

Research Article

The Design of New Fermentation Workshop about Pu'er Ripe Tea

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Abstract: During the production of Pu'er tea, pile fermentation plays a very important role in the formation of Pu'er tea's good quality. However, the effect of pile fermentation can be easily influenced by environmental temperature and humidity. Nowadays, manufacturers usually stack tea in ordinary fermentations, where the temperature and humidity have great changes. So the quality of tea is uneven. In order to solve the problem, this study put forward a design plan of the new fermentation workshop. Besides using traditional technology, the new fermentation workshop has new layout, modern measurement technology and equipment. It can regulate temperature and humidity based on the need of production to create the most suitable small artificial environment for the fermentation of Pu'er, overcoming the impact of dramatic changes in temperature and humidity. Therefore, the new workshop can stabilize the quality of fermentation, shorten fermentation cycle and improve production clean.

Keywords: Fermentation workshop, pile fermentation, Pu'er tea, the control of temperature and humidity

INTRODUCTION

Pu'er tea in China mainly refers to Pu'er tea in Yunnan, which uses the Yunnan's large leaf tea as raw material, is naturally stored for 3-5 years through the traditional process and then has aroma and taste with aging effects (Wang, 2005). The plantation area of all the province reached 400 acres. The production reached 178,000 tons. The output value reached 20.1 billion Yuan (Yao and Zeng, 2005; Li, 2002). As far as the processing technology of Pu'er tea, the current domestic tea processing still remain in the traditional processing model. Manual workshops account for a large proportion. There is a certain amount of manufacturer with crude processing equipment. The workers basically inherit empirical processing skill. Such condition makes the tea quality greatly affected by varieties of raw materials and processing and causes stability of quality poor (Bai, 2009). In a word, the tea processing enterprises form neither a modern, intelligence, information-based production system nor an automation process (Chen, 2006), clean, standardized production management platform (Wang *et al.*, 1994). In order to solve the above problems, this study put forward a design plan of the new fermentation workshop.

THE DESIGN PROCESS OF PU'ER TEA FERMENTATION WORKSHOP

The design of Pu'er tea fermentation workshop requires the integration of the knowledge of tea

fermentation and the theory of mechanical and electrical control. Although this process is very different from other designs, the design still has common law with other systems. According to the system theory, the process must use the modern design methods to design the structure and function of fermentation workshop. The main design process can be divided into five stages: overall planning, conceptual design, detailed design, design implementation and design and shape (Shan and Zhang, 2013). Each stage has its different content and focus.

The design of Pu'er tea production plant with an annual output of 100 tons: The Accordance with the production experience from Yunnan Wanhongyang tea Limited company and the technical support from Yunnan Agricultural University, after discussion, we have designed a distribution of demonstration production plant of Pu'er tea, where plant layout exactly matches with process of tea production (Fig. 1): Pu'er tea demonstration plant will layout plant according to processing order of bringing the raw material into the plant, humidifying, post fermentation (microbial solid-state fermentation), sieving, blending, autoclaved, packaging and warehousing aging processes etc., plus conveyors, turning machinery and other equipment, to constitute a complete tea processing lines.

This design is an engineering design which is based on the national food enterprise common hygiene norms, through market research, combines the characteristics of tea processing procedure and references domestic

