Design and Key Technology Research on Veterinary Drug Quality and Safety Traceability System

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Abstract. Starting from the status quo of veterinary product traceability, this paper analyses the necessity of establishing the Veterinary Drug Quality and Safety Traceability System (the System), and expounds that the veterinary drug quality and safety traceability technology includes food safety traceability technology based on veterinary drug big data and key point information monitoring technology in the veterinary drug circulation. Then, according to "one code for one thing" standard of agricultural products, based on the framework of veterinary drug management system based on cloud platform, the veterinary drug quality and safety traceability system is constructed by integrating the cloud service resources such as infrastructure, data service and platform service provided by cloud platform of veterinary drug management information service. The opportunities and challenges facing the construction of veterinary drug quality and safety traceability system are also discussed in a bid to provide reference for the construction of veterinary drug quality and safety traceability system.

1. Introduction
In recent years, with the full implementation of Good Manufacturing Practice for Veterinary Drugs (GMP) in China, veterinary drug market regulations have been strengthened, veterinary drug counterfeiting has been intensified, and industry access standards have been improved. The strengthening of veterinary drug quality supervision has improved the overall quality of veterinary drug industry so that veterinary drug quality has been significantly improved. However, the means of information supervision of veterinary drug products is still single. In recent years, counterfeiting of factory name, counterfeiting of approval number and illegal addition of active ingredients other than prescriptions have continued to occur. The supervision of veterinary drug market is quite difficult and workload is heavy. It can be seen that only traditional means of veterinary drug supervision is unable to meet the needs of information development. Therefore, it is necessary to establish a traceability system for the quality and safety of veterinary drugs, and to strengthen the safety supervision of veterinary drug quality.

2. Research status
Quality tracking, like a link, connects the links of veterinary drug production, collects and preserves all the information of veterinary drug production, storage, sales and other processes, so as to find out which
link the quality problems of veterinary drugs are in a timely manner [1]. In January 2015, the Ministry of Agriculture promulgated a public announcement, and began to use the national veterinary drug product traceability system to implement the electronic traceability code (2-D code) identification system for veterinary drug products. Veterinary drug products need to be listed with all codes, and also need to upload the information of electronic traceability codes (2-D codes) of veterinary drugs into/out of warehouses. Pilot work has been carried out nationwide in terms of the operation link [2].

Xiong Benhai and Luo Qingyao [3] put forward the data specification of mobile data acquisition in pig farming process, and developed a mobile system suitable for the establishment of pig farming archives and traceability of pork product quality. Operation of the system shows that the mobile system can collect and transmit the data of immune events, feed and veterinary drug use by mobile and wireless network, and realize establishment of electronic files and deep inquiry of product quality and safety data in pig breeding process. Ji Zengtao, Sun Chuanheng [4] and others have designed and developed an information management system of pig health breeding network. The system includes 8 modules: pig farm management, pig herd management, feed management, veterinary drug vaccine management, disease prevention and control, statistical analysis, GAP management and system management, among which veterinary drug vaccine module is used for veterinary drug and vaccine import and export management, including veterinary drug storage, veterinary drug outflow, vaccine storage, vaccine outflow, inventory statistics, Veterinary Drug Dictionary and vaccine dictionary and other functions. Lei Xinggang, Zhou Lv [5] and others, through the establishment of traceability management system, make real record and acquire basic information of pigs, feed use information, veterinary drug use information and immune information. The management function of veterinary drug archives is mainly used to manage veterinary drugs and immunological drugs in farms. Zhang Chaofeng [6] developed a sheep farm information management system, which mainly includes the following 8 modules: sheep management module, sheep breeding module, embryo transfer module, disease and epidemic prevention module, report module, learning and appreciation module, sheep farm management module and system module, among which the disease and epidemic prevention module includes 4 catalogues: disease diagnosis and treatment, quarantine and immunization, sheep house disinfection and veterinary drug entry.

3. Requirement analysis

At present, the veterinary drug industry cannot achieve information management of veterinary drug products, such as warehousing, logistics, management and supervision, cannot meet the current information age veterinary drug industry management and development needs. The establishment of veterinary drug traceability information system with veterinary drug product identification as the core is particularly urgent. Referring to the application status of veterinary drug traceability system and national drug electronic supervision, veterinary drug products, as an important part of protecting livestock and poultry health, should also adapt to the trend of information age and establish veterinary drug quality and safety traceability system. In the meantime, veterinary drug quality and safety traceability system is conducive to defining the specific identity of veterinary drug products, determining the source and process of veterinary drug products, providing services for veterinary drug production, business enterprises and consumers, ensuring and stabilizing veterinary drug quality, and establishing veterinary drug quality and safety traceability is of great significance. Furthermore, the establishment of veterinary drug quality and safety traceability is an important means and necessary measures for product and business enterprises and consumers to find quality problems and recover problematic products.

