The Technology Research on The Automation Control of Excess Dilute Acid Delinting

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Abstract: The excess dilute acid delinting technology is widely used in our country. But there are many problems in the actual operation processes. Based on the introduction of the technical characteristics, process and problems, it analyzed the automation control object in the process, and put forward a kind of way to use intelligent modules and other industrial automation technology to replace the outdated manual operations, so as to automatically control the concentration of dilute sulfuric acid, the temperature of dryers and friction machines and the passage time of cotton seeds in the equipment. Thus to improve the control accuracy of the production process, ensure seed quality, and extend MTBF equipment uptime.

Keywords: excess dilute acid delinting; automation control; intelligent module

1 Introduction

The technology of excess dilute acid delinting is developped by the United States in the 20th century 70's. In the 20th century 80's, based on the introduction, assimilating and improving of foreign advanced technologies, our country has successfully introducted the new technology of excess dilute acid delinting. Now, such production process has been generally great paid attention in our country, and the technology of excess dilute acid delinting has been widely used and has achieved good results[1].

2 The Technology of E xcess Dilute Acid Delinting

The technology of delinting of cotton seeds included mechanical delinting and chemical delinting, and the commonly used processes of chemical delinting method consisted of foamed acid delinting and excess dilute acid delinting. The excess dilute acid delinting technology used sulfuric acid which is more than 3~4 times the actual amount to mix with the cotton seeds, the excess acid was then filtered and recycled for reuse. The technology of foamed acid delinting used the amount of dilute sulfuric acid solution coupled with a certain amount of foam, so that the volume of sulfuric acid solution 30~50-fold increase to cover the surface of cotton seeds in the form of bubble, the short fiber of cotton seeds then absorbed the acid on the role of capillary.

2.1 Technical Advantages

Compared with the foamed delinting technology which is also the chemical delinting, the adoption of excess dilute acid delinting mainly has the following technical advantages:

2.1.1 Fast

At the same employment, acid using and the amount of fuel consumed, the processing capacity of excess dilute acid delinting technology is twice as high the foamed acid delinting.

2.1.2 Light Polluted

Dilute sulfuric acid can be recycled and reused, so this technology will greatly reduce the impact on the environment.

2.1.3 Good Result

Clean seed from cashmere, cashmere residual indicators significantly is lower than the national standards.

2.1.4 Low Production Cost

Compared with the foamed delinting technology, it has the characters of convenient operation, low materials and

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energy consumption and low cost.

2.1.5 Steady Quality

The excess dilute acid delinting technology injuried the seeds little and significantly reduced the rate of seed burning, and the rate of residual cashmere and residual acid was less than the foamed delinting method. It don't use ammonia to neutralize and is in favor of storage.

The excess dilute acid delinting process with centrifuge is the more sophisticated and reliable kind of all of the current delinting processes.

2.2 Process Flow

The process flow of excess dilute acid delinting is: first, dilute the concentrated sulfuric acid into 8% -14% of the acid solution mixed together with the activation agent at acid tank, then use the liquid pumps and a group of spray nozzles to the cotton seeds waiting for delinting, full mix in the blender, so that the surface of the seeds are infiltrated with the acid mixture. The cotton seeds treated with acid were feeded into centrifuge for fluid exhausetion by the center thrusters, so as to release the excess acid mixture back to acid mixture tank for recycling. After fluid exhausetion, the cotton seeds were feeded into the dryers for drying, followed with the process that the water was evaporated from inside the cotton linter, the concentration of sulfuric acid was improved to carbonize cotton linter, and some of the short fiber was put off. After drying, the cotton seeds were put into the friction machine, the carbonized cotton seeds were flipped by the hollow flap[2]. In the friction machine, the cotton seeds were rotated non-stop to automatically drop, collide and rub to delint and polish. The residual acid on the surface of the seeds after delinting were neutralized by ammonia or limewater. Finally, selected by the wind sieve-type cleaning machine or gravity cleaning machine, coated with coating machine, and dried with air-dryer or dryer, quantitative bagging storage.

