Optimize Storage Management System of Electric Power Enterprises

Yan Li*, Xiaodong Tu

Jiaxing Power Supply Company of State Grid Zhejiang Province, Jiaxing, China

*Corresponding author: liyan_jxep@sgcc.com.cn

Abstract. In order to further improve the operation efficiency and ensure the power system more safe and stable operation of power system. Power supplies management system based on the existing electric power enterprises, this paper supplies store shelves, in-out warehouse management, management of the rolls and outbound management optimization scheme is put forward, after the improved shelves can avoid the waste of small size materials occupy large shelf phenomenon. The stacker and AGV are used to take charge of different areas of the shelves and work at the same time to improve the efficiency of in-out and stored-in operation. In the warehouse management and post-warehouse management, the positioning and tracking of single material products can be carried out. In addition to accurate quality inspection, the information of material products can be timely understood, and products can be replaced and repaired regularly to further ensure the stable operation of the power system.

Keywords: electric power enterprise, warehouse management, materials, warehousing management, warehousing management after management.

1. Introduction

In recent years, under the joint action of market demand and scientific and technological progress, emerging industries dominated by e-commerce industry have significantly promoted the development of logistics industry. As an important link in the logistics process, intelligent warehousing management is very important. In addition, with the increasing improvement of people's living standard and the continuous improvement of the modernization level of the electric power industry, the management of electric power materials is also facing major challenges. Traditional power supplies are mostly based on the traditional manage storage environment, the traditional management mode, the majority of human, time spent in sorting and handling of materials, and after a long-time operation, different kinds of power supplies and other reasons, will cause the sorting error, homework problem such as low efficiency, thus greatly reduce the power level of operation, is not conducive to the development of modern electric power industry.

In order to improve the working efficiency and reduce the working intensity, this paper proposes an intelligent warehouse management system based on electric power enterprises.

2. Current situation of storage management of electric power enterprises

Modern warehousing is not a "warehouse" or "warehouse management" in the traditional sense, but a modern logistics activity that uses self-built or leased warehouses or sites to store, load, unload, carry and distribute goods, and plays a unique role as a resource provider in the supply chain[1]. China's smart grid project construction scale continues to expand, producing a large number of materials, and different types of power equipment of different sizes, the gap is large, some large equipment need open storage. Therefore, the difficulty of warehouse management is increasing, and it is necessary to use information means and data visualization technology to improve the efficiency and benefits of warehouse management.

Compared with foreign logistics technology, China is still at a relatively early stage. Based on China's current situation, the existing storage facilities and management mainly have the following problems [2][3]:

(1) Backward storage equipment; Modern new warehouses and large storage equipment are limited. In intelligent storage management, storage automation equipment has higher requirements on the operating environment, such as: the traditional shelves need to be replaced by standard square shelves, and large rail stacker is used to store and store goods in large warehouses.

(2) Land acquisition difficulties; China's strict land control makes it difficult for warehousing to acquire large areas of land. At the same time, warehousing enterprises are faced with such strong competitors as real estate enterprises, which greatly increases the acquisition cost of land.

(3) Demand exceeds supply; The Yangtze River Delta and some parts of the Pearl River Delta are confronted with the contradiction of developed logistics but limited storage.

(4) The western region and some backward areas lack modern warehousing facilities;

(5) Lack of talents; Lack of professional and technical personnel of warehouse management.

From the traditional manual stacking plane storehouse, to the automatic three-dimensional storehouse based on stacker, and then to the highly flexible automatic three-dimensional storehouse based on shuttle. How to further optimize and improve the intelligence of storage is a problem that the current society is thinking about. Intelligent warehouse management can greatly reduce the problems such as irregular delivery procedures, unsalable products, untimely cleaning of impending products, large deviation between material purchase quantity and actual demand, etc., and bring convenience for standardizing delivery procedures, regular inventory count and improving material purchase efficiency [4] [5]. Based on the storage problem of electric power enterprises, this paper proposes a warehouse management scheme design of electric power enterprises.

3. Electric power enterprise warehouse management process

In warehouse management, the system of warehouse management takes the lead. Any enterprise should have appropriate systems and rules for its own development. For example, the market value of an enterprise using SCOR model (reference model for supply chain operation) is better than that of Dow Jones and Standard & Poor's index [6] [7] [8]. Secondly, it is the execution of enterprise management. On the one hand, enterprises should have advanced and efficient facilities and software, and on the other hand, they also need operators who can operate these facilities and software.