4. Key technology analysis

4.1. The whole process traceability technology of veterinary drug quality based on big data

Veterinary drug quality and safety big data traceability technology is the key to achieve traceable flow of veterinary drug products, traceable responsibility, and provide veterinary drug traceability services
for the industry. The first is the construction technology of dynamic information association model for veterinary drugs in the whole process. This paper studies the heterogeneous data dictionary of veterinary drug traceability, establishes the vertical serial mapping relationship between veterinary drug identification information and basic information and dynamic real-time information, establishes the horizontal mapping relationship of veterinary drug data information, image information and video information, and forms the dynamic information association model of veterinary drug whole process. The second is the correlation method between livestock products and veterinary drug identification. Aiming at the problem of over-proof veterinary drug residues in livestock products, based on the one-to-one correspondence between veterinary drug labels and livestock and poultry labels and veterinary drug forward traceability and reverse traceability technology, the traceability technology of quality and safety of livestock products is put forward, and the veterinary drug use is traced back to realize the over-proof of veterinary drug residues caused by blindness, over-dose and drug withdrawal use, such people can be held responsible quickly.

4.2. Livestock product safety prediction technology based on spatial information technology

The technology of livestock product safety prediction based on spatial information technology is to use GIS spatial analysis technology to form a spatial distribution pattern of veterinary drug flow direction according to the flow direction of veterinary drug flow and regional breeding situation, and to explore the relationship between veterinary drug residue and flow direction of veterinary drug flow by using large data mining technology and intelligent analysis technology. In order to realize early warning and timely prevention of veterinary drug residue risk in livestock products, the residual risk of certain veterinary drugs in livestock products is studied and judged, and the analysis and prediction model of livestock product quality and safety based on veterinary drug big data is constructed in an effort to realize early warning and timely prevention of veterinary drug residue risks of livestock products.

4.3. Perception monitoring technology for key points of veterinary drug circulation based on internet of things

The first is the aggregation and split technology of veterinary drug logistics packaging identity. A multi-to-one association model is established to form an aggregation association information table and association rules of packaging aggregation process, and to form a multi-level association relationship among different packages. A one-to-many association model of large unit packaging label and small unit packaging label is established to form disassembly for the disassembly process of veterinary drugs from large unit packaging to small unit packaging. Subdivide the related information table to realize the conversion between the large unit packaging identification code and the small unit packaging identification code. The second is real-time sensing technology for cold chain transportation of veterinary biologics. To divide the environmental adaptation grade of veterinary biological products, formulate the corresponding control standard of transportation environmental factors, develop a real-time monitoring device for veterinary drug cold chain transportation based on temperature, humidity, illumination intensity and air pressure sensors, and combine wireless transmission device and GPS device to form Internet of Things technological solution integrating environmental monitoring, real-time positioning and wireless transmission of veterinary drug cold chain transportation. Finally, based on the developed Internet of Things device, the environmental distribution law of veterinary drugs in different time and space in the vehicle is explored, and the 3-D monitoring and control model of veterinary drugs transportation is constructed.

5. System framework and structure design

5.1. System framework design

Based on Android development and mobile Internet technology, a veterinary drug quality and safety traceability system is constructed to realize the basic information query of veterinary drug products and the whole traceability of veterinary drug production and circulation information. Firstly, in view of the
complexity of veterinary drug network environment, the adaptive network switch algorithm is studied to realize automatic switch of wireless communication network, fully considering the application scenario and environmental applicability of intelligent terminals, testing high-performance materials, developing intelligent terminal protection packaging technology, combining with the requirements of high-speed and sensitive code reading, developing professional bar scanning engine for 2-D veterinary drugs. On the basis of ARM processor, integrating the latest bus technology, to develop a special intelligent terminal for veterinary drug information supervision, in a bid to realize the portability, intelligence, high efficiency and humanization of the intelligent terminal for veterinary drug information traceability; Then, using the Spring for Android framework, combined with the veterinary drug 2-D code graphics pre-processing and decoding technology, to develop rapid identification method of veterinary drug traceability identification, based on the veterinary drug packaging identification aggregation split conversion method, to establish automatically associated model of veterinary drug identification and veterinary drug whole process information, adopting observer mode, designing the network communication and veterinary drug information query quick response mechanism, constructing the veterinary drug whole process information query method based on the 2-D code or attribute information, integrating the veterinary drug information traceability APP, realizing the veterinary drug traceability and related information quickly and accurately. Finally, based on veterinary drug quality and safety traceability system, combined with veterinary drug traceability marking fast recognition technology and veterinary drug whole process information automatic association technology, the traceability application method of 2-D code marking in veterinary drug production, circulation and use process is studied, so as to realize real-time dynamic traceability of whole veterinary drug circulation process information.

