Research on Environmental Management and Monitoring Technology of Solid Waste in China Based on Knowledge Map

Chengwei Jiang
Zhaotong City Environmental Monitoring Station, China

Abstract. In recent years, environmental governance has attracted wide attention of domestic academia, and relevant research has achieved fruitful results. Some scholars have used bibliometric methods to discuss the current research situation of environmental governance, but few have analyzed the current domestic research path of environmental governance. Based on the key words, authors and authors of the 8962 journal articles on the environmental management and environmental monitoring technology of solid waste in China from 2016 to 2018, the article uses CiteSpace software to apply knowledge maps and common word analysis. A variety of quantitative analysis methods such as cluster analysis and strategic coordinate graph analysis. The knowledge map in the field of environmental monitoring is constructed, and the map is analyzed and interpreted. The analysis results show the structural characteristics of Chinese solid waste environmental management and environmental monitoring technology in the form of knowledge map, and obtain the research frontier and its evolution law in this research field.

1. Introduction
With the substantial increase of living demand, industrial production has been rising year by year. With the continuous development of economy, the continuous utilization and consumption of resources, the solid wastes generated have also led to accumulation and difficult treatment year by year [1]. The power source of innovative monitoring technology is an important means to discover and solve new problems and a medium for extensive cooperation and exchange. Incidents of social conflicts caused by solid waste pollution are common, which not only endanger human health and destroy urban landscape, but also affect environmental safety and social stability [2]. Chinese environmental monitoring scientific research undertakings are increasingly prosperous and developing. How to systematically sort out, summarize, evaluate and reflect on the research results in the field of environmental monitoring has become a necessary and urgent task. However, China is in a country with economic development, and it is the lifeline of national economic development. However, compared with developed countries, there are still many vacancies. China still needs to face many problems in solid waste treatment and testing. Difficulties and challenges [3]. The scientific knowledge atlas method can deeply mine and transform massive data in a certain discipline or field into visual images, and then prove the overall picture, research content and pre-research of the discipline or field [4]. Therefore, the research on solid waste monitoring technology is of great significance to improve Chinese solid waste monitoring system and to formulate more effective solid waste control measures.

2. Research Method
With the development of various scientific and technological literature databases at home and abroad and the development of computer data mining technology and data visualization technology, it is
possible for us to help solve these problems through new ways of data mining and visual analysis of scientific and technological literature databases. Solid waste environmental management is the whole process control of solid waste collection, separation, storage, transportation, processing, treatment, recovery and disposal. Firstly, this paper uses visual knowledge atlas tool software to analyze the co-words, calculates the co-occurrence intensity among the co-occurrence keywords, and constructs sub-clusters to cluster the keywords. With the help of the concept and technology of knowledge atlas, this paper analyzed the research hotspots in the field of environmental monitoring in China in recent years, which main research institutions, the most important scholars and their team members, and so on.

3. Research Steps

3.1. Data sources
China Knowledge Net is the largest knowledge portal in the world, with a wide range of contents. It is a knowledge service website that integrates periodicals, newspapers, doctoral dissertations, conference papers, books, yearbooks and multimedia teaching materials. The academic level and influence of the articles included in the book are relatively high. They often represent the latest research results of various disciplines in Chinese Social Sciences and lead the research and development of various disciplines in China. The data used in this study comes from the CNKI citation database, which includes references of all source database products published by China Academic Journal Electronic Magazine, and reveals the mutual citation relationship between various types of documents. The research contents, research hotspots and trends of population, resources and environment disciplines are displayed visually, and corresponding analysis and explanation are made. At the same time, the article also analyzed and summarized the knowledge map of the author and the author institution of the discipline.

3.2. Data procurement
With the increase in the generation and accumulation of municipal solid waste, the problem of personal sewage discharge in residents' lives has also become one of the important sources of solid waste. In the China Knowledge Network database, the "author unit" is selected as the retrieval route, the "environmental detection" is used as the search term to search, and the search results are clustered according to the age, and the related information is exported to the corresponding data processing tool.

