

## **Present Situation and Ways of Technical Upgrading of Traditional Chinese Medicine Pharmaceutical Equipment**

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**Abstract:** The development of traditional Chinese medicine pharmaceutical industry in China is highly dependent on pharmaceutical equipment. In the development of national medical industry, the revitalization of traditional Chinese medicine pharmaceutical industry should be taken as the basic premise. With the development of science and technology, China continues to reform, innovate and upgrade pharmaceutical equipment. At present, China has become a world-class pharmaceutical machinery country. However, it must be recognized that China's traditional Chinese medicine pharmaceutical equipment technology still needs to be improved, among which there are still many problems, affecting the development of traditional Chinese medicine industry. In view of this, in order to explore the road of upgrading and development of pharmaceutical equipment in line with the development of traditional Chinese medicine industry, it is necessary to be based on the background of technological upgrading of traditional Chinese medicine pharmaceutical equipment, and analyze the development status and practical application of traditional Chinese medicine preparation equipment technology. Therefore, targeted exploration and development will be carried out to effectively promote the comprehensive upgrading and development of traditional Chinese medicine pharmaceutical equipment technology.

### **1. Introduction**

Traditional Chinese medicine is the quintessence of Chinese traditional medicine, the treasure of the country and the crystallization of national wisdom. In recent years, our country pays more and more attention to the traditional Chinese medicine industry, no matter from the policy, or the fund is giving the strong support, however, at present, the development of traditional Chinese medicine pharmaceutical equipment industry is still relatively slow. The relevant departments of the state are aware of the bottleneck of the development of traditional Chinese medicine pharmaceutical equipment industry, and have taken a series of efforts to change the current situation of the development of traditional Chinese medicine pharmaceutical equipment technology. From the present situation and future development momentum of traditional Chinese medicine pharmaceutical industry in recent years, it can be seen that the development prospect of traditional Chinese medicine pharmaceutical equipment technology in China is considerable, but there are some problems in the development process of this technology, such as lack of independent innovation ability, non-standard management and so on. It restricts the further development of traditional Chinese medicine pharmaceutical equipment technology. Based on this, the research and development personnel, users and managers of traditional Chinese medicine pharmaceutical equipment should improve the standardization of work, and in order to improve the quality and competitiveness of traditional Chinese medicine pharmaceutical equipment, to promote the upgrading of traditional Chinese medicine pharmaceutical equipment technology.

### **2. Background of technical upgrading of traditional Chinese medicine pharmaceutical equipment**

National policy background. China's current economic development is in the context of the new normal development, the country in the process of economic construction, began to think about the important driving force of various industries to economic development. As an important industry

that can promote economic construction and improve national health, traditional Chinese medicine pharmaceutical industry needs to strengthen its development support. The state has brought the traditional Chinese medicine industry into the ranks of basic industries for strategic development, and subsequently issued a series of policies, the most representative of which is the "outline of the Development of traditional Chinese Medicine in 2006 / 2020" issued by many ministries and commissions in 2007. Among them, it has made clear provisions on traditional Chinese medicine, which has become the development guide and norm of traditional Chinese medicine pharmaceutical industry in the new period. And in the 13th five-year Plan for the Development of Pharmaceutical Industry issued in 2015, it is also stressed that in the process of the development of the pharmaceutical industry, we should increase the support for the pharmaceutical industry of traditional Chinese medicine, and focus on upgrading the technical level of traditional Chinese medicine pharmaceutical equipment, and provide policy guidance for equipment upgrading and innovation. In the report of the 19th CPC National Congress, General Secretary Xi Jinping put forward a new development instruction for the cause of traditional Chinese medicine, put forward a "healthy China strategy," focused on "inheriting and developing the cause of traditional Chinese medicine," and stressed the need to revitalize the traditional Chinese medicine industry with the help of intelligent technology. for the upgrading of traditional Chinese medicine pharmaceutical equipment technology, we also need to actively rely on modern technology.