The storage management of electric power enterprises mainly has the following principles:

(1) Safety and integrity: to ensure the safety and integrity of warehouse materials.

(2) High quality and high efficiency: the warehouse can serve the production and power generation with high quality and high efficiency.

(3) Consistency and reliability: to ensure the warehouse records, such as the quantity of goods in and out of the warehouse, quality inspection, financial records consistency and reliability.

Storage management methods mainly include ABC analysis method, 6S site management:

① ABC analysis method

The widely used method is ABC analysis proposed by Italian economist Barreto in 1879. In warehouse management, materials are divided into THREE grades: ABC, with more distinct priorities, which is more conducive to the control of different levels of materials. In the ABC analysis method,

grade A is the main influencing factor, and the material type takes up A proportion of 0%-80%; Grade B is the secondary influencing factor, and the material type takes up A proportion of 80%-90%; grade C is the general influencing factor, and the material type takes up A proportion of 90%-100%.

② 6S Site management

As an upgrade of 5S management, 6S management includes six management modes beginning with S, such as SEIRI, SEITON, SEISO, SEIKETSU, SHITSUKE and SECURITY [9], so it is simply called "6S".

Table 1. Contents of 6S

Chinese name	Japanese name	Content
settle	SEIRI	Categorize what you need and what you don't, and leave what you need
rectify	SEITON	Arrange and mark the remaining materials according to the regulations
sweep	SEISO	All material storage areas should be cleaned and kept clean
clean	SEIKETSU	Systematize sorting, rectification and cleaning, so that every staff in the work area to maintain a consistent concept of cleaning
literacy	SHITSUKE	Through culture training, each staff member maintains good quality and habits
security	SECURITY	Safety awareness of staff and potential safety hazards in storage environment

Combined with the above principles and methods, the rational use of it in warehouse management. In modern and efficient warehouse management, the main tasks of power enterprises in small and medium-sized areas include three parts, namely, material warehousing, warehouse management and material dispatching.

(1) Inbound and outbound management of materials is very important. Accurate inbound and outbound data is an important basis for subsequent material scheduling;

(2) Management in the warehouse. Materials should also be properly kept when they are stored in the warehouse, such as quality inspection, daily maintenance and inventory taking;

(3) Management after the delivery of the power supplies, whether to carry out regular maintenance and replacement, to ensure the better operation of the power system.

This paper summarizes and summarizes the three aspects of material warehousing, warehouse management and post-warehouse management, and puts forward corresponding opinions and suggestions on the current development of these three aspects.

3.1. Materials in and out of storage

Power equipment is mainly divided into power generation equipment and power supply equipment. For example, power generation equipment includes power station boiler, steam turbine, gas turbine, water turbine, generator, transformer and so on. Power supply equipment includes transmission lines of various voltage levels, mutual inductors, contactors and so on. These various materials bring a lot of difficulties for the warehousing.