5.2. System structure design
According to the "one code for one thing" standard of agricultural products, under the framework of veterinary drug management system based on cloud platform, the veterinary drug management information service cloud platform provides infrastructure, data services, platform services and other cloud service resources, and mainstream intelligent terminal platform is applied to build veterinary drug quality and safety traceability system. Management departments at all levels, veterinary drug production and marketing enterprises and consumers can accurately understand the whole process dynamic information of veterinary drug production, processing, logistics, warehousing, sales and so on through scanning 2-D code, bar code and other inquiries on intelligent terminals at anytime and anywhere according to their authority, so as to ensure "the quality of veterinary drugs can be monitored, process can be traced, and government can regulate", in a bid to achieve the goal of "clear source, clear direction, consumers 'confidence" of veterinary drugs. The main functional structure of veterinary drug quality and safety traceability system is shown in Figure 1.
5. Conclusions
Veterinary Drug Quality and Safety Traceability System mainly aims at issues of difficult access to production data, logistics monitoring data and the lack of anti-counterfeiting means in veterinary drug industry. Through the unique identification information printed on veterinary drug package, the System can provide service for veterinary drug industry production statistics, enterprise warehouse management and product market circulation, etc. The establishment of Veterinary Drug Quality and Safety Traceability System, through the identification and traceability of veterinary drug products, can also achieve the whole process monitoring of all animal disease vaccines and other veterinary drug products national wide, and achieve product traceability and origin. The System can not only provide a data information management platform for the whole process monitoring of veterinary drug production, circulation and use, but also provide relevant public information services for the government, enterprises and consumers.

The key to the establishment of the System aims at such issues as data fragmentation, islanding and incoherence in the whole process of veterinary drug production, circulation and use. Using Internet of Things technology and equipment, mobile terminal equipment and other modern concepts based on the concept of "one code for one drug, one code for one animal, one-to-one correspondence, whole process traceability", using information flow to reflect the material flow of veterinary drugs in the whole process could meet the immediate needs of veterinary drug producers, veterinary drug operators, veterinary drug regulators and livestock and poultry breeders for the key information of veterinary drugs in the whole process, and could realize the forward tracking and reverse traceability of veterinary drugs. The innovation of this research lies in the design of traceable coding and watermarking encryption technology for minimum sales unit of veterinary drugs, the establishment of multi-source heterogeneous data dictionary for large data of veterinary drugs, the development of related Internet of Things technology and equipment, and the dynamic real-time perception of key information in production and circulation, to establish the information chain of the whole process of veterinary drugs by integrating...
pig, cattle, sheep RFID identification code and group identification code of bird and wasp, and creating an information chain of the whole veterinary drug process, integrating the technological system of traceability, origin source, and supervision of veterinary drugs.

The establishment of the System conforms to the current trend of global informationization and is an important part of veterinary drug industry informationization. Meanwhile, the Medium-Term and Long-Term Plan for Animal Epidemics approved by the State Council also provides a rare opportunity for the development of veterinary drug industry. The safety, effectiveness and quality of veterinary drugs can be controlled and tracked. Tracing is also the voice of industry. This brings good opportunities for the building of the System. At the same time, the construction of the System is also facing challenges such as huge amount of data, high real-time requirements, high-frequency concurrent access and complex operation logics. Therefore, the construction of the System should not only be paid enough attention by the government supervision department, but also be promoted by relevant documents. In the meantime, the System is only a part of the veterinary drug industry product traceability system construction. It also needs the government to increase investment and orientation. Effective measures should be taken to ensure the effective operation of the System.

Acknowledgments
This research was funded by the National Natural Science Foundation of China (71573263), the Fundamental Research Funds for the Central Research Institutes (Y2018PT82 and Y2018PT35) and The Agricultural Science and Technology Innovation Program (CAAS-ASTIP-2016-AII).

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