Background of industrial policy. With the rapid development of society, people pay more and more attention to health. as a treasure of Chinese traditional culture, traditional Chinese medicine (TCM), which is an important part of medicine in the world, has attracted more and more attention from the society. In recent years, people began to advocate the concept of health preservation of traditional Chinese medicine, which plays a certain role in the development of traditional Chinese medicine industry. In the process of the development of traditional Chinese medicine industry in the new period, it also grasps the characteristics of people's health concept, and actively adjusts the industry to meet the needs of people. In 2016, the outline of the Strategic Plan for the Development of traditional Chinese Medicine (2016-2030) was issued, which provides a clearer development direction for the development of the traditional Chinese medicine industry, for example, promoting the development of the traditional Chinese medicine service industry, broadening the service field, integrating the concepts of innovation, coordination, green and openness into the service field of traditional Chinese medicine, making great efforts to innovate and upgrade the technology of traditional Chinese medicine pharmaceutical equipment, and raising the development level of traditional Chinese medicine in an all-round way. Based on this, the traditional Chinese medicine pharmaceutical industry should carry on the upgrade management for the pharmaceutical equipment, strictly control the energy consumption of the pharmaceutical equipment, update the equipment technology at the same time, avoid the loss of more effective components in the pharmaceutical process, and realize the overall upgrading of traditional Chinese medicine pharmaceutical equipment technology.

### **3. The technical status of traditional Chinese medicine pharmaceutical equipment**

Pharmaceutical equipment is lack of adaptability. As we all know, most of the traditional Chinese medicine pharmaceutical equipment comes from the western medicine pharmaceutical equipment, but the traditional Chinese medicine production is extremely complex, wants to maintain the medicinal property to have the extremely high request to the pharmaceutical equipment, the present traditional Chinese medicine pharmaceutical equipment can not meet the requirements of traditional Chinese medicine production very well, so it can not guarantee the preparation efficiency of traditional Chinese medicine. In the process of traditional Chinese medicine, because the matching degree of traditional Chinese medicine pharmaceutical equipment and traditional Chinese medicine production details is not high, its function will not be consistent with the industry standards.

Equipment pharmacy lacks energy saving. In the improvement of traditional Chinese medicine pharmaceutical equipment, there are mainly two paths, one is based on the western medicine pharmaceutical equipment, based on the production requirements of traditional Chinese medicine to

adjust and reconstruct. Second, innovative adjustment of traditional Chinese medicine processing technology. The traditional Chinese medicine pharmaceutical equipment constructed in these two ways can not meet the needs of the modern traditional Chinese medicine pharmaceutical industry. And in the production process, because the traditional Chinese medicine pharmaceutical equipment in the temperature and heat utilization efficiency is low, and can not well control the uniformity of drug materials, it will lead to the problem of environmental pollution in the pharmaceutical process. At the same time, there will be more energy consumption in the production process, which is not consistent with the requirements of intensive, energy-saving and systematic production put forward by the current pharmaceutical industry.

The effective components are lack of protection. The traditional Chinese medicine pharmaceutical equipment evolved from the western medicine pharmaceutical equipment is designed and made for the components of the western medicine. Therefore, the pertinence of the traditional Chinese medicine in drug extraction, drying and spectral sterilization is not strong, and it is easy to affect the medicinal properties of the raw materials of traditional Chinese medicine. Under this problem, the function and stability of traditional Chinese medicine preparation will be affected, at the same time, it will increase its thermal sensitivity, thus affecting the pharmaceutical effect of traditional Chinese medicine.