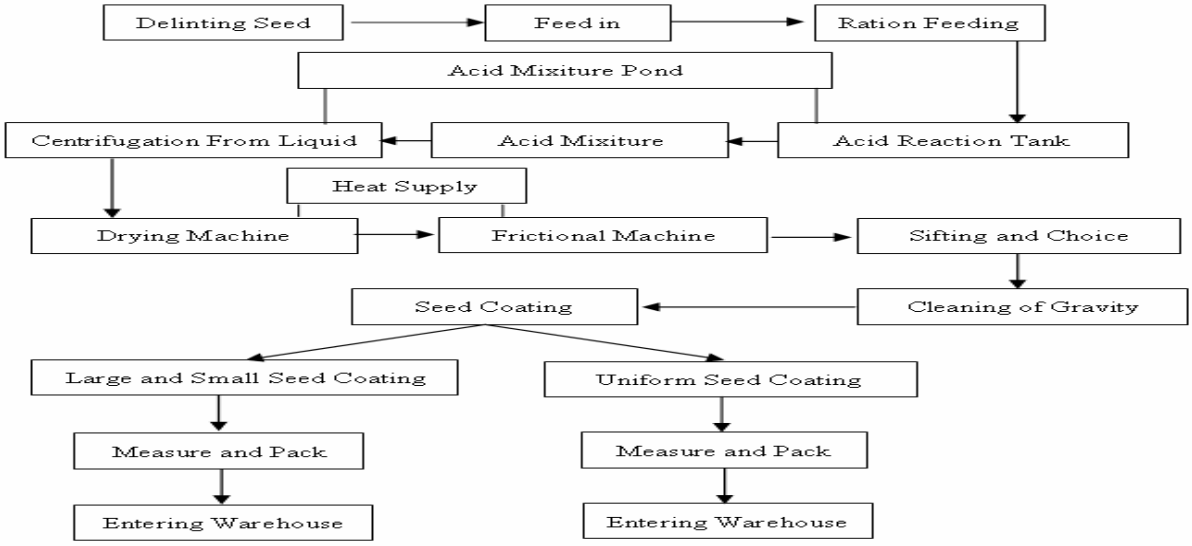

Figure 1 The process of traditional dilute acid delinting of cotton seed

2.3 Open Question

There are many problems during the traditional process of the delinting of cotton seeds, such as the low degree of automation equipment, temperature, concentration of sulfuric acid and other key parameters manually adjusted, poor stability, the residual acid content of cotton exceeded, rotten seed, lower germination rate, etc. At the same time, there are many other problems such as our seed quality testing methods were backward, unable to effectively achieve the grade of the cotton, the qulity of seed processing was relatively low, etc. On the other hand, During the delinting process, an important factor that impact the seed quality is the temperature of the seed, and the key is the velvet containing of the cotton seeds. Under

a certain seed temperature, the low concentration of dilute acid would result in the low short velvet droping rate of the contton seed, and would increase the residue acid rate of the seed, result in difficult choiceness and poor choiceness quality, so that the seeds can't be coated, and can not be precisely planted. Under a certan seed temperature and the high concentration of dilute acid, the short velvet can be easily taked off from the cotton seed, the residue acid and choiceness can all be good, but this would significantly reduce the seed germination rate, seeds may cause end-of-life, and can not be precisely planted, too. Therefore, temperature and concentration are all very important to the quality of the seed, how to automatic control the production process is the effective guarantee of the quality of the seeds.

3 The Automation Control Object

With computer technology, the sulfuric acid concentration, heating temperature and quality control will be automatically controled, so as to enhance the stability of equipment operation to improve the quality of seeds[3]. The automation control object of the process of excess dilute acid delinting includes:

3.1 The Control of The Concentration of Sulfuric Acid

According to the released agricultural industry standards in 2006, the concentration of dilute acid is specified that the attenuant acid concentration range is 6% -14%[4].

3.2 Temperature Control

In accordance with the released agricultural industry standards in 2006, in the section of drying, the fluid exhausetion cotton seeds enter the drying machine for drying and the temperature of the hot air in the dryers ought to be no higher than 210 ℃, the outlet temperature is 65 ℃ -76 ℃, the temperature of the seeds at the outlet does not exceed 54 ℃. The dried cotton seeds enter the friction machine for delinting, the temperature of the hot air in the friction machine is not higher than 100 ℃. The temperature of the air at the outlet does not exceed 50 ℃ [4].

3.3 Time Control

According to the realeased agricultural industry standards in 2006, the fluid exhausetion cotton seeds enter the dring machine, the passing time for the cotton seeds in the dryer is 8 min-12min. The dried cotton seeds enter the friction machine for delinting, the passing time for the cotton seeds in the friction machine is 15 min-20min[4].

4 The Idea of Automation Control

Based on the specific targets about the concentration of sulfuric acid, temperature and passing time, intelligent modules and other industrial automation technologies can be used to full replace the backward manual operation. The control object is the equipment temperature for the cotton seeds delinting by dilute sulfuric acid, including the dryer inlet temperature, outlet temperature, friction machine inlet temperature, outlet temperature and the concentration of the dilute sulfuric acid and the liquid level control, required to be strict accordance with the requirements of processing technology, so as to automatically maintain the equipment temperature and concentration of dilute acid within the required scope, in order to prevent the cotton seeds being injured. The control parameters include temperature, flow, liquid level, rotate speed, valve opening, and sulfuric acid concentration, etc. The control processes include the regulation of the liquid level of concentrated sulfuric acid and dilute sulfuric acid, the ratio of acid concentration, and the temperature regulation, etc. The automation control system is divided into upper monitor and lower monitor, the upper monitor used PC to development and design the configuration software to implement the monitoring and data detection of the whole process. The lower machine used the programmable logic coontroller, which is powerful, reliable, easy to maintain and with strong anti-jamming ability, could complete the on-site control and the data detection under the control.

5 Conclusion

The excess dilute acid delinting technology used automation control to replace the backward manual operation. The using of the new process improved the control precision, not only ensured the quality of the seeds, but also extended the failure free operation times of the system and improved the production efficiency. With the implementation of the production management system, the required data was collected once and treated synthetically to achieve the integrated resources and information shar-

ing of the system information.

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