still certain distances of the equipment aggregate level between domestic and abroad.

At present, our company's equipments are widely used in the manufacture of grind wash refined salt in China.

THE GRIND AND WASH MECHANISM OF CRUDE SALT

The grind and wash function of crude salt

In the production process of grind wash refined salt, the first step is grind. There are two purposes of grinding: first, to reduce the granularity and enable the edible salt to achieve the granularity standard of edible salt; second, fully expose the impurity in the salty crystal interior or the crevasse, increase superficial area and improve washing effect.

Washing may remove the majority of soluble and insoluble impurity which exist in crystal surface and entrainment, but cannot remove the impurity which wrap in crystal internal. If break up the crude salt, its cross section often is the bottleneck of crystal combining site or the impurity spot. After breaking up and washing, the impurity may be removed, moreover, the smaller size crude salt granularity is, the better washing effect is.

Research on the mechanism of material comminuting

According to the material grinding theory, there are 5 ways of comminuting: extrusion, cutting, bend, impact, grind, extrudes, the impact, the grinding. Among

them extrusion, impact and grind may cause overgrind. At present, any kind of grinder is combining two kinds of above ways. For example, ball mill is the combination of impact and grind, stick grinder is the combination of extrusion and grinding, cage type grinder is the combination of impact and cutting, etc. If combination is appropriate, then over comminute of the material may be reduced.

After introduce Spanish equipment in end of last century, the development of roller couple grinder with dentiform started in domestic. After research trial, the comminute of roller couple grinder with dentiform is proved as the combination of cutting, bend break and extrusion, the cutting and bend break is the key point. Compare with other comminuting equipment, the powder salt can be reduced. If the feeding is not uniform, the thickness of partial material level will be too thick then change to extrusion break up, as a result, the powder salt is generated. In order to ensure the uniform of feeding, different types of feed installment are developed, which is higher than the overseas equipment level.

The so-called selectivity crushing refers to crush the particles base on the particle size. The bigger ones should be grinded firstly. The process of grind follows the order of particle size, from the big to the small ones. If the granularity qualified, then there is no need to grind. Obviously all shocking grind belongs to non-selective grind. In the other word, no matter how the initial granularity is, it will suffer impact fracture, its result is the big particles turn to small particles, the small particles turn to powdery. This is the reason of the generation of powder salt.

If combine with screen equipment to grind, which particle needs to be grinded can be setted before, then the grinding will only carry on those unqualified particles. The result will be much better.

Research on the mechanism of material washing

Whether the effect of material washing is good or bad is guaranteed by two aspects. The first is wash processing route, the second is the structural form of washing equipment.

In wash process, in order to guarantee the effect of washing, liquid-solid separation needs to be done after each step in washing process. Discharge the washing liquid with a lot of impurity as much as possible. Then add more clean brine to wash again. For example, the part above "wetted circuit" of screw salt washer have to maintain certain length with controlled washing and settle a liquid-solid separator before entering countercurrent washer, etc. Its principle is similar with family washing machine process: wash → hydro-extract → rinse → hydro-extract → spray → hydro-extract. According to this may obtain the good washing effect with less saturated brine, so the technological process should be formulated base on this principle. In addition, the flow direction of clean brine is opposite to the material.

In wash equipment, when comes to the washing effect, with agitation is better than without agitation, non-contact agitation is better than contact agitation, countercurrent washing is better than co-current washing.

PRESENT SITUATION OF THE DEVELOPMENT OF GRIND WASH REFINED SALT-MAKING IN CHINA

Production process

Synthesizes the experience and lesson of domestic and foreign, quite perfect technique

of production is so-called "four wash three grind" process. The "four wash" are: primary screw wash, secondary screw wash, vertical agitation wash and countercurrent wash. The "three grind" are: primary grind, wet milling and fucking the method smashes. High quality can be reached from different raw materials through the reasonable combination of wet milling and fucking the method smashes and the match of many kinds of wash ways.

According to the quality of crude salt, the length of technical process may be adjusted. If the quality of crude salt is, the wash time could be reduced. If the particle size is small, the grind time could be reduced.

The "four wash three grind" process flow

Raw material storage → quantitative feeding → transportation → screw washing → wet milling → screw washing → wet milling → vertical agitation washing → transportation → thickening → countercurrent washing → centrifuge dewatering → drying → screen (overtails →fucking the method smashes) → measurement packing

The flow sheet is shown as Figure 1.