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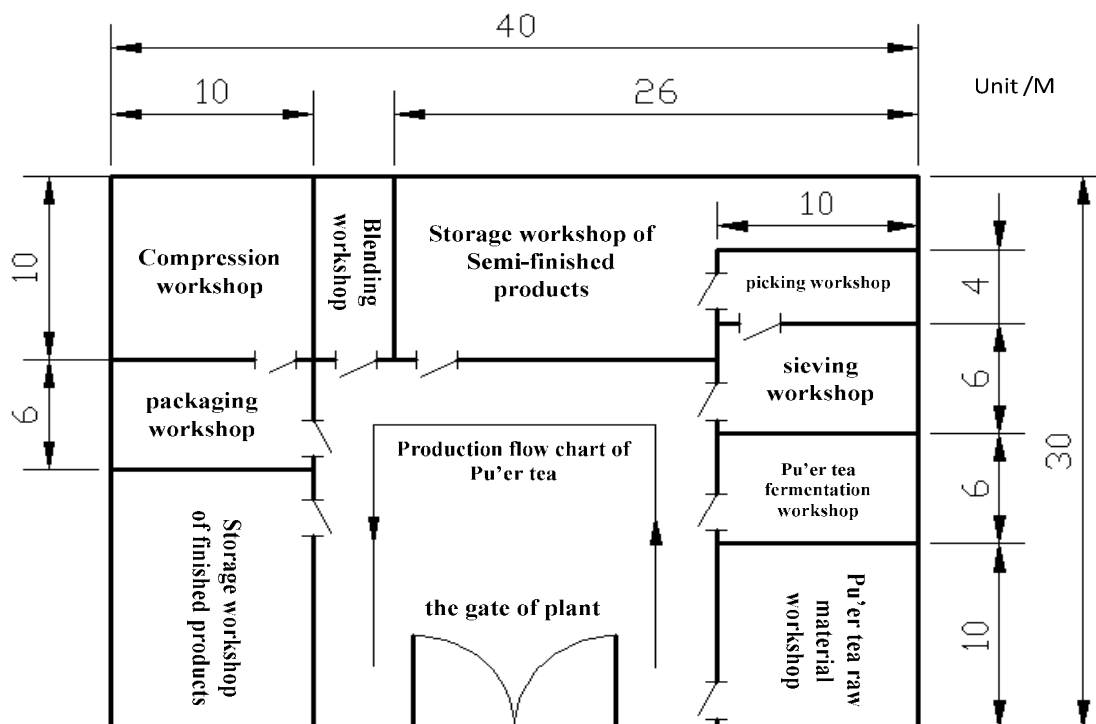


Fig. 1: Demonstration production plant of Pu'er tea

advanced production technology. The data during design are measured on field, used after consulting the relevant professionals, partially changed and adjusted in according to local conditions.

Workshop layout reasonably arranges making-tea machinery according to tea processing, to become a assembly line, which can achieve the target of high efficiency, low consumption and security.

Pu'er tea raw material workshop: The raw material workshop stores tea raw materials, whose workshop production capacity size determines the annual value of the tea plant. According to the requirement of annual output of 100 tons, tea raw materials must be 120-130 t (because the loss of 20-30% in the tea production process). So the capacity of material workshop can be between 50-70 t.

By measuring the area of raw materials stack, the area of bagged Pu'er tea raw materials is generally 700-800 kg/m², then 50 tons of raw materials can be calculated as follows:

$$S = 50000 \div 800 = 62.5 \text{ m}^2$$

Taking the secure channel into account, the design plan material workshop in size of 100 m². Detailed design is shown in Fig. 2.

Pu'er tea fermentation workshop: The fermentation workshop where the pile fermentation of Pu'er tea is

carried plays a very important part in the formation of good tea quality. The fermentation period is between 40 and 60 days. Within one year, Pu'er can be fermented five times and each time is 25 tons. During the fermentation process, every square can stack one ton. So each time covers an area of:

$$S = 25 \div 1 = 25 \text{ m}^2$$

As the fermentation workshop needs to be installed and commissioned in the electromechanical control systems, there must be a separate fermentation control room. The fermentation workshop is planned in the size of 60 m² (Fig. 3).

Sieving workshop: Sieving is an important part of process which separates the thickness and length. The rank of tea is set according to sieving requirements. Generally, shaking sieving, garden sieving and winnowing sieving equipment are used online and the mesh configuration is decided by the tea freshness. By selecting sieving machinery, the size of sieving workshop can be determined:

- **Shaking sieve:** The reserved area of shaking sieving is: $S = 4 \times 2 = 8 \text{ m}^2$
- **Round sieving:** The reserved area of garden sieving is: $S = 4 \times 3 = 12 \text{ m}^2$
- **Winnowing sieving equipment:** The reserved area of winnowing sieving equipment is:

