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Design of Baijiu Blending Control System

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Abstract: As a key link in the whole process of Baijiu production, the traditional blending method, which mainly relies on manual experience, has some shortcomings, such as obvious quality fluctuation, difficulty in cost control and low blending efficiency, in the market environment with increasing demand and increasingly stringent quality. Therefore, the Baijiu blending control system was designed to realize the intelligentization of Baijiu blending. The Baijiu blending formula model was established based on the sensory evaluation data and physical and chemical index data of Baijiu. A top-down control system composed of information system layer, blend operation station, PLC programmable controller and field equipment layer; It is characterized by integration from formula design to target Baijiu production. The automatic control in the production process is realized, which guarantees the stability of Baijiu quality, improves the efficiency of Baijiu production, reduces the production cost, and promotes the modernization level of Baijiu productiont.

Keywords: Baijiu blending, Control system, Automation.

1. Introduction

Baijiu blending is an important link in the Baijiu production process. Since the 70s of the 20th century, the Baijiu industry has begun to judge the quality of Baijiu by combining spectral analysis technology and sensory indicators, which has further promoted the development of blending technology. Since the 80s of the 20th century, the combination of chromatographic technology and sensory indicators has been used to verify the quality of Baijiu and improve the merit factor of products. In the early 90s of the 20th century, computer technology was introduced into the field of Baijiu blending, which promoted the application of mathematical programming methods in the field of Baijiu blending. Stepping into the 21st century, the rapid development of artificial intelligence and pattern recognition technology has made it possible to solve the problem of combination optimization of Baijiu blending.

In recent years, some domestic scientific research institutions and distilleries have done corresponding research on the intelligentization of Baijiu blending, and have achieved some scientific research results. For example, according to the process flow of Baijiu blending and flavoring, Zhu Jingwei designed the Baijiu blending microcomputer system, to imitate and give play to the role of experts in the blending and flavoring process as the design idea, to use the analysis method of complex system for Baijiu blending and seasoning for systematic analysis, and to establish a mathematical model with the nonlinear superposition method of complex relationships, which laid a theoretical foundation for computer blending [1]. Based on the fuzzy mathematics theory, Li Jiaming organically combined the mathematical planning theory with the mature, scientific and effective experience of the blending engineer, formulated the corresponding standards according to the taste preferences of consumers, and established the mathematical model of Baijiu blending formula with the fuzzy mathematics theory [2]. Zhang Rongxin designed a computer aided blending system for Luzhou-flavor Baijiu, improved the traditional sensory quality evaluation method and designed a new sensory quality evaluation standard and method that meet the actual production demand, which further improved the production quality and ensured the stability of product quality [3]. In order to optimize the blending process, Baiyunbian Baijiu Industry Co., Ltd. optimized the design of the process pipeline of the blending, filtration and conveying process, and applied the link and embedding technology in process control, fieldbus technology and JX-300X distributed control system to realize the automatic transmission and blending between each tank, improve the blending accuracy, and achieve a one-time blending success rate of more than 95% [4]. In order to solve the bottleneck problems such as many batches of small containers, easy fluctuations and low efficiency, Kweichow Moutai Baijiu Industry for the first time comprehensively applied the pulse pneumatic blending system and sheet filtration equipment to the Baijiu blending process, which improved the utilization rate of base liquor and the automation level of Baijiu production [5]. In order to ensure the accuracy of large-scale blending and improve the level of enterprise informatization, the intelligent control system of large-scale blending of Baijiu developed by Hengshui Laobai Dry Brewing Group focuses on the change law of temperature and Baijiu, which eliminates the deviation of large sample blending and promotes the establishment of the relationship between trace components and Baijiu style in the finished Baijiu [6]. In order to avoid the duplication of small samples and large samples of Baijiu, Zheng Zhihua and others established an automatic measurement system for Baijiu blending, which improved the stability between batches of finished Baijiu [7].

In the production management of traditional Baijiu enterprises, the method of combining sensory analysis and experience is used to combine the finished Baijiu, but relying on people to evaluate is easily affected by subjective and objective environmental factors, fluctuating greatly, and each batch of products inevitably has differences, which leads to unstable product quality, low production efficiency, and inability to optimize product costs. Therefore, in order to ensure the relative stability of product quality, improve production efficiency, and optimize product costs, it is necessary to systematically analyze the traditional blending and flavoring process with the help of computer and artificial intelligence technology, establish a mathematical model of the Baijiu body data, so as to discover its inherent essential laws and realize computer blending.