3.3. Data processing and analysis
Solid waste management is the whole process control of solid waste collection, separation, storage, transportation, processing, treatment, recovery and disposal. The purpose of solid waste environmental monitoring is to provide real analysis and measurement data for environmental management. In this step, a total of 8962 pieces of data from 2016 and 2018 are selected, metadata such as titles, authors, document sources, author organizations, keywords and the like of these documents are exported to an EXCEL table, after sorting, a list of all reference documents is obtained, and then these data are led to the A CCESS database for data processing, and a total of 5634 different authors are obtained from 8962 reference documents. Statistics show that there are 26 journals with more than 500 papers on population, resources and environment published in China between 2016 and 2018, the largest of which is Eco-economy (489), followed by Population, Resources and Environment (668). Most journals only have a small number of relevant articles, and contain a large number of journals that only publish one article. In this search result, there are 15 journals with more than 1000 papers. These journals, with more than 200 papers, have become the main journals for disseminating the research results of population, resources and environment in China.
Using the derived keyword data, each article selects the first 4 keywords. These keywords are preprocessed by removing irrelevant words and merging synonyms, and then statistical analysis is carried out by using relevant tools of knowledge map, EXCEL, SPSS. The research contents of the subject of resources and environment directly reveal the research hotspots, knowledge structure and evolution of the subject of population, resources and environment. Cite Space software parameters are set to one time slice per year at runtime. Thresholds of citation number, co-citation frequency and co-citation coefficient are set in the first, middle and last three time intervals respectively. Thresholds of each time interval are determined by linear interpolation. Through the keyword matrix analysis, the areas of environmental monitoring concern include: research and monitoring of PM2.5 and PM10, quality management in environmental monitoring, and heavy metal pollution in soil. The keyword curve is shown in Figure 1 above. The keyword matrix analysis is shown in Table 1 above.

4. Knowledge Map Presentation of Environmental Management and Monitoring Technology of Solid Waste in China
Knowledge map can show the knowledge distribution structure and development law in a specific research field, and has important reference value [5]. The components of knowledge map are scattered nodes and their connections. These elements indicate the cooperation, citation or co-occurrence of sample documents. The main research frontier can be determined by studying cluster names and emergent words with high emergent values. In addition, active citation documents in each cluster are prominent representatives of research frontier issues in the field of subject knowledge. Keyword clustering uses Callon to construct sub-clusters, which can identify the research contents and research directions of population, resources and environment disciplines. Therefore, the keyword becomes a high-level summary of the main purpose of the article, and it is also a highly concise subject of the article, which can be studied as a key indicator of the bibliometric method. The research hotspots of each stage can be judged by observing the change of keyword frequency. However, it is also limited by the lack of perfect testing technology and testing foundation, and the number of staff engaged in
environmental monitoring work is insufficient, technical capacity is not enough, and even temporary workers are hired to monitor related work. The development of solid waste monitoring system in China shows a trend from individual to general, from scattered to the whole, the scope of monitoring is gradually broadened, and the monitoring methods are gradually increasing [6]. The tightness of knowledge atlas shows the strong correlation between nodes, which also indicates to some extent that the focus of scholars' research is the correlation between research objects.

The knowledge network presented in the knowledge map is relatively close and complicated. We have reason to believe that these knowledge networks are the result of the diffusion of high-frequency keyword nodes in the graph. A total of 246 clusters are formed in the municipal solid waste co-citation network. The size of each cluster is quite different. The largest cluster is cluster 130, with 284 members, the smallest is cluster 17, and the number of members is only 2. The uneven cluster size reflects the centralized research of research frontier issues. These high-frequency keywords are the core topics of the research in this field. They have strong adsorption ability to other nodes around them, and the connection between them also shows the co-occurrence and interactive relationship between keywords. Today, a relatively complete monitoring system including solid waste sampling and sample preparation, hazardous waste identification and various monitoring and analysis methods has been formed. The higher degree of silhouette indicates that the degree of similarity between the cluster members is also higher, and the research direction is more concentrated. After re-adjusting the threshold, 336 high-frequency keywords are obtained, and a total of 551 clusters are formed, and clusters composed of two keywords that cannot accurately express the clustering research content are eliminated. In the sampling of solid waste, the purpose of sampling should be clarified, sampling plans should be formulated according to the purpose of sampling, and corresponding quality control measures should be established. We can make a preliminary judgment on the current status of domestic environmental governance research, and grasp the research topics and research interests in this field as a whole.

In the literature measurement, the biggest performance feature of the research frontier is the emergent nature. Using the prominent words provided by CiteSpace, the frontier of urban domestic waste research can be further confirmed and supplemented [7]. The most important key word is “environmental governance”. The more important keywords are ecological environment, public participation, local government, global environmental governance, ecological environment management, and environmental protection. The uniformity during sample collection and preparation has a great influence on subsequent measurements. If the uniformity of the sampled object is not good, sampling and sample preparation errors will become the determinants of sample variability [8]. Therefore, while building laws and regulations to control pollutant emissions, it is also necessary to incorporate pollutant-discharging enterprises, residents and individuals into the scope of environmental monitoring. Although individual garbage production and emissions are small, according to the total amount of urban residents, it is no less than the enterprise's emissions. Some clusters appear for a short time and are relatively independent. They have few connections with other clusters, and there are no key nodes with turning points. They disappear quickly after a period of time. The information in the picture was fine-tuned to highlight the keywords that appeared more frequently. The reason for this adjustment is to show more clearly the status of key nodes and the relationship between them, so that we can grasp the main information reflected.

