

PAPER • OPEN ACCESS

Analysis of Principal Issues and Key Technologies in Intelligent Perception of Veterinary Drug Circulation and Use Process

To cite this article: Liwei Xing *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **218** 012164

View the [article online](#) for updates and enhancements.

You may also like

- [Intelligent Veterinary Drug Information Management System: Architecture, Technology and Application](#)
Jianhua Zhang, Fantao Kong, Shanshan Cao *et al.*
- [The Value, Mode and Promotion Path of the Informatization of Veterinary Drug Production and Supervision](#)
Guodong Cheng, Liwei Xing, Shanshan Cao *et al.*
- [Mannheimiosis of cattle, sheep and goats](#)
A I Laishevtsev



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

Analysis of Principal Issues and Key Technologies in Intelligent Perception of Veterinary Drug Circulation and Use Process

Liwei Xing¹, Guodong Cheng¹, Wei Sun¹, Jianzhai Wu¹, Shuqing Han¹ and Fantao Kong^{1*}

¹Agricultural Information Institute, Chinese Academy of Agricultural Sciences/Key Laboratory of Agricultural Big Data, Ministry of Agriculture and Rural Affairs, Beijing, 100081, China

*Corresponding author's e-mail: kongfantao@caas.cn

Abstract. Through exploring the current research status of veterinary drug circulation and use, the principal issues in the process of veterinary drug circulation and use are discussed. This paper summarizes the application of GSP-based traceability and correlation technology in veterinary drug circulation, package identification aggregation and splitting conversion technology in veterinary drug logistics, real-time perception technology in cold chain transportation of veterinary biological products, and "one-to-one" matching technology, veterinary drugs, livestock and poultry in intelligent perception of veterinary drug circulation and use process.

1. Introduction

On January 15, 2010, the Ministry of Agriculture issued Regulation No. 3, "Good Sale Practice for Veterinary Drugs" (referred to as "GSP") that came into effect since March 1st, 2010. GSP is the basic standard for veterinary drug quality control, and is a set of management system to strengthen the management of veterinary drug operation in a bid to ensure the quality of veterinary drug. The essence of GSP is as follows: in the process of veterinary drug circulation, aiming at the procurement, storage and sale of veterinary drugs, a whole set of standards and regulations are formulated to prevent the occurrence of quality accidents and guarantee the veterinary drugs to meet the quality standards. The core is to restrict the behaviour of veterinary drug enterprises through strict management system, control the quality of the whole process of veterinary drug operation, prevent the occurrence of quality accidents, and ensure the supply of qualified veterinary drugs to users [1]. Therefore, monitoring and control of veterinary drug circulation process are favourable guarantee for the quality control of veterinary drugs.

Federal Food, Drugs and Cosmetics Act of the United States provides very clear and specific provisions on the use of veterinary drugs. Those drugs shared by both human and livestock must be used according to the prescriptions of licensed veterinarians and under their guidance. The use of feed drug additives must also be based on the prescription of medicated feed issued by a licensed veterinarian and be used under the guidance and supervision of a licensed veterinarian. A licensed veterinarian must be responsible for the prescription of the medicated feed. If a veterinary drug is to be used for feed, an application must be made and used under the guidance of a licensed veterinarian. The use of new veterinary drugs that are patented must be authorized. In case of any problem found or



inconsistent with the declaration, the authority has the right to request to stop sale or suspend the use of the drug. Any violation of the above regulations will be considered illegal. China's Veterinary Drug Administrative Regulations stipulate that veterinary drug users shall abide by the regulations on the safe use of veterinary drugs formulated by the veterinary administrative department under the State Council and establish medication administration records. It is prohibited to use fake or inferior veterinary drugs as well as drugs and other compounds prohibited by the veterinary administrative department under the State Council. The catalogue of prohibited drugs and other compounds shall be formulated and promulgated by the veterinary administrative department under the State Council. When veterinary drugs are used for edible animals as prescribed by the off-medication period, the breeder shall provide the purchaser or slaughter with accurate and true medication records, and the purchaser or slaughter shall ensure that the animals and their products are not used for food consumption during the medication and off-medication periods. It is strictly forbidden that drugs for humans are used animals without authorization. It is also forbidden to sell edible animal products containing prohibited drugs or veterinary drug residues exceeding the standard.