#### **4. The application of modern pharmaceutical control technology in traditional Chinese medicine pharmaceutical equipment**

In the cleaning of traditional Chinese medicine slices, the traditional process is manual cleaning, which is common in small clinics with fewer drugs, but the materials used by traditional Chinese medicine pharmaceutical factories are larger. If the manual cleaning method is simply adopted, it will not only increase the cost, but also cost more time and effort. For example, the spray drum can carry out centralized and mass cleaning of medicinal materials, but it is unable to clean fragile medicinal materials such as flowers, and the emergence of professional cleaning tools has solved this problem. In order to solve the above problems, stainless steel can be used instead of carbon steel. By increasing the water pressure, the cleaning efficiency and cleanliness can be improved, and the life of the machine can be prolonged at the same time.

In drug extraction, ultrasonic and microwave extraction technology should be the most extensive, for example, the use of ultrasonic extraction omits the heating link, unlike the traditional room temperature boiling method and reflux method, which need to be heated for a long time and affect the efficacy of medicinal materials, this method is especially suitable for heat-sensitive medicinal materials; microwave extraction technology with the help of microwave for rapid drug extraction, the process is faster and less consumption. In addition, the medicine can be extracted by refining juice extraction method, and the essence can be extracted by evaporation and concentration after the raw material is changed into juice. At the same time, the essence can be condensed into tablets, this process can be used with scraper agitator, the agitator is supported by polytetrafluoroethylene plate, has the advantages of rapid heat transfer and evaporation, rapid concentration, low bottom loss of extract, and the yield of extract can be effectively improved.

The drying of tablets is generally microwave vacuum drying equipment, vacuum freeze dryer and so on. The first kind of drying equipment is to use microwave to heat the extract as a whole, because the transmission of microwave in vacuum is not affected, so it is easy to remove the moisture, and the time is short, the loss is small, and the efficacy of the pill is fully guaranteed. The second kind of drying equipment is mainly used to dry the extract under the environment of low temperature and low pressure. This kind of equipment is most suitable for the drying of thermosensitive substances, which is helpful to ensure its activity, prevent the drug from being decomposed and deformed under high temperature and high pressure, and affect the active components such as proteins in the drug. and this kind of equipment has good sealing, less pollution to the extract, and can effectively ensure the original medicinal properties of the drug. In the drying equipment of traditional Chinese medicine pills, the traditional equipment has hot air oven, vacuum drying equipment and so on, but these equipment have the following disadvantages: high

temperature, high energy consumption, difficult to effectively control temperature, long drying time, inadequate utilization of heat energy, low degree of automation, failure to form assembly line operation, dynamic monitoring is not in place, pill treatment has been greatly affected. With the rapid development of intelligent technology, intelligent centrifugal vibration dryer is more and more used in the field of tablet drying. The equipment can effectively shorten the drying time, the energy consumption is low, the loss of drug composition is small, the drying process is more uniform and dynamic, the quality of pills is better and the medicinal property is better.

Quality control technology for preparation of traditional Chinese medicine. Chinese medicine has a long history of development, and it has its own set in the preparation of traditional Chinese medicine. Nowadays, the supervision of drug quality is increasing in our country, therefore, the monitoring of the preparation quality of traditional Chinese medicine is strengthened, with the help of professional quality inspection means and equipment for quality inspection. In the aspect of separation technology of traditional Chinese medicine, high pressure liquid pump, high sensitivity detector and high efficiency particle fixation are commonly used. In the extraction of drugs, it is also necessary to do a good job of quality detection and control. The links of drug extraction, pharmaceutical concentration and drug drying should remain independent of each other, and the quality of each link of drug extraction should be supervised to ensure that the quality is up to the standard.

## **5. Effective ways to upgrade the technology of traditional Chinese medicine pharmaceutical equipment**

Strengthen the applicability of traditional Chinese medicine pharmaceutical equipment. With the support of modern science and technology, when upgrading the technology of traditional Chinese medicine pharmaceutical equipment, we can make targeted improvements with reference to the preparation standard of traditional Chinese medicine preparation. Modern processes such as ultrasound, high pressure and intelligent drying are introduced into pharmaceutical equipment. Through the comprehensive application of the above technology, we can make the traditional Chinese medicine pharmaceutical equipment technology to achieve a more effective upgrade, can make the traditional Chinese medicine pharmaceutical equipment more able to meet the technical details of the current traditional Chinese medicine production requirements, to achieve a comprehensive adaptation to the production of traditional Chinese medicine.