5. Analysis of Research Path for Environmental Management and Monitoring Technology of Solid Waste in China

From the current research on environmental governance, we can easily see the efforts of scholars to localize the issue. The localization research with the local government's environmental governance behavior as the main research object has become the main focus of this research field. Despite this, the new standard methods and similar methods in foreign countries have short-term experiments that can not fully simulate the changes of field conditions with time, and do not consider the impact of laboratory anaerobic conditions on the leaching of various pollutants. However, as the frequency of use increases, the spectrophotometer is easily damaged and difficult to maintain, so the environmental detection work
has a large difficulty coefficient. The relevant content is mostly a reference or principled provision or suggestion, and there is still no systematic test basis [9]. For example, the recommended sampling methods include simple random sampling, stratified random sampling, systematic random sampling and authoritative sampling. In other words, the current research on environmental governance is mainly based on Chinese unique environmental problems and environmental governance systems and mechanisms to study the behavior of local governments and discuss their governance performance and evaluation [10]. The focus of sample preparation method lies in the degree of sample pulverization and the preparation method of leaching solution, especially the leaching method of organic pollutants, which has many problems both in theory and in practice. On the other hand, in the independent innovation of solid waste sampling and detection in our country, systematic sampling method and stratified sampling method are proposed. However, most of them lay particular stress on theory. In practice, there are some deviations in the sampling point principle and local differences, which lack further improvement.

Local government's environmental governance behavior has become the main content of current environmental governance research. The publicity of environmental issues pushes the government to the forefront of environmental governance and makes environmental governance one of the important functions of local governments. The composition of leachate from solid waste is complex, which will bring matrix interference, spectral interference and mass spectrum interference to the determination. However, the interpretation of this kind of interference by the method focuses on theory, and its practicability needs to be improved. Therefore, the discharge of personal waste should be included in the scope of environmental monitoring at the right time. At the same time, residents should fulfill their obligation to protect the environment through publicity and education. For residents' personal pollution discharge, the community can be taken as a unit and a related domestic waste collection and disposal system can be established. Because the initial environmental governance system is mainly characterized by administrative leadership or administrative control, scholars are accustomed to focus their research on government behavior only. Under the traditional mode of environmental governance in China, the government has emerged as a 'consultation' rather than a 'governance', and various governance models, markets and social network mechanisms cannot function effectively. The regulatory authorities need to regularly monitor and collect statistics on community waste. For solid wastes with heavy pollution hazards, they should be disposed of in a timely manner. Due to the increasing number of detectable chemicals, it is difficult to analyze one by one, and various biological methods that are useful for comprehensive evaluation should be studied. The main object of environmental governance research is no longer limited to the government level, but the behavior of enterprises, non-governmental organizations and public individuals are all included in the important research object of environmental governance.

For urban environmental governance, the wave of urbanization is impacting all aspects of Chinese social and economic life, and urban environmental issues are increasingly becoming the most important factor affecting the speed of urbanization and the size of the city. Because the main reason for the abnormality of a large number of monitoring data comes from the faults and fluctuations of the testing instruments during daily operation and maintenance, the inspectors should strengthen the calibration of the precision of the instrument and eliminate the malfunction of the instrument. Although such tests cannot be directly used to determine the effects of solid waste on the human body, they can be used to predict the effects on organisms and thus have certain practicability. It is necessary to strengthen the links and cooperation between authors of population, resources and environment to jointly promote the development of the discipline. The original intention of environmental governance research is to contribute to realistic politics, which is also a microcosm of social science research, especially political science, which is increasingly moving towards policy science. Theory serves reality and depends on the public function of social science. At the same time, it is also helpful to standardize the operation of operation and maintenance personnel and establish event log system for sub-stations. In addition to automatic Zero-Span and automatic accuracy check, sub-stations should record events. In fact, it is more important to know the hazardous characteristics of waste than its chemical composition, and in many cases, it is impractical to obtain accurate chemical composition. In short, all aspects of the national
governance system put forward higher requirements for environmental governance objectives, and also develop a broad research space for domestic environmental governance research. Especially, the localization research based on Chinese position and vision is the spiritual driving force for the continuous promotion of environmental governance practice.

6. Conclusion

According to the principle of knowledge atlas construction, this paper quantitatively analyzed 8962 literatures in the field of solid waste environmental management and environmental monitoring technology, and constructed knowledge atlas for the main scholars, research institutions and research fields in the field of environmental monitoring in China. The results show that cluster analysis and analysis of co-citation frequency, emergence value and centrality of key words and documents can effectively detect the frontier issues in the research field, which is of great significance to grasp the hot issues, the latest research progress and the development track of this field. Understanding the distribution, research topics, hot spots and trends, and core research fields of population, resources, and environment disciplines is conducive to promoting the cooperation between authors and institutions among scholars of this discipline. At the same time of conducting normative research, we should strengthen empirical research. Through the use of empirical research methods, we can have a fine grasp of the environmental governance practice in political life and enhance the effectiveness and practicality of the research. Generally speaking, Chinese solid waste environmental monitoring work is still far away and requires the joint efforts of people from all walks of life. The national government should also respond, support and improve the regulations of the management system.

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