In order to realize the automatic management of Baijiu production, improve the modernization level of Baijiu production, and improve production efficiency and product quality stability, this paper does the following work:

a. Collection of Baijiu basic data

The key physical and chemical indexes of raw base liquor and finished Baijiu were analyzed and tested by an analysis and detection method of ion-charge mass ratio. The sensory evaluation data of Baijiu were obtained by professional Baijiu tasters who used scientific sensory evaluation and scoring criteria to evaluate the tested Baijiu samples. The physical and chemical indexes of the raw material base liquor and the finished Baijiu and the sensory evaluation score of the Baijiu provided the data basis for the establishment of the Baijiu blending formula model in the later stage.

b. Establish a basic database

For the design of the database, considering that the back-end database can realize the rapid access of all kinds of data in the process of the call-in operation, and become the data exchange center of the whole system, to ensure the smooth operation of the call-in control system, and to help it efficiently manage all kinds of data, retain the call-in technician experience, improve the work efficiency. The main sections of back-end database of Baijiu distilling system are user information section, sensory evaluation data section, finished Baijiu flavor data section, raw material base liquor flavor data section and formula data section.

c. Establish the blending model

Based on the sensory evaluation data and flavor component content data obtained from the experiment, the quality relationship model between sensory evaluation and flavor components of Baijiu was designed and constructed to explore the implicit relationship between sensory evaluation and flavor components. And based on the objective programming method to construct the blending formula model, using genetic algorithm to optimize the objective programming, get the optimal priority factor sequence, combined with the constraint equation to obtain the optimal blending ratio.

d. Establish Baijiu blending control system

Based on the above database and the blend mathematical model, a kind of adjustable and optional blend system is established. And the Internet of Things technology is applied in the Baijiu blending intelligent system to connect the blending control center, blending seasoning production module, enterprise information network through local area network, Internet, VPN and other forms. In the process of blend and drop at the same time, the real-time sharing of data resources is realized through remote monitoring.

2. The Establishment of Formula Mode

(1) Basic data collection

Firstly, the flavor components in Baijiu were detected by gas chromatography [8]. Gas chromatograph was used to detect the physicochemical indexes of the Baijiu sample data provided by the Baijiu. The qualitative analysis of each unknown volatile component in the sample was obtained by computer retrieval and matching with the NIST mass spectrometry library. Volatile components with high matching degree were selected for qualitative analysis [9-11], as shown in Figure 1.

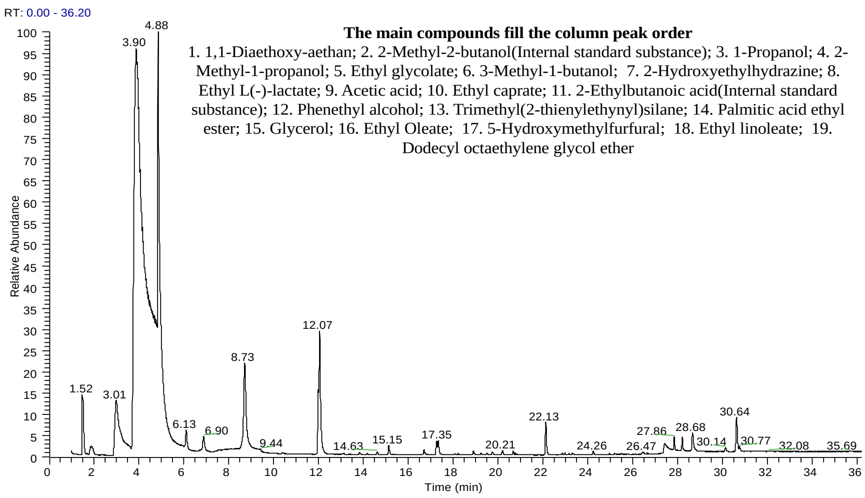

Figure 1. Chromatogram of trace components of a Baijiu sample

The internal standard method was used for quantitative analysis. The chromatographic standard (with purity greater than 99%) corresponding to the internal standard compound and the compound obtained by qualitative analysis was configured with mixed standard sample solution, and tert-amyl alcohol and 2-ethylbutyric acid were selected as internal standard substances [12].