Reduce the loss in the application of traditional Chinese medicine pharmaceutical equipment technology. In the process of upgrading the technology of traditional Chinese medicine pharmaceutical equipment, it is necessary to strictly control the energy consumption, reduce the loss as much as possible, and regard it as the core priority. In the process of controlling energy consumption, the whole process of traditional Chinese medicine should be controlled to ensure the high uniformity of raw materials. On this basis, the thermal energy loss of pharmaceutical equipment can be effectively reduced.

To ensure that the active ingredients of the drug are not lost. In the process of preparation of traditional Chinese medicine, it involves extraction, concentration, drying and sterilization. There is a common phenomenon in the pharmaceutical equipment used in these operation units, that is, there is great damage to the heat-sensitive components and the transfer rate of active components is low. When extracting the raw materials of traditional Chinese medicine, when condensing the extract, we should pay attention to the concentration ratio, relative density and concentration efficiency, so that the above parameters should be at a relatively high level. Most of the pharmaceutical equipment has some problems, such as long heating time, unable to heat the material evenly and so on, which will affect the thermal sensitivity and volatility of traditional Chinese medicine. Based on the above problems, the research and development of traditional Chinese medicine pharmaceutical equipment should adopt the corresponding technical means to control the process of extraction, drying and sterilization of traditional Chinese medicine. The extraction ratio, the concentration parameters of raw materials and the drying and heating values of raw materials should be controlled. During the inactivation operation, the number of operations should be reduced as far as possible to

ensure the probability of reducing the loss of effective components in the drug.

Innovation and construction of local traditional Chinese medicine pharmaceutical engineering technology platform. With the support of information technology, when upgrading the traditional Chinese medicine pharmaceutical equipment technology, we should actively build the traditional Chinese medicine pharmaceutical engineering technology platform based on the local internationalization. We should pay attention to the innovation of independent property rights, ensure the diversification of traditional Chinese medicine production technology, and adapt to the future development trend of traditional Chinese medicine preparation. In the practice of drug preparation, we should pay attention to the diversified combination process, and pay attention to the combination requirements when combining each unit, so as to realize the reasonable allocation of equipment technology in the process of individual unit pharmacy. In the pharmaceutical engineering technology platform, the technology coverage should be improved, including industrial membrane separation technology, new micronization technology, new carbon dioxide supercritical extraction technology and so on. Among them, the industrial membrane separation technology refers to the separation of substances based on the original biological system, which can effectively concentrate the substances. The new micronization technology is mainly to crush the medicinal materials, and the modern new micronization technology has been developing in the direction of realizing the ultra-fine grinding of medicinal materials. The supercritical extraction technology of new carbon dioxide refers to the extraction and extraction of drugs, which is often used in the development of first and second class drugs.

## **6. Development trend of traditional Chinese medicine pharmaceutical equipment Industry in China**

### **6.1 Product integration and modularization**

The analysis of the pharmaceutical process of traditional Chinese medicine shows that the production process is more complex, from the pretreatment of traditional Chinese medicine to the specific production links, all involve the corresponding production technology. In the preliminary treatment, the basic procedures such as cleaning, cutting, drying and sterilization should be done well, and then the effective extraction and extraction should be carried out. By perfecting the above complex production process, the structure of traditional Chinese medicine equipment is also more complex. For the traditional Chinese medicine pharmaceutical equipment, it lacks the continuity between the processes. Relying on the modern technology, the traditional Chinese medicine pharmaceutical equipment can be integrated, modularized and controlled in the whole process, and several unit processes in the pharmaceutical process can be integrated, which is basically in line with the requirements for the pharmaceutical process put forward in the new version of GMP. The analysis of the modularization of pharmaceutical equipment shows that its main function is to modularize and control the system as a whole, to combine the production modules on the basis of understanding the specific needs of customers, and to connect the pipes and equipment with specific functions, so as to operate through the man-machine interface, so it is easier to maintain and adjust.

