Design and Research of Intelligent Energy Monitoring System for Traditional Chinese Medicine Production Enterprises

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Abstract: Energy consumption is high in traditional Chinese medicine production enterprises. The production of traditional Chinese medicine includes the extraction of traditional Chinese medicine components and preparations. The extraction process can be divided into several unit operations, such as filtration, evaporation, crystallization, drying, etc. The preparation process can be divided into crushing, sieving, granulation, tabletting, etc. These processes require energy consumption. Energy consumption is high in traditional Chinese medicine production enterprises. The production of traditional Chinese medicine includes the extraction of traditional Chinese medicine components and preparations. The extraction process can be divided into several unit operations, such as filtration, evaporation, crystallization, drying, etc. The preparation process can be divided into crushing, sieving, granulation, tabletting, etc. These processes require energy consumption.

Keywords: Chinese medicine production, energy monitoring, intelligent

1 INTRODUCTION

At present, the manufacturing industry is actively developing new energy. China 's production enterprises have a large demand for energy, and the problem of energy saving and consumption reduction has attracted more and more attention from the country. The energy consumption problem in the production process of traditional Chinese medicine is becoming more and more prominent, especially the steam consumption. Because the traditional Chinese medicine production enterprises include water, electricity, steam and gas in many aspects of energy use, it is necessary to take measures to reduce energy consumption from the aspects of energy production, use, management and recycling. At present, Chinese medicine production enterprises pay more and more attention to the energy efficiency management and optimization of Chinese medicine production process. Through the application of intelligent manufacturing, refined energy management methods and data-driven energy consumption prediction modeling has become an important research direction.

2   STATUS QUO OF EQUIPMENT ENERGY MANAGEMENT IN CHINESE MEDICINE PRODUCTION ENTERPRISES

2.1 Problems faced by equipment energy management in traditional Chinese medicine production enterprises

The energy management of most Chinese medicine production enterprises is in the primary stage, and there are many unfavorable environmental factors and obstacles to be overcome. The energy management of enterprises is facing a series of problems, mainly in the following aspects. The data collection method is backward, the energy consumption data statistics lag, and the authenticity and integrity of the data are difficult to guarantee, which cannot provide support for energy decision-making and energy conservation. It is difficult to analyze data reports, and manual recording of energy data and paper data reports lacks intuitive data visualization. The energy consumption of different equipment and different operating parameters of the same equipment varies greatly. Energy management lacks scientific and systematic energy management methods. Energy consumption management and capacity planning cannot be reasonably implemented, resulting in a certain degree of waste of resources.

2.2 Key process of equipment energy management in Chinese medicine production enterprises

An energy management system (EMS) was established. By installing intelligent sensors on key energy consumption equipment, energy information is collected in real time and transmitted to EMS. The water, electricity and gas energy consumption data of production workshops, key equipment and public works are collected, monitored and visualized in real time. The production process is mainly composed of feeding dust removal process, extraction process, concentration process and alcohol precipitation, alcohol recovery process, preparation and other stages. The production process of traditional Chinese medicine is shown in figure 1.
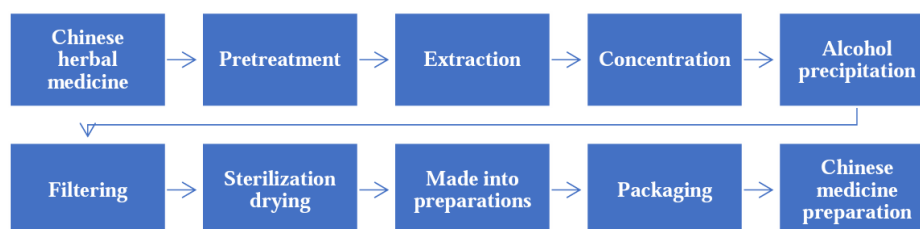

Figure 1. The production process of traditional Chinese medicine.

3   INTRODUCTION OF EQUIPMENT ENERGY MONITORING AND ANALYSIS SYSTEM FOR TRADITIONAL CHINESE MEDICINE PRODUCTION ENTERPRISES

The energy use process monitoring and energy efficiency management of traditional Chinese medicine production enterprises is a management system that integrates information and automation technology, and can realize online monitoring, data statistical analysis, historical

query and other functions of production energy consumption. The system provides managers with transparent data and scientific judgment of fine energy management tools.

3.1 The purpose of the design of energy monitoring and analysis system for pharmaceutical enterprises

The energy data ledger requires that the system can query all energy statistics of the company according to the energy unit tree structure, including energy category, day, month, year, and any time period. The analysis system realizes the retrospective data statistics of any statistical data and restores the statistical process. Energy managers can see how each energy indicator is calculated.