In the process of quantitative analysis and calculation using internal standard method, the relative correction factor and the amount of internal standard substance are calculated simultaneously. The specific process is as follows:

$$f_i = \frac{\omega_i}{A_i}$$

Where, ω_i represents the standard sample content of the compound to be measured; A_i Represents the peak area of the compound to be measured.

$$f_s = \frac{\omega_s}{A_s}$$

Where, ω_s represents the content of internal standard compound in the standard sample solution; A_s Represents the peak area of internal standard compound in standard sample solution.

$$\frac{f_i}{f_s} = \frac{\omega_i}{\omega_s} \times \frac{A_s}{A_i}$$

The working curve is drawn by measuring the corresponding results of different concentrations. The slope of the standard working curve is the absolute correction factor, and the corresponding mathematical expression is shown in Formula 2-4.

$$P = f \times A \times \frac{\omega_n}{A_n}$$

Where, P represents the content of compound to be measured; f Represents relative response factor; A Represents the peak area of compound to be tested, ω_n represents the content of internal standard in the Baijiu sample to be tested, and A_n represents the peak area of internal standard in the Baijiu sample to be tested.

The contents of flavor components in Baijiu samples were calculated by internal standard method. Table 1 shows the contents of some flavor components of a Baijiu sample.

Table 1. The content of some flavor components in a Baijiu sample.

Name	Content(mg/L)
propyl-d7 alcohol	150.9584
Isobutanol	916.9921
Ethyl 2-hydroxyacetate	30.5128
3-Methyl-1-butanol	1401.9861
Ethyl lactate	75.4792
Ethyl caprylate	35.3306
Acetic acid	75.2464
Furfuryl alcohol	28.9069
Furfural	96.3564
Ethyl caprate	33.7247
Lactic acid	80.1806
Ethyl palmitate	80.2971

The sensory evaluation of Baijiu provides sensory data for blending and is a direct expression of Baijiu quality. The scoring criteria of sensory evaluation adopts the method shown in Table 2. Through the mathification of sensory data, sensory evaluation data is established [13]. The evaluation results are stored in the database to form the target Baijiu sensory index system for the establishment of the recipe.

Table 2. Description of sensory quality

Description of sensory qualities	Fraction of the score	The scale occupied by each subterm	Branch number
appearance	5	5	1
color	5	5	1
aroma	20	5	3
taste	60	5	4
style	10	5	1

(2) Database Design

As for the design of back-end database of Baijiu blending system, it can be divided into two aspects: at the level of production link, back-end database can realize the rapid access of all kinds of data in the process of blending operation, and become the data exchange center of the whole system to ensure the smooth operation of blending control system, improve the efficiency of Baijiu production, and retain the experience of blending master; At the level of Baijiu practitioners, the design and implementation of the database can help them efficiently manage all kinds of data and improve work efficiency.

The above data were divided into three sections and stored in the database. These three sections were successively the sensory evaluation data plate for accessing the four aspects of the appearance color, aroma, taste and style in the sensory evaluation of Baijiu, and the finished Baijiu flavor data plate for accessing the type and content of the flavor components in the determined finished Baijiu. Raw material base liquor flavor data plate for accessing the type and content of flavor components in the determined raw material base liquor. Then, the user information plate is added for the management of basic information of new and old users and the design of the completed Baijiu body formula, that is, the ratio of various raw material based Baijiu is centrally managed, and the formula data plate is used to distinguish different Baijiu body formula with specific variables.

(3) The Establishment of A Model of The Relationship Between Flavor Components and Sensory Evaluation Quality

Sensory evaluation of Baijiu is one of the ways to collect basic modeling data. In the process of tasting experiments, Baijiu contains flavor components that can cause sensory changes, and these flavor components have minimum content values. That is, if the content of a certain flavor substance reaches or exceeds a certain value, it can give feedback to the taster in terms of sensory performance, mainly reflected in the aroma and taste of the Baijiu [14,15]. The sensory thresholds and corresponding sensory performance characteristics of some flavor components in the Baijiu are shown in Table 3. In the process of Baijiu quality assessment, the richness of its flavor components and the corresponding content are the most important considerations. However, as a direct reflection of the quality of Baijiu, the sensory evaluation of Baijiu has reliability and authority. Therefore, the establishment of a quality relationship model to explore the implicit relationship between the two, and the characteristic data obtained by sensory evaluation can accurately map the content of flavor ingredients in the target Baijiu, which can provide a theoretical and data basis for the construction of the blending formula model [16].