### **6.2 Automation and intelligence of traditional Chinese medicine pharmaceutical equipment**

According to the current situation of traditional Chinese medicine pharmaceutical equipment in China, it lacks the application of automation and intelligent technology, so it is unable to achieve efficient drug preparation. In the new version of GMP, drug quality control is more stringent. And on the basis of the continuous development of information technology, it is very necessary to innovate the pharmaceutical equipment technology. The traditional Chinese medicine preparation process is highly dependent on manual operation, which has a certain blocking effect on the improvement of the overall pharmaceutical efficiency. In the current traditional Chinese medicine pharmaceutical equipment, we should actively apply the intelligent control system, but also can apply the remote monitoring system to achieve the overall control of the pharmaceutical process. In order to realize the on-line monitoring and control of traditional Chinese medicine pharmaceutical

equipment, we should ensure that the equipment has a perfect analysis and processing system, and can be produced and controlled automatically in the pharmaceutical process. In the design of advanced pharmaceutical equipment, priority should be given to its functions, such as random control, real-time analysis, memory printing, automatic alarm and remote control. The traditional Chinese medicine preparation equipment is basically a single machine and a single process production, in the future development trend, will be transformed into an automated production line, at the same time can achieve unit operation. At present, our country also pays more attention to the innovation of traditional Chinese medicine pharmaceutical equipment, so the degree of automation and intelligence of traditional Chinese medicine pharmaceutical equipment in our country is constantly improving. Research and development personnel should be aware of the particularity of Chinese medicine production to ensure that accurate production control can be achieved.

### **6.3 Pre-evolution and completion of pharmaceutical technology of traditional Chinese medicine**

Countercurrent multistage leaching process of traditional Chinese medicine. This technique mainly uses the solid-liquid two-phase concentration gradient difference to transfer the effective components of medicinal materials, and the diffusion path is the diffusion of the extraction solution from the high concentration to the low concentration. In the extraction of traditional Chinese medicine, more professional and technical parameters are involved, including solution mass, medicinal material surface area, diffusion time, diffusion coefficient and concentration gradient. The relationship between the above parameters can be represented by the following formula:  $ds=D.F.dc/dx.dt$ .

Spray drying technology of traditional Chinese medicine. The preparation of traditional Chinese medicine involves drying technology, in terms of the current drying system, it is lack of more clear dynamic data. The drying time of traditional Chinese medicine spray is short, but this problem can not be solved only by theoretical data. If the heat-sensitive drugs need to be sprayed into particles or powder, it is suitable to use traditional Chinese medicine spray drying method, the use of this drying process, mainly according to different types of drugs to select appropriate process parameters, at the same time targeted adjustment and control.

## **7. Conclusion**

There are still many problems in the development of traditional Chinese medicine pharmaceutical equipment technology in our country. Under the social background of vigorously supporting the development of traditional Chinese medicine industry, the traditional Chinese medicine industry should recognize the present situation of its own development and find out the correct development goal. through the upgrading of traditional Chinese medicine pharmaceutical equipment technology, in order to improve the production quality of traditional Chinese medicine. More production processes will be involved in the pharmaceutical process of traditional Chinese medicine, and the preparation personnel should make a reasonable application of it. At the same time, we should strengthen the control of traditional Chinese medicine pharmaceutical equipment, make it more adaptive, realize the effective control of energy consumption in the production process, and reduce the loss of effective components in the production process. On the basis of building a professional integration platform of traditional Chinese medicine pharmaceutical equipment technology, strengthen the control of traditional Chinese medicine production process. It is necessary to actively innovate the technology of traditional Chinese medicine pharmaceutical equipment in order to promote its intelligent development.

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