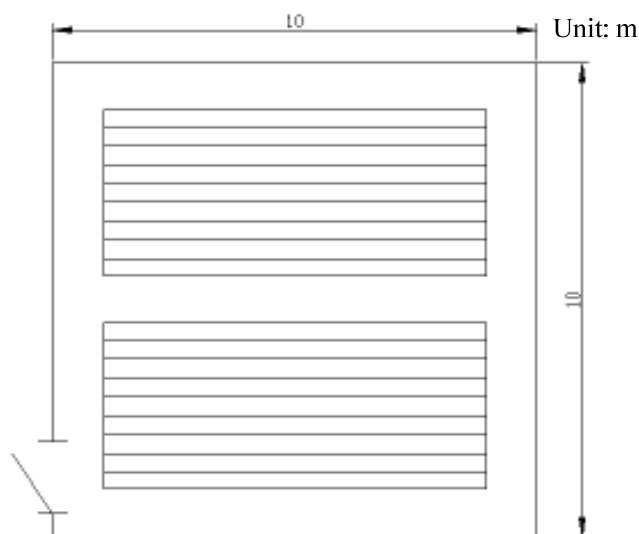


Fig. 2: Layout of Pu'er tea raw material workshop

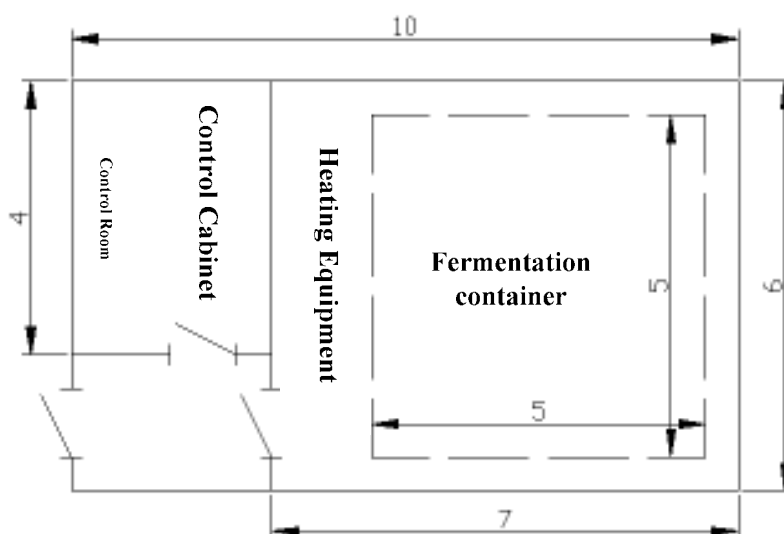


Fig. 3: Layout of Pu'er tea fermentation workshop

$$S = 6 \times 2 = 12 \text{ m}^2$$

Therefore, in the sieving workshop the total reserved area of tea machine is:

$$S = 8 + 12 + 12 = 32 \text{ m}^2$$

In this workshop, the secure channel and stacking of sieved material and tea leaves need to reverse space. The workshop is planned at 60 m², shown in Fig. 4.

Picking workshop: In the production process of Pu'er tea, picking generally have to rely on manual work to complete. A picking operative picks 40-50 kg of tea leaves one day, so 10 people a day can complete 40-500 kg task. Then a year (based on 300 days) operatives can

complete 120-150 tons, fully meeting the production tasks.

Each worker takes up 2 m², then the total working area covers:

$$S = 10 \times 2 = 20 \text{ m}^2$$

Considering the access channel of workers, picking workshop is planned in the size of 40 m².

Storage workshop of semi-finished products: Storage workshop of Semi-finished products mainly store sieved and picked tea. Because the classification has a lot after sieving, the required space needed becomes much larger than the material workshop. Besides, after tea blending process carried out, tea leaves that in no hurry will be