Table 3. Formula information data sheet.

name	threshold/ (mg/L)	Sensory characteristics
ethyl formate	150	thinner, fruity aroma
ethyl acetate	17	apple smell, fragrance
ethyl caproate	0.076	resembles carnelian apple fragrance
isobutanol	7.5	faint pentanol taste
Isoamyl alcohol	6.5	fusel oil odor
n-butanol	25.0	a little jasmine
butyric acid	3.4	mild butter odor
valeric acid	0.5	fat odorous, slightly acidic
caproic acid	8.6	strong fat odor
acetaldehyde	1.2	green leaves and grass smell
furfural	44.0	nutty and smelly

The prediction of chemical compounds in target Baijiu is based on the sensory evaluation data of finished Baijiu and the content data of chemical compounds, and the quality relationship model is established based on the genetic algorithm optimization support vector regression prediction [17]. The mass relation model was established by the support vector regression algorithm, and the penalty factor C and kernel function parameters g had great influence on the performance of the model in the process of predicting the compound content in the target Baijiu. Therefore, in the process of model initialization and training, it is particularly important to find the optimal combination of penalty parameter and kernel function parameter (C, g), so genetic algorithm is used to complete the optimization operation of parameter combination.

(3) Establishment of Baijiu Blending Formula Model

The goal programming is evolved from linear programming. The goal in goal programming is not a single goal but a multi-goal, with both primary and secondary goals. This kind of model does not consider the minimization or maximization of each goal, but hopes that each goal can be as close as possible to the preset target value under the constraints [18-19].

This characteristic of objective programming accords with the characteristic of blending process and can be effectively applied to the formula calculation of finished Baijiu. Objective programming treats the constraints of all physical and chemical indexes in finished Baijiu as targets, assigns a "priority factor" weight to each target to set the importance degree of constraints, and optimizes all targets according to the different importance degrees of targets to meet the requirements as far as possible. The model of blending formula was established by using the objective programming optimized by genetic algorithm to optimize the ratio of raw cooking Baijiu during blending process. Figure 2 shows the design flow chart of the blend dispensing formula.

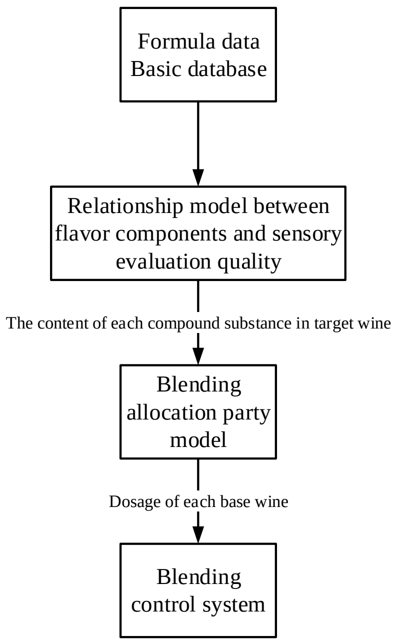

Figure 2. Design flow chart of the system

The design process of the concoction formula is as follows: firstly, the finished wine, the physicochemical index data of raw material base liquor and the sensory evaluation data of Baijiu are called from the formula basic database; Then, the relationship model between flavor components and sensory evaluation quality was established based on the physicochemical indexes and sensory evaluation data of finished Baijiu. Then, the target wine physicochemical index, the target wine quality requirement, the cost requirement and other conditions predicted by the relationship model between flavor components and sensory evaluation quality were established. The specific dosage of each base liquor required by the target wine was calculated through the blending formula model. Finally, the dosage data of each base liquor is introduced into the hook control system.

3. The Establishment of the Bending System

(1) System Control Architecture

The system is designed for the DIY information system layer to obtain orders and processed by the enterprise ERP server, to the hook operation station to issue production instructions, and then by the hook operation station to control the PLC programmable controller layer directly control the operation of the field device layer in the blending process, by the hooking operation station to configure and monitor the operating status of each equipment and system parameter data, so that the Baijiu blending process is carried out automatically and orderly. The hook operation station manages production tasks by sharing data with the DIY information system. As a result, a top-down control system composed of DIY information system layer, hook operation station, PLC programmable controller and field device layer is formed, and the control architecture is shown in Figure 3:

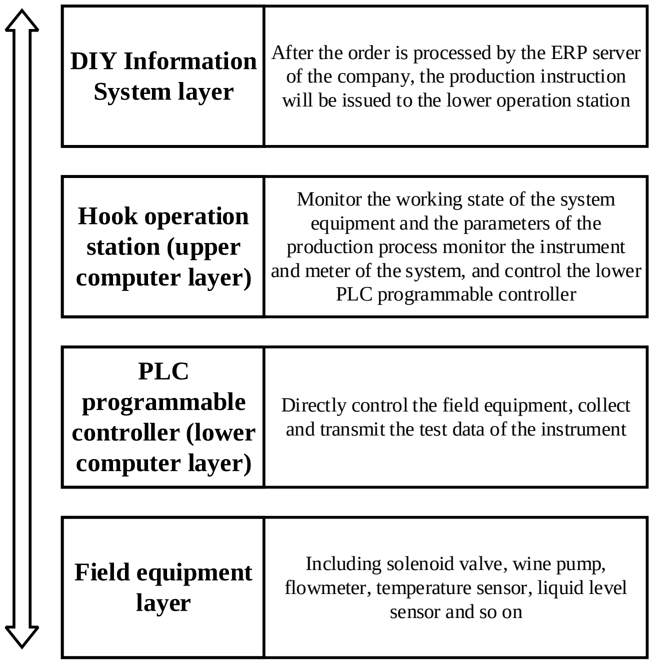

Figure 3. Control architecture diagram

The functions of each layer are as follows:

a. DIY information system layer: obtain orders and issue production instructions to the hook operation station after being processed by the enterprise ERP server;

b. Hooking operation station: The hooking operation station has the function of human-computer interaction to realize the monitoring of the system, control the transportation, measurement, blending and other processes of Baijiu through communication with the PLC programmable controller, and monitor the working status, parameter data and production process of the system equipment;

c. PLC programmable controller: directly control the field equipment, accurately complete the production process, and process and transmit the collected data;

d. Field device layer: including the instrumentation to be used for detecting system data, the external actuator of the controller, etc., to realize the detection of the data required by the system and the execution of the output control signal of the lower machine layer.

(2) DIY Information system design

DIY information system recipe display block contains a number of Baijiu brewing masters of the Baijiu body blending recipe, customers can choose their own finished recipe, can also customize the recipe according to their own needs, after entering the demand configuration, you can use the intelligent algorithm to automatically design the outlining recipe, or you can manually design the outlining formula through the Baijiu brewing master until the customer is satisfied [20]. After the customer confirms the formula, product quantity, product packaging and payment of the order, the order display background begins to process the order, and the formula information is sent to the hooking operation station of the hooking workshop, and the hooking operation station automatically blends the Baijiu body according to the formula, and the finished Baijiu after filling and packaging is shipped to the customer, and the customer can view the production progress of the product in the order display link, and the entire operation process is shown in Figure 4.