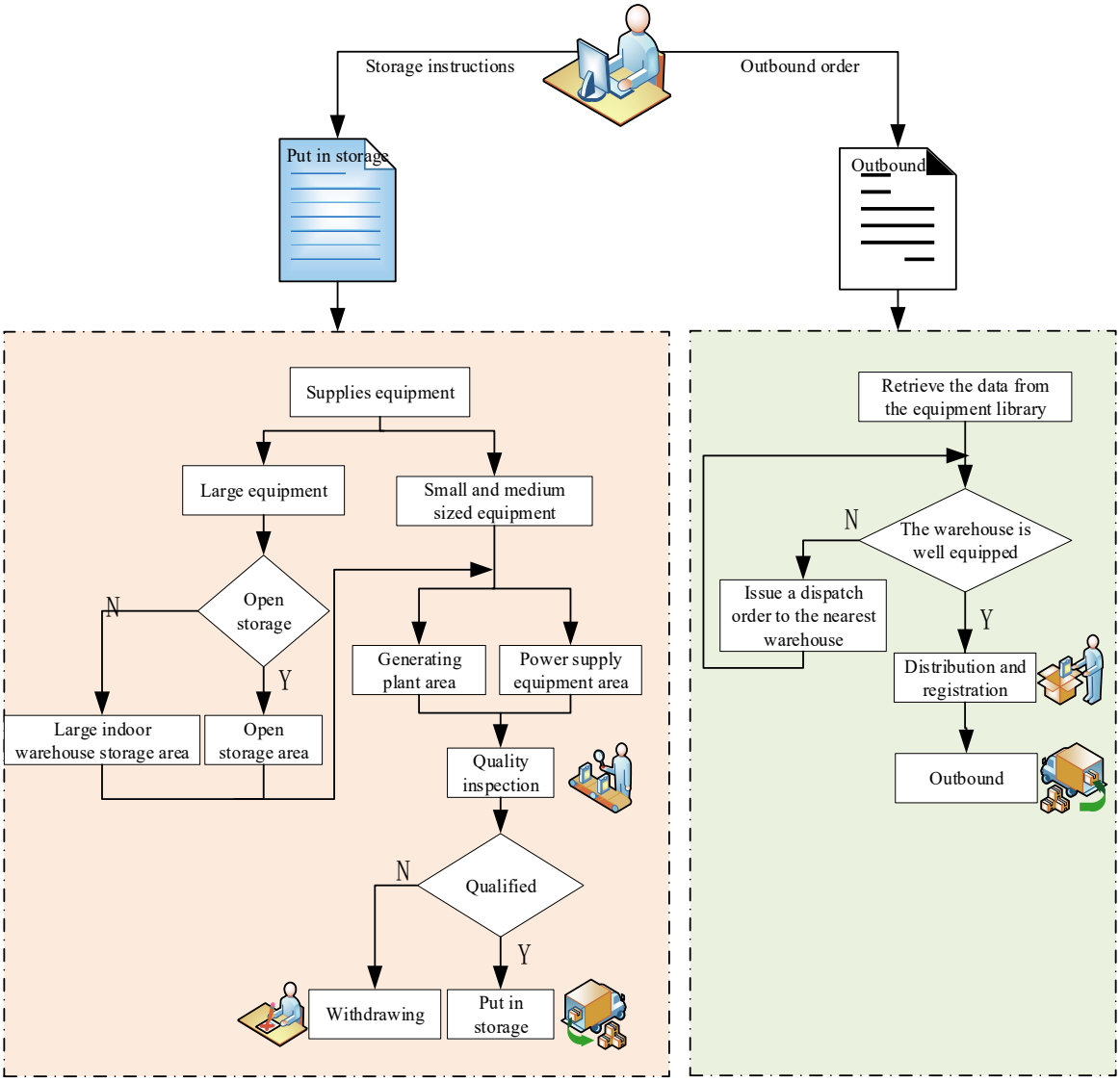

Figure 1. Basic flow of material entering and leaving warehouse

According to the above figure 1, the incoming and outgoing instructions of materials are first issued by the intelligent terminal.

(1) if the instruction for storage. Then input the information in the system, make out the corresponding inventory of incoming materials, and make the storage plan. Store plan, first of all by its inventory list if there is a large equipment, in the electric power enterprise, some large equipment such as high and low voltage power cables, telephone poles, etc (as shown in figure 2 (a) (b)) can be in open air, open cases should be dry, wind, shock and the impact characteristics, avoid losses due to improper safekeeping. And pipe type is unfavourable outdoor open storage, because ultraviolet ray can cause a certain degree of damage to the structure of the pipe, so as to shorten the service life of the pipe.

After the judgment of whether the material is stored in the open air, the material is classified into power supply or power generation. Finally, the quality inspection is carried out on the material (referred to as quality inspection). If the quality inspection is qualified, the material will be put into storage.

(a)Cable (b)Telegraph poles

Figure 2. Open storage of materials

If the equipment is small or medium size, it will be stored in the indoor warehouse. First, the equipment will be classified according to power supply and power generation. After the classification, the materials will be inspected. If the quality is not up to standard, refuse to accept or return the stock.

If it is out of the warehouse instruction. Then list the corresponding list of goods to be delivered out of the warehouse, and check out whether the corresponding quantity of qualified goods is sufficient in the system. If so, carry out distribution one by one and make detailed registration; If the inventory is not sufficient, dispatch the material to the nearest storage point until the required quantity is reached.

The whole warehousing link includes the material unloading, shipping, quantity counting, quality inspection, warehousing stacking, handover procedures and entry procedures, etc., and the accurate implementation of each link is an important principle of warehouse management.