Generally speaking, the circulation and use of veterinary drugs may lead to the safety problems of veterinary drugs. If veterinary drugs are used extensively, to guarantee the food safety level, it is necessary to strengthen the monitoring and supervision of the circulation and use of veterinary drugs. Therefore, it is necessary to apply modern agricultural technology to the monitoring and supervision of the circulation and use of veterinary drugs in an effort to ensure safety of veterinary drugs in the whole process of circulation and use.

2. Analysis of Main Issues

Chinese researchers have studied the marketing and cold chain logistics supervision mode and system development in the process of veterinary drug circulation. For example, Anxi County [2], Fujian Province proposed a new mode of veterinary drug supervision, such as the establishment of county-level veterinary drug chain management system, the establishment of electronic veterinary drug supervision platform, the implementation of veterinary drug farmers purchase card system, etc. These targeted measures and ideas will promote the establishment and improvement of a good monitoring platform for the circulation and safe use of veterinary drugs, and provide reference for other similar areas to improve and standardize veterinary drug supervision. In order to better manage veterinary drug sales and improve the modern level of veterinary drug sales management, on the basis of demand analysis of veterinary drug enterprises, Sun Lingling [3] used SQL Server 2008 database and C#.NET technology to develop a C/S structure of veterinary drug sales management information management system under the circumstance of Microsoft Visual Studio 2013. It can manage the basic information of veterinary drugs, the basic information of veterinary drug pharmaceutical manufacturer, the basic information of customer and the related data, and synthetically query, statistics and analysis of the complicated combination conditions in the process of veterinary drug sales, thus the scientific office work and effective improvement of the efficiency and accuracy of information management in the process of veterinary drug sales. Gao Lujun and Liu Ling [4], aiming at the issues of temperature control in the production, storage and transportation of veterinary biological products, taking the national veterinary drug electronic traceability code as the carrier, proposed the application mode of temperature control of the Internet of Things (IOT) in the field of veterinary biological products by using the temperature acquisition terminal to obtain real-time temperature of all veterinary biological products in a bid to provide reference for the application of Internet of things in veterinary drug industry. Internet of Things (IOT) and cloud computing [5], two advanced and increasingly matured information technologies, can be integrated into vaccine cold chain monitoring projects and show excellent results. Similarly, both technologies can be applied to veterinary drug cold chain monitoring systems such as animal vaccines, etc. but the current research is relatively less. How to apply the advanced information technology to the circulation and use process of veterinary drugs is the inevitable trend of future veterinary drug intelligent supervision.

3. Exploration of Key Technology Research Path

3.1. Traceability Correlation Technology of Veterinary Drug Circulation Process Based on GSP

The dynamic correlation of veterinary drug circulation information is not only the key of veterinary drug traceability, but also the basis of large data supervision [6]. Firstly, the construction technology of key information collection directory in circulation; In view of the important links involved in the process of veterinary drugs from pharmaceutical to animal use and circulation, and referring to GSP quality management practice for drug operation, combined with field investigation and expert discussion, the key information involved in the five links of veterinary drug circulation, such as logistics transportation, storage, veterinary drug testing, distribution and animal use, is clarified. The catalogue of key information collection in circulation links can record the key data in detail, form the information chain and data chain throughout the circulation process, and ensure the record of key information and the identification of information carriers. Secondly, the traceability correlation technology based on minimum veterinary drug unit; according to the idea of "one code for one drug, whole process traceability", taking the individual traceability mark of the smallest unit of veterinary drugs as the main line, combining with the catalogue of key information collection in circulation link, the mapping relationship between the traceability mark of veterinary drugs and the key information in circulation link is established, and the traceability correlation model based on the smallest unit of veterinary drugs is formed to realize positive sequence query and reverse sequence traceability of the information of veterinary drugs circulation process so as to ensure the synchronization of information flow and real logistics of veterinary drugs.