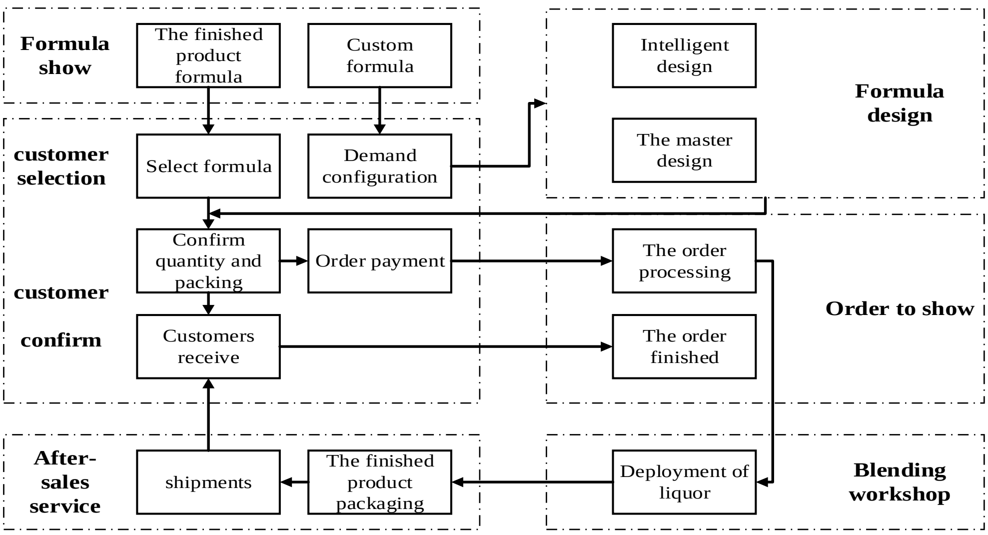

Figure 4. System flowchart

(3) Design of blending operation station

In the process of blending, the operation station first needs to call the Baijiu blending formula model, after obtaining the optimal blending formula, the operation station can complete the whole blending process according to the specific data control system of the formula. In the process of operation, the system should first open the corresponding valves of each wine tank used in the process of hooking, and start the wine pump at the same time when opening the valves. After the flowmeter starts to work, the collected data will be transmitted to the hooking operation station in real time. When a kind of base liquor reaches the target throughput, the valve of the base liquor tank will be automatically closed, and the next kind of base liquor tank will be selected after the remaining wine is cleaned in the pipeline. And open the corresponding valve, so repeated until all kinds of base liquor in the hook mixing party is delivered. During the operation of the system, it is necessary to monitor the liquid level of all the relevant wine tanks, the state of the wine pump, the state of the valve and the working condition of the equipment.

(4) Blending control program and equipment

In order to make the hook control system with a high degree of automation and accurate flow control ability, the design of the control program is as follows.

Blending control main program, its function is to quantitatively transport Baijiu of the base liquor tank to the target wine tank. Because the whole process of wine from the base liquor tank to the target wine tank, the need to control the solenoid valve, wine pump, electric regulating valve and other equipment, so in order to avoid the wine pump idling, it is necessary to consider the electromagnetic valve, wine pump, electric regulating valve and other equipment starting sequence. The starting sequence is designed to first open the valve of the base liquor tank and the target wine tank, and then open the electric regulating valve required in the transportation process, and finally start the wine pump. When the Baijiu is delivered to the specified amount, it is necessary to close the electric regulating valve, then stop the wine pump, and finally close the valve of the base liquor tank and the target wine tank.

In order to avoid the Baijiu residue of the previous step or the last delivery mixed with the subsequent Baijiu in the pipeline, which would affect the quality of the target Baijiu product, the pipeline Baijiu cleaning subroutine was designed. Figure 5 shows the design of waste wine cleaning pipe:

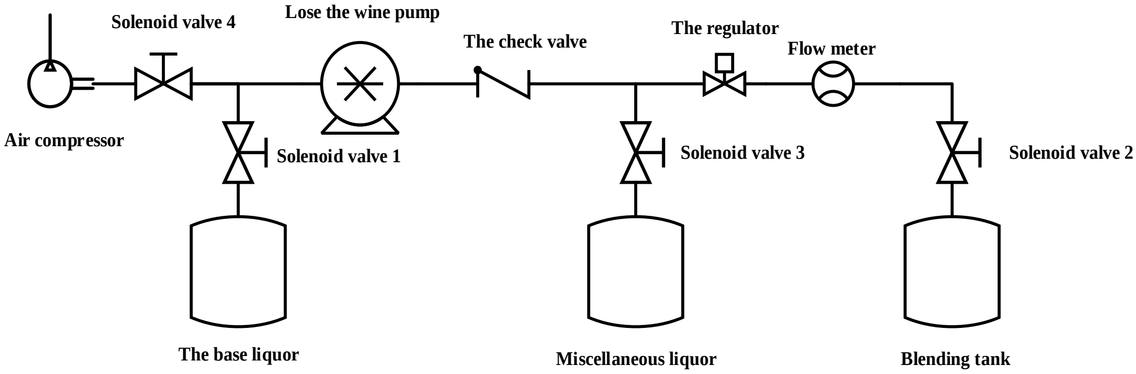

Figure 5. Design drawing of Baijiu cleaning pipeline

During the operation of the whole control program, when the selected base liquor reaches the specified throughput, the solenoid valve 1, electric regulating valve and wine pump of the base liquor tank are closed at the same time; Then open the solenoid valve 3 of the mixed wine tank and the air compressor, the air compressor will be used to send the residual Baijiu in the pipeline into the mixed wine tank, after reaching the cleaning time set by the program, close the electromagnetic valve 3 of the mixed wine tank and the air compressor, the subsequent base liquor transportation.

In the whole process of hooking and tuning, accurate flow control algorithm design is essential if the product quality is to be stable. Due to the whole quantitative transmission process, the Baijiu from the base liquor tank to the final target wine tank needs to go through a series of equipment such as wine pump, electric regulating valve, flow meter, and so on, when the specified throughput is reached, the transportation will stop. Therefore, the whole system has the characteristics of time delay, nonlinear and no overshoot [21-23]. Therefore, according to the controlled object of the control system has the characteristics of hysteresis and nonlinear, combined with the advantages of classical control algorithm, advanced control algorithm and intelligent control algorithm, select a control algorithm that meets the requirements.