The energy monitoring and analysis system obtains the feedback signal of each energy sampling point from the industrial process database through the OPC interface to form the secondary processing data of the energy management system. According to different equipment types, workshops and customer commissions, electric energy is measured separately.

The whole system from real-time monitoring, data acquisition and storage, integrated information management to resource sharing and information exchange, through the relevant logical relationship processing to achieve a variety of data analysis, early warning alarm, system mutual control, to achieve better management efficiency.

3.2 Overall structure of energy monitoring and analysis system design

Through the analysis of the factory monitoring logic structure, the system logic framework is designed into four layers, which are acquisition control layer, data storage layer[1], process monitoring layer and management application layer. The functions of these four layers are shown in Figure 2.
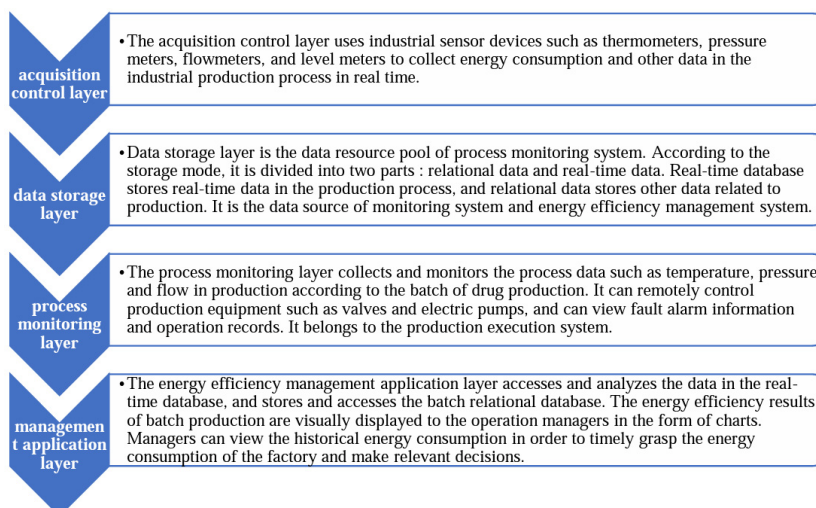

acquisition control layer
- The acquisition control layer uses industrial sensor devices such as thermometers, pressure meters, flowmeters, and level meters to collect energy consumption and other data in the industrial production process in real time.

data storage layer
- Data storage layer is the data resource pool of process monitoring system. According to the storage mode, it is divided into two parts : relational data and real-time data. Real-time database stores real-time data in the production process, and relational data stores other data related to production. It is the data source of monitoring system and energy efficiency management system.

process monitoring layer
- The process monitoring layer collects and monitors the process data such as temperature, pressure and flow in production according to the batch of drug production. It can remotely control production equipment such as valves and electric pumps, and can view fault alarm information and operation records. It belongs to the production execution system.

management application layer
- The energy efficiency management application layer accesses and analyzes the data in the real-time database, and stores and accesses the batch relational database. The energy efficiency results of batch production are visually displayed to the operation managers in the form of charts. Managers can view the historical energy consumption in order to timely grasp the energy consumption of the factory and make relevant decisions.

Figure 2 Overall structure of energy monitoring and analysis system design

4   DESIGN OF EQUIPMENT ENERGY MONITORING AND ANALYSIS SYSTEM FOR TRADITIONAL CHINESE MEDICINE PRODUCTION ENTERPRISES

By constructing a complete energy management system covering the whole process of energy supply, production, transmission, conversion and consumption of Chinese medicine enterprises ; chinese medicine enterprises aim to reduce energy consumption and improve energy efficiency, realize the digitization of energy flow management business and maximize energy saving benefits[2].