3.2. Management within the material warehouse

Materials stored in the warehouse, the materials still need regular quality inspection, daily maintenance and inventory work.

Quality inspection means that warehouse management personnel take certain technical means [10], such as comparing the results of observation, measurement and test on the quality characteristics of materials with the quality requirements, and judging whether the materials meet the qualified standards. Quality inspection is mainly divided into total quality inspection and sampling quality inspection. Total quality inspection means that all materials are inspected and the amount of work is relatively large. Sampling quality inspection means irregular sampling inspection, so there is a certain degree of missing inspection.

During the storage of materials, regular maintenance and maintenance are required, including cleaning, anticorrosion, moisture-proof, etc. [11] Reasonable maintenance and maintenance of materials can ensure the normal operation of materials in the actual production for a long time and reduce the failure rate in the use of materials.

There are two ways of inventory taking: regular inventory taking and temporary inventory taking. The main purpose of inventory taking is to check and count the actual quantity of goods and materials in storage. It mainly includes the check of material quantity and important inventory taking, the check between material and bill, and the check between bill and bill. Regular stocktaking is generally a comprehensive stocktaking carried out at the end of each quarter, half a year or year. Temporary inventory is a task that needs to be carried out when a series of changes occur in the warehouse, such as the replacement of warehouse personnel or warehouse material checking errors, etc. Now, the inventory has been updated from the early manual records to the Personal Digital Assistant (PDA) handheld terminal scanning code inventory, greatly reducing the mistakes caused by human records and improving the efficiency of inventory.

The specific procedures of quality inspection, daily maintenance and inventory taking are shown in Figure 3 below.

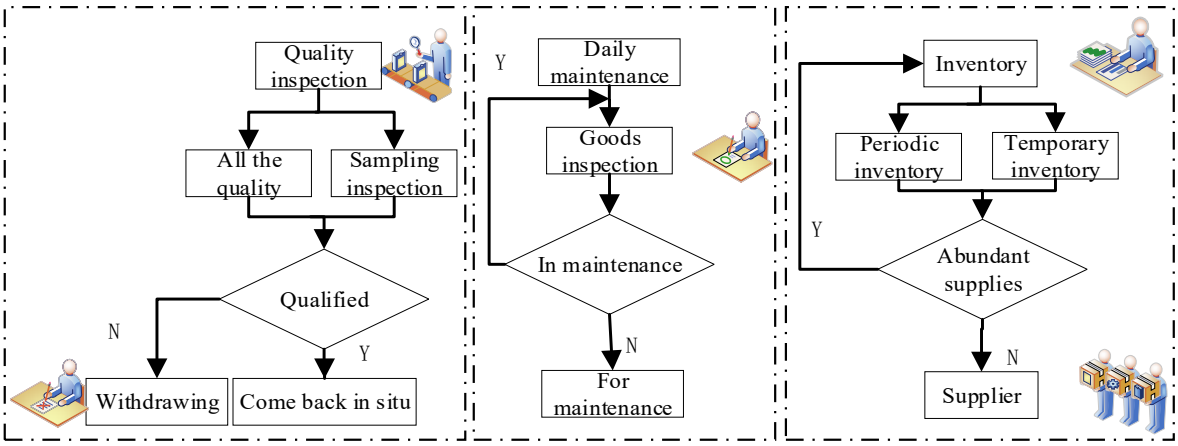

Figure 3. Basic process of material warehouse management

3.3. Management of materials after delivery

Every power enterprise assumes the responsibility of providing electricity to all residents within its management scope, and it is the basic task of the power enterprise to ensure that every local household has access to electricity [12] [13]. In order to meet this requirement, power enterprises need to regularly overhaul and replace the parts whose life is about to expire in power production. This can further ensure the safe and stable operation of the power system.

Generally, power enterprises do not track materials after they leave the warehouse. The follow-up work is to carry out maintenance and treatment after problems occur in the power system. To a certain extent, whether the power system can operate stably within a period of time is always in an unmeasurable state, which is the link that needs to be optimized at present.

4. System scheme design

In order to improve the storage efficiency of electric power enterprises, this paper proposes the following optimization scheme according to the storage characteristics of electric power enterprises:

(1) Personalized shelf management

According to the performance and size of materials, the corresponding shelf management mode is proposed, as shown in Figure 4 below. Compared with the traditional shelf, it can reduce the space occupied by each material product and greatly increase the quantity of material storage.