When designing the control algorithm for the time-delay system with a large lag controlled object, the Smith estimator is introduced first to exclude the pure lag link from the closed-loop control loop and eliminate its influence on the stability of the closed-loop system. Then the controller is designed separately for the part of the controlled object that does not contain the lag link, and the expected control goal can be achieved. Then the fuzzy controller is used to solve the problem that the Smith estimator has high sensitivity to the change of model parameters, and the fuzzy - Smith control method is formed. Then, the proportion integral is introduced into the controller to form a fuzzy - PI-Smith controller, which can eliminate the steady-state error of the system which can not be eliminated by the fuzzy controller, and finally realize the precise control of the Baijiu flow in the control system.

Combined with the control program, the acquisition of each input signal of the system and the execution of the output control signal are designed as follows:

a. liquor temperature: the temperature transmitter is selected to achieve this function, and the PLC collects the 4-20mA current signal output by the PLC, and converts it into a temperature value by the equal proportional rules set in advance, obtains the Baijiu temperature information, makes appropriate control actions accordingly, and provides reference for other relevant parameters of the accurate measurement system;

b. liquor tank level: choose a liquid level transmitter to achieve this function, the liquid level transmitter converts the sensor measurement signal into a standard 4-20mA current signal and outputs, connects to the PLC analog input module and converts it into liquid level by the equal proportional rules set in advance, obtains the liquid level information in the tank, and can derive the balance of the Baijiu tank, in order to improve the detection accuracy, add temperature and alcohol compensation when setting the conversion rules;

c. Flow: pure alcohol uses turbine flowmeter, Baijiu and pure water use electromagnetic flowmeter, mass flowmeter is used in places with high requirements for flow accuracy, PLC collects 4-20mA current output signal of flowmeter, and converts it into corresponding flow data, the metered data not only includes instantaneous flow, but also cumulative flow;

d. Fluid interception control: In pipelines that do not have metering requirements for flow, such as Baijiu inlet valves, Baijiu outlet valves, compressed air pipelines for stirring, etc., where the on-off of the pipeline needs to be controlled, the solenoid valve is used to realize this function, and the switching signal output by the PLC digital output channel controls the opening and closing of the valve, so as to achieve flow interception;

e. Control of transfer pump: connect the suction coil contact of the AC contactor of the transfer pump in series with the digital output channel of PLC to control the start and stop of the transfer pump;

f. Flow control method: choose the electric control valve to achieve flow control, the electric control valve is installed in the common section of the Baijiu pipeline, PLC collects the output signal of the flow meter, calculates the cumulative flow rate and according to its deviation from the given value, calculates according to the designed control algorithm and converts the output into a standard 4-20mA current control signal, adjusts the opening of the electric valve, so as to adjust the size of the flow;

g. Monitoring of the switch status of the pump and each valve: judge the switching state of the solenoid valve according to the signal status of the corresponding digital output port of the PLC, connect the status contact of the electric control valve and the transfer pump to the digital input channel of the PLC, judge the working status of the electric control valve and the transfer pump according to the high and low level signals of the corresponding channel, and display its working status in the hook operation station (upper computer layer) for operator analysis and processing;

According to the above scheme design, each equipment performs its own functions under the coordinated control of PLC to form an effective operation system, and the control principle is shown in Figure 6, Figure 7 shows the hook adjustment device:

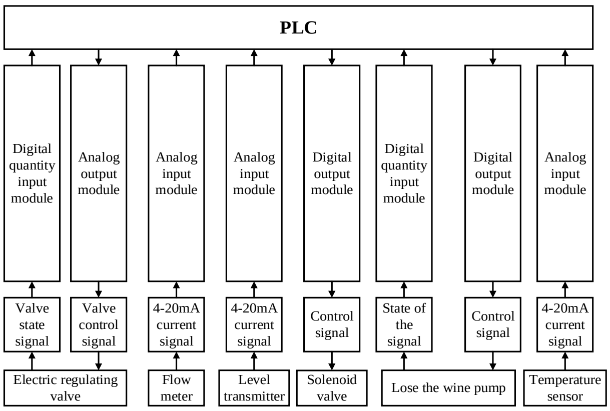

Figure 6. PLC control schematic

Figure 7. Blending adjustment device

(5) Blending control system overall process design

The control flow of the system from receiving orders to production completion is shown in Figure 8:

Combined with the system control flow chart, the specific implementation steps of the system are as follows:

a. The DIY information system obtains the order and issues production instructions to the hooking operation station after being processed by the enterprise ERP server;

b. After the hook operation station gets the order production instruction, it first determines whether there is an order in production, and if so, it enters the order production queue; If not, start production and proceed to the next step;

c. After starting production, first call the Baijiu blending recipe model, obtain the optimal blending formula, and transport it to the blending irrigation according to the required amount of each base liquor;

d. When transporting each base liquor, first judge whether the amount of base liquor in the tank is sufficient, if it is insufficient, wait for the base liquor to be added to a reasonable level, and if it is sufficient, proceed to the next step;

e. When transporting each base liquor to blending irrigation, the quantitative conveying subprogram is first mobilized to meet the quantitative transportation of the base liquor under the control of the flow precise control algorithm;

f After each base liquor is conveyed, call the pipeline residual Baijiu cleaning subprogram to clean up the remaining Baijiu in the pipeline to avoid Baijiu mixing affecting product quality;

g. Finally, judge whether the quantitative conveying of the required base liquor is completed, if it is not completed, carry out the quantitative transportation of the next base liquor, and if it is completed, start the production of the next order.

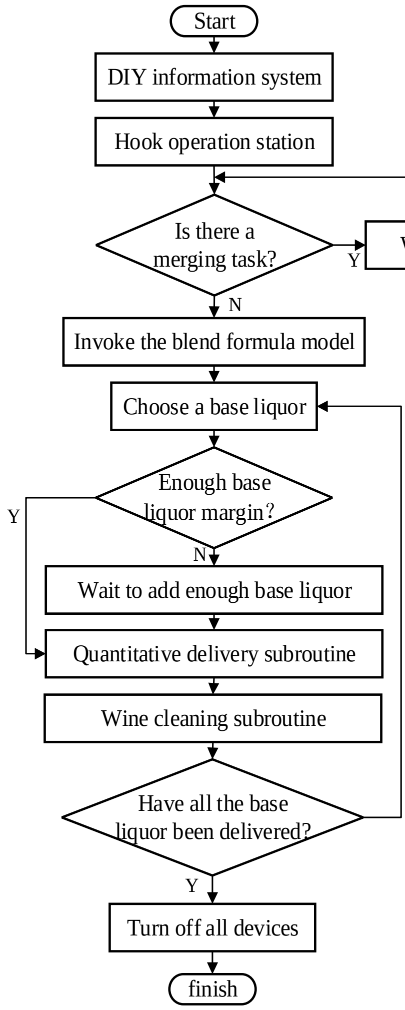

Figure 8. System control flowchart

4. Conclusion

The purpose of this system is to realize the automatic control in the process of production, improve the efficiency of Baijiu production, reduce the intensity of manual labor, and enhance the modernization level of Baijiu production. The implementation functions are as follows:

a. The automatic control system adopts computer operation and display;

b. Data sharing with Baijiu storage and distribution production management system through Ethernet;

c. Realize the blending control of finished Baijiu by calling the optimal control formula model;

d. Design a flow control algorithm to accurately control the dosage of each base liquor according to the recipe to ensure production efficiency and product quality standards;

e. Realize automatic control of the operation of each equipment (Baijiu pump, valve, etc.) in the production process, set the automatic manual control switching function, display the operating status of the equipment, and be able to carry out fault alarm;

f. Collect real-time measurement data of the system through various instruments and meters, and can query through the host computer for operator analysis and processing;

g. Realize the cleaning of the remaining Baijiu in the pipeline, prevent the mixing of different Baijiu bodies from affecting product quality and improve the utilization rate.

The Baijiu blending control system uses pattern recognition, data mining and other methods to establish a Baijiu sensory tasting experience database, and establishes a mathematical model of Baijiu blending based on the database to realize the online expert knowledge system. The target planning algorithm based on genetic algorithm is used to train the data to derive the optimal blending formula model to reduce production costs and ensure the quality of Baijiu. Establish an artificial intelligence blending network control system in the production of Baijiu blending and flavoring. Fully automatic integration from order generation to production of finished products to improve production efficiency. Realize OEM customization of Baijiu, fully automatic integration from order generation to production of finished products, and improve production efficiency. It will have an obvious role in accelerating the new product development cycle of the enterprise, ensuring the consistency of product quality, shortening the decision-making and information transmission cycle, and improving the scientific and production efficiency of management decisions.

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