The construction of energy management system of traditional Chinese medicine enterprises depends on data acquisition and monitoring system. Using the industrial Internet, the main network architecture within the company, and the dedicated energy management system server, intelligent energy monitoring sensors are installed in key energy supervision links such as decoction, filtration, ethanol recovery, and preparation to realize real-time monitoring, control, optimal scheduling, and comprehensive management of various energy media and key energy-consuming equipment such as water, electricity, and steam. The composition of the intelligent energy management system is shown in Figure 3.
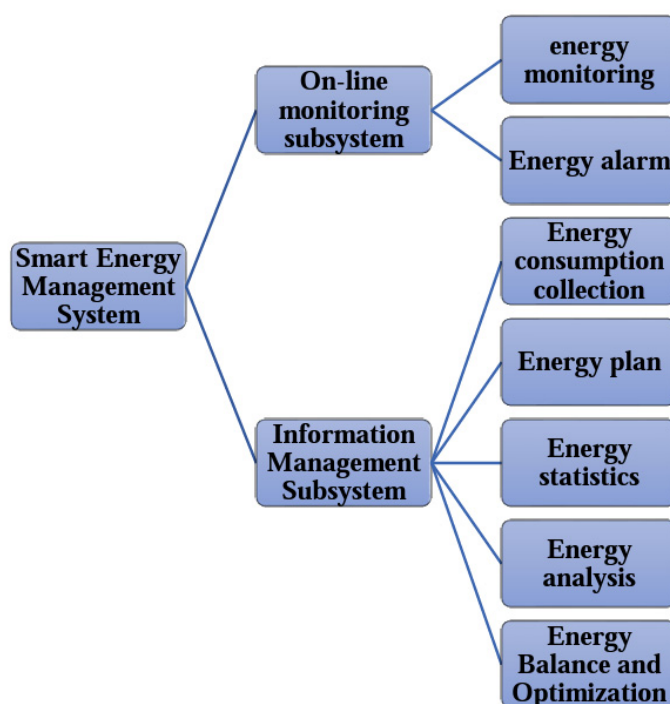

Figure 3 Composition of intelligent energy management system

4.1 Energy monitoring

The real-time energy monitoring of traditional Chinese medicine production enterprises includes energy flow chart monitoring. The scope of energy efficiency monitoring includes energy network general diagram, water, electricity, steam, steam, natural gas and other energy medium diagrams, and flow chart of energy medium in public works. Enterprise key device operation status monitoring diagram.

4.2 Energy alarm

Classified monitoring was performed according to the energy attribution category, such as traditional Chinese medicine extraction, organic solvent recovery, and traditional Chinese medicine preparations. When the energy consumption is abnormal, the system sends an alarm message to notify the relevant processing personnel. Through the system, the energy consumption of energy consumption equipment in traditional Chinese medicine production is obtained in real time, and the real-time dynamic curve is automatically drawn. If the energy consumption system is abnormal, send instructions to the energy consumption equipment in time.

4.3 Energy plan

According to the production operation data, equipment maintenance plan, historical energy consumption and other data of the same period of traditional Chinese medicine production, the energy supply and demand plan of the month and quarter was formulated. According to the production plan, the tracking information is implemented to guide the enterprise to rationally carry out energy production and distribution[3].

4.4 Energy analysis

According to the production situation of traditional Chinese medicine production enterprises, the staff analyzes the consumption of main energy-consuming equipment, analyzes the problems of energy consumption, and explores the methods to reduce energy consumption through energy-saving transformation. The energy planning and actual energy consumption are compared and analyzed by charts. The system performs intelligent statistical analysis on the node meter data of the energy supply system to determine whether it is balanced, so as to detect abnormal energy consumption in time, achieve the purpose of safe energy use, and reduce abnormal energy consumption. At the same time, according to the use of big data analysis and previous historical data to predict energy consumption[4].

4.5 Energy statistics

The statistical analysis of various application data such as water, electricity and gas in the production of traditional Chinese medicine is carried out, and relevant reports are generated. The energy consumption of a stage is analyzed according to the energy category or region, including the energy consumption of each equipment, unit operation energy consumption, growth trend, internal and external energy consumption standards.

4.6 Energy balance and optimization

The energy balance scheduling system of traditional Chinese medicine production enterprises is based on the historical data and real-time data of energy system. On the premise of safe and stable operation of energy system, the comprehensive balance model of energy system is established, and the data analysis is carried out to predict and analyze the energy supply and consumption of enterprise energy system[5]. According to the results of prediction and analysis, the energy balance scheduling scheme is generated, which provides an effective reference for enterprise energy scheduling managers. Considering the changes of steam demand, water and electricity consumption, coal price and power demand with season, environment, production plan, start and stop of equipment and equipment, a multi-cycle scheduling optimization model is constructed. The optimal configuration scheme of steam turbine load, boiler and steam transmission and distribution scheme, and the equipment start-stop strategy with the lowest production cost of traditional Chinese medicine are given online. The model-based optimal scheduling is realized, and the safety, stability and economy[6-7].

5　CONCLUSIONS AND RECOMMENDATIONS

According to the characteristics of traditional Chinese medicine pharmaceutical process, database technology and industrial Ethernet are used to collect data and build a platform for monitoring and energy efficiency management of traditional Chinese medicine pharmaceutical process. The functions of real-time information collection and monitoring, equipment management, energy consumption information statistics and analysis are realized. The intelligence of the energy system is not only the transformation of a certain equipment and process, but also the optimization of the energy consumption process of the whole system of Chinese medicine enterprises. Intelligent energy efficiency management information system can comprehensively monitor, analyze and evaluate the energy.

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