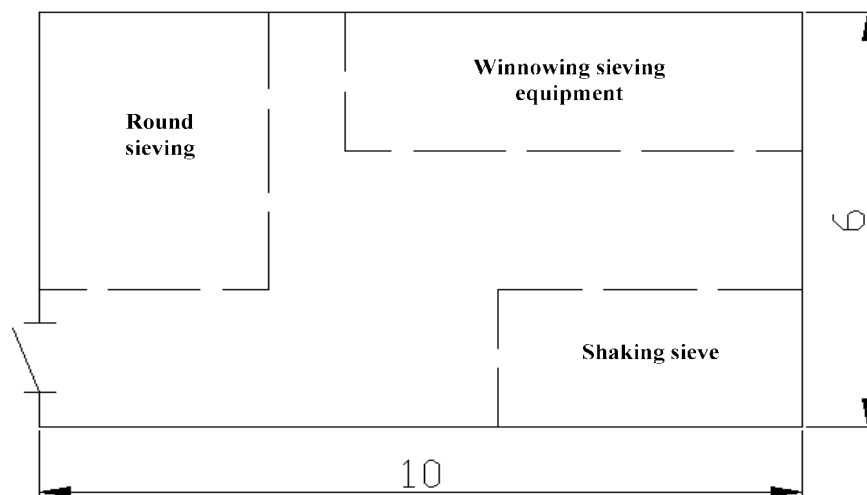


Fig. 4: Layout of sieving workshop

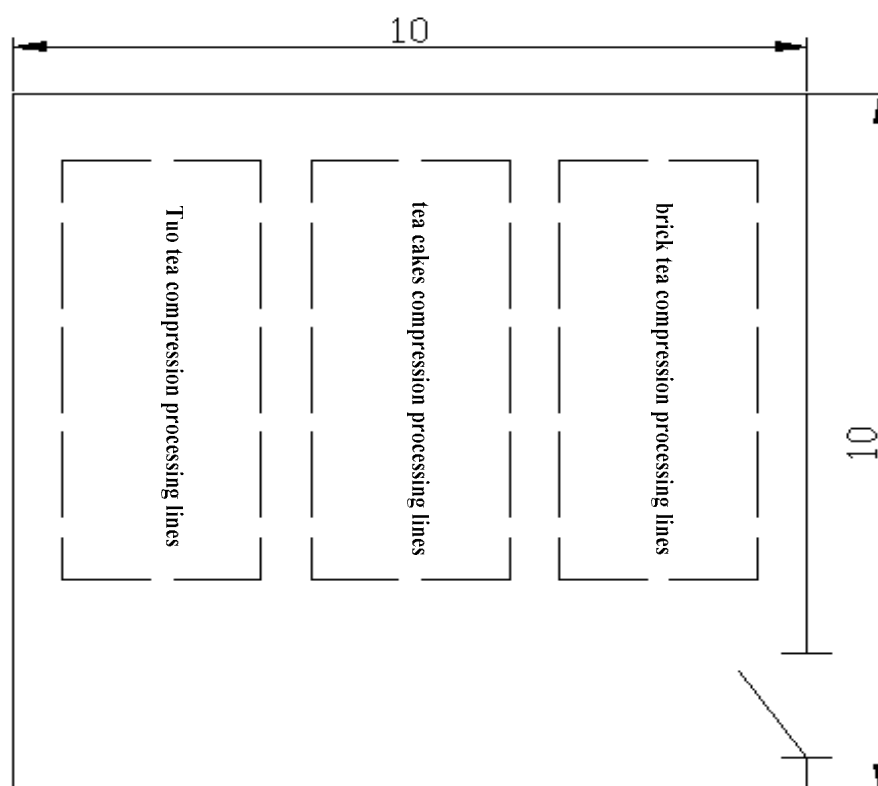


Fig. 5: Layout of compression workshop

pushed into semi-finished cake can be stored in the workshop, so that the workshop covers an area of more expansion. Therefore it will be planned at 200 m².

Blending workshop: The main function of this workshop is to shend sieved and picked tea at a certain percentage to constitute palace, super, 1, 3, 5, 7, 9, 10 and etc. The operation is relatively simple, so covering needs less and the workshop is planned at 40 m².

Compression workshop: This workshop has three main lines: brick tea, Tuo tea and tea cakes compression processing lines. Each line is calculated at 15 m², totaling 45 m². Plus other factors, the shop is planned at 100 m², such as shown in Fig. 5.

Packaging workshop: In the packaging workshop, there is mainly packaging machinery. The packaging of finished products can choose different packaging

machine, such as paper packaging of tea cakes, tea bag packing and so on. The packaging workshop is planned in the size of 50 m².

Storage workshop of finished products: After packaging, products can be stored in the storage workshop of finished products. Warehousing aging can make tea better quality, better taste. Finished storage is relatively simple, the required area is not large, so the workshop is planned at 100 m².

CONCLUSION

The new Pu'er tea fermentation workshop designed in this study can reach the level of 100 tons/year. Each fermentation capacity is about 10 tons, meeting the tea processing technology. While the technology is not complex, but due to the long processing time, not a small amount of tea processing, the number generally is relatively good at 10 tons. To some extent, the new design achieves modernization and clean, stabilizes fermentation environment, shortens the period, increasing the economic benefits. In the meantime, it

provides a research base for the technicalization and clean of Pu'er tea fermentation.

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