Figure 4 (a) shows the top view of the shelves. In the horizontal direction, the shelves of the same kind are classified according to the volume size, for example, the horizontal width of ABCD increases successively; in FIG. 4(b), the shelves of the same kind are classified according to the volume size in the vertical direction; in EF, the vertical width increases successively. The overall shelf mode is shown in Figure 5 below.

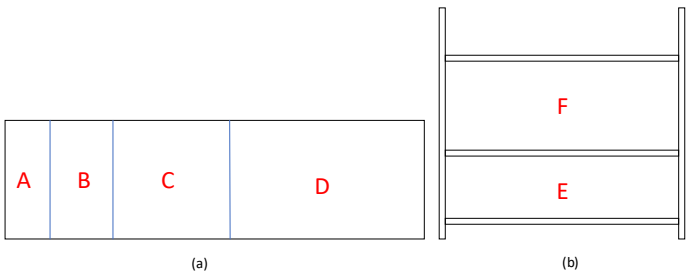

Figure 4. Shelf design schem

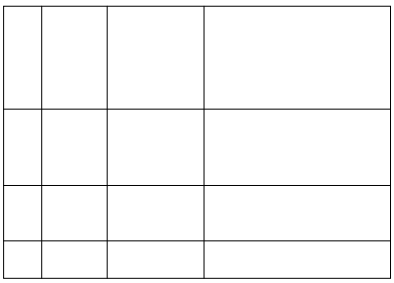

Figure 5. Shelf design schem

As can be seen from Figure 5, the shelf increases from left to right and from bottom to top in the order of small to large.

(2) Automatic inbound and outbound management

In general, large warehouses, stacker will be used to store and store goods. However, in a warehouse, there is usually only one stacker in one tunnel. If a large number and a wide variety of materials need to be put in and out of storage, stacker's efficiency is relatively limited. In this paper, based on the shelves of the design, when used in large warehouse, loading and unloading efficiency, in order to improve can be large stacker and AGV (Automated Guided Vehicle, automatic car navigation) used in combination, stacker can be responsible for high and large area of loading and unloading (yellow area), supplies products and AGV is responsible for the low and small area of the material loading and unloading (blue area), the products are shown in figure 6 below. Many AGVs are often arranged on the warehouse site, and the stacking machine and AGV work simultaneously, which can greatly improve the efficiency of store-in and store-out.

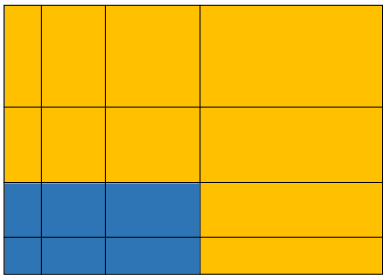

Figure 6. Inbound and outbound allocation

(3) In-warehouse and out-warehouse management

The management of materials during storage is also crucial, such as ventilation, fire prevention, moisture-proof, dust-proof and cleaning, etc. [14] [15] [16]. The existing material management system takes a single material type as the smallest unit for management. This paper puts forward a comprehensive tracking and positioning of a single material. Which supplies products in production have the corresponding production code, after the completion of the electric power enterprise after the firm order, producers will deliver goods to the corresponding information sent to the electric power enterprise, the electric power enterprise's material management system is to track of supplies, supplies in the subsequent transport loading and unloading, production, installation, operation, maintenance and so on carries on the comprehensive management.

The existing material management system of electric power enterprises mainly includes the warehousing, in-warehouse management and outbound of materials, as shown in the green area in Figure 7. A management system is proposed, which can accurately track and locate a single material, obtain the logistics information after the material is shipped, and track the material even after the material is shipped, and synchronize the information in the system, as shown in Figure 7 below.

The positioning and tracking of a single material in the warehouse are accurate to the information of a material product, which can guarantee the problems such as re-inspection and missing inspection of material products and achieve accurate quality inspection.

Outbound after the synchronization information as shown in table 2, the synchronous information in table 2, on the one hand, to supplies the performance of the product under the specific operating environment, on the other hand the quality of manufacturers products does "relationship", through the summary of the more data in the process of production, the material parts replaced periodically in time, so as to ensure the stable operation of power system.