3.2. The aggression and split conversion technologies for veterinary drugs logistics package marking

In the circulation of veterinary drugs, there exist many packaging conversion phenomena, the conversion of packaging size is easy to cause the mark miss-matched so that traceability information cannot be related, affecting the whole traceability of veterinary drugs. The first is the construction technology of many-for-one aggregation association model. Aiming at the aggregation process of veterinary drugs from small unit packaging to large unit packaging, a many-for-one aggregation association model is established according to the label coding and packaging quantity of small unit packaging and large unit packaging, and the aggregation association information table is formed. Through the association correspondence, the association rules of packaging aggregation process are established to form different packaging. The multi-level relationship between them can realize the conversion of batch code and large unit code of small unit packaging of veterinary drugs, and then obtain the synchronous interaction between the label of small unit packaging of veterinary drugs and the circulation information. The second is the construction technology of one-to-many split association model. Aiming at the split process of veterinary drugs from large-unit packaging to small-unit packaging, a one-to-many split correlation model of large-unit packaging label and small-unit packaging label is established, and a split correlation information table is formed to realize the conversion of large-unit packaging label code and small-unit packaging label code of veterinary drugs, and to promote the label corresponding and circulation information tracking of veterinary drugs.

3.3. Real-time Sensing Technology for Cold Chain Transportation of Veterinary Biological Products

Veterinary drugs, especially veterinary biological products, have very strict requirements in the transportation process. It is urgent to carry out the real-time dynamic perception of environmental information in the cold chain transportation process. The first is to establish the control standard of environmental factors in the transportation process. Based on the environmental conditions of veterinary biological products during transportation and from the perspective of ensuring the quality of veterinary drugs, the effects of environmental factors such as temperature, humidity, illumination and atmospheric pressure on veterinary biological products are studied. The environmental adaptability grades of veterinary biological products are classified and the corresponding control standards of environmental factors for transportation are worked out. The second is the technology of Internet of

Things for monitoring the cold chain transportation process of veterinary drugs. Aiming at the difficult problem of monitoring the cold chain logistics process of veterinary biological products, a real-time monitoring device suitable for cold chain transportation of veterinary drugs is developed based on temperature and humidity, light intensity and air pressure sensors. Combining wireless transmission technology and GPS positioning technology, environmental monitoring, real-time positioning and wireless transmission of cold chain transportation of veterinary drugs are put forward. Internet of Things technology solutions is used to realize a positive track of veterinary drug transport trajectory and environmental information. The third is the simulation method of 3D environment perception for the carriage of veterinary drugs. Based on the developed Internet of Things device, the environmental distribution of veterinary drugs in different time and space in the carriage is explored, and the 3D monitoring and control model of veterinary drug transportation is constructed to realize the optimal environmental control in the process of veterinary biological products transportation.

3.4. *“One-to-one” Matching Technology between Veterinary Drugs and Livestock-and-poultry*