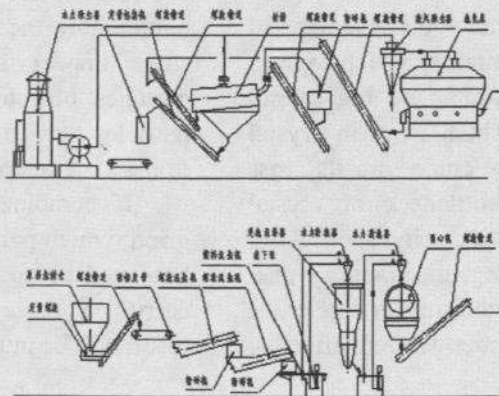


Figure 1. "Four wash three grind" process flow

"Three wash three grind" process flow
Raw material storage → quantitative

feeding → transportation → grinding → screw washing → wet milling → vertical

agitation washing → transportation → thickening → countercurrent washing → centrifuge dewatering → drying → screen (overtails →fucking the method smashes) → measurement packing

“Three wash two grind” process flow

Raw material storage → quantitative feeding → transportation → screw washing → wet milling → vertical agitation washing → transportation → thickening → countercurrent washing → centrifuge dewatering → drying → screen (overtails →fucking the method smashes) → measurement packing

Based on the quality of crude salt, the process flow mentioned above can be combined together whatever.

The characteristic of equipment

(1) In order to prevent the oversized material enter the feeding device, which affects the normal work of the system, stockade is equipped above the feeding device. In order to prevent the pace set inside of the feeding device, vibrator is installed on the sidewall of the feeding device.scre

(2) Quantitative feeding screw has a velocity modulation motor, so stepless speed regulation is achieved and productivity of the system is guaranteed and regulated.

(3) Before materials enter the system, the foreign matter of metal is removed by strength magnet.

(4) Concave die is opened on the comminution roller of roller couple grinder, between two rollers there is a speed discrepancy. The feed end is equipped with vibrator to ensure the material is feeding evenly.

(5) The overflow cycle is equipped on the vertical agitation tube to overflow sewage, and give the attention to the function of both stir and wash.

(6) In order to improve the precision of adding iodine, automatic iodize installment is researched and developed. If evenly iodize needs to be guaranteed, then transportation quantity and iodize quantity of material is requested to be constant. The automatic iodize installment is loaded with charge/discharge position on the material bin to prevent the material warehouse is full of

materials throughout. Adjust the spurted iodine quantity according to the material quantity, the iodize process is completed with high accuracy metering pump. After adding the iodine, strength mixing is needed.

(7) The way of heat up is hot-blast stove, is suitable specially in the condition without steam source. The fuel may be selected at will, like coal-burning, fuel oil and natural gas and so on.

THE DEVELOPMENT TREND OF GRIND WASH REFINED SALT-MAKING TECHNOLOGY IN CHINA

Product edible refined salt with grind wash method is very common in the overseas salt industry, like France, Spain and so on. The main feature of this method is saving the energy, especially in the very intense situation of international energy resources. Along with the lack of energy all over the world, product edible refined salt with grind wash method will exist for long time. Nowadays, the development of using vacuum crystallization to product refined salt is very fast in China. It has a great tendency to replace the grind wash refined salt. But the author thought that there still is a space for produce edible refined salt with grind wash method. Moreover this method advances in less input, promise quick returns, suit the product reform and satisfy the various requirement of the market. Especially to some products, like monosodium glutamate salt and vacuum salt cannot be produced.

The development trend of grind wash refined salt-making technology is:

(1) Promote and develop the washing way and washing equipment. For example, the overseas washing machine can achieve a good washing effect under turbulent condition. The attempt of “gas-liquid” washing, in the other word, inlet the pressure air to the washing machine may increase the washing intensity.

(2) Promote and develop the heat source equipment. Disposable energy has its own advantage, especially under the condition without steam source. The development and promotion of heat source equipment mainly forces on the raising of thermal efficiency, the extension of service life and satisfying the use

of different fuel.

(3) The improvement of the level of production processing control includes the control of production process, on-site

supervision, plant production, the control of computer management and so on. The goal is raising the labor productivity and reducing the cost.