The supervision of veterinary drugs in the use of farms has always been a difficult problem for traceability. It is urgent to carry out the “one-to-one” matching technology research between the smallest sales unit of veterinary drugs and the individual use of livestock-and-poultry by adhering to the concept of “one code for one drug, one code for one animal, one-to-one correspondence, and full traceability for the whole process”. The first is “one-to-one” matching technology for pig, cattle and sheep identification and veterinary drug identification. In view of the unique RFID characteristics of pig, cattle and sheep, etc. the difference between the identification carrier and coding of pig, cattle, sheep and the smallest unit veterinary drugs is clarified. The mapping relationship of different identification vectors is established, and a “one-to-one” matching model of pig, cattle, sheep identification and veterinary drug identification is constructed, and finally, the time, place and name of the large animal receiving veterinary drugs are finally formed. The matching information table of veterinary drug identification and coding is used to realize association and matching between veterinary drugs and large livestock. The second is the correlation matching method between stable group identification and veterinary drug identification. In order to ensure the “one-to-one” correspondence between a stable of poultry colony and veterinary drug labels, a correlation matching model is constructed for the identification characteristics of poultry and bees. The third is the video surveillance network technology of veterinary drugs. Aiming at the issue of animal husbandry drug suspension period and supervision of prohibited drugs, a video monitoring network for veterinary drug use is constructed based on remote infrared camera to monitor the animal during suspension period and prohibition period in an all-round way, so as to prevent veterinary drug residues from exceeding the standard.

4. Conclusion

With the adjustment of agricultural industrialization structure, the government has strengthened support to animal husbandry, and the scale of animal husbandry has been expanding, which has led to the rapid development of veterinary drugs industry. In the meantime, the quality and safety of veterinary drugs have also been highly valued. The intelligent perception of circulation and use process is conducive to strengthening the quality management of veterinary drugs and ensuring the quality and safety of veterinary drugs. Based on the “dynamic correlation technology of GSP veterinary drug circulation process information”, “veterinary drug logistic packaging label aggregation and split conversion technology”, “real-time perception technology of veterinary biological products cold chain transport Internet of Things” and “one-to-one matching technology between veterinary drugs and livestock-poultry”, in the circulation and use link of veterinary drugs, this research studied the built of key information collection directory and of traceable correlation model based on minimum veterinary drug unit. Via the aggregate association information formed by many-to-one aggregate association model, and its correlation corresponding ties, it is possible to further obtain the synchronous interaction between the packaging identification and circulation information of small

veterinary drug units. And the split correlation information formed by one-to-many split correlation model of large unit packaging label and small unit packaging label is realized, which promotes the correspondence of veterinary drug label and the tracking of circulation information. The control standards for corresponding environmental factors for veterinary biological products can be made. The technology of Internet of Things, which integrates environmental monitoring, real-time positioning and wireless transmission of veterinary drug cold chain transportation, can effectively solve the forward tracking issue of veterinary drug transportation track and environmental information. Based on 3D environment perception simulation method of veterinary drug transport vehicle, the environment optimal control of the transportation process of veterinary biological products is realized; based on the “one-to-one” correlation matching model between the label of large livestock and the label of veterinary drug, the association matching between veterinary drug and livestock can be realized; thus via the establishment of video monitoring network of veterinary drugs, the overall monitoring of livestock both in the withdrawal period and the prohibited period can be realized.

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).

*Corresponding author: Fantao Kong (kongfantao@caas.cn).

References

- [1] Shan S., Wang Y., Jin S., et al. (2015) The key and Essence of Veterinary Drugs GSP. Northern Animal Husbandry, 21: 35-35.
- [2] Zhang C.. (2014) Current Situation and Countermeasures of Veterinary Drugs Supervision in Anxi County of Fujian province. Chinese Academy of Agricultural Sciences.
- [3] Sun L.. (2015) Research and Design of Veterinary Drug Sales Management Information Platform. Practical Electronics, 24: 45-45.
- [4] Gao L., Liu L., Guo H., et al. (2017) Research on Application Pattern of Internet of Things for Temperature Control in Veterinary Biological Products. Chinese Journal of Veterinary Drug, 4: 65-69.
- [5] Han Y., Zhao Z., Wang G., et al. (2010) Internet of Things and Cloud Computing. Communications of the CCF, 2: 58-62.
- [6] Hao H., Gao L., Zhang J., et al. (2017) Research on Construction of Veterinary Drugs Big Data Platform Based on Veterinary Drugs Electronic Trace. Chinese Journal of Veterinary Drug, 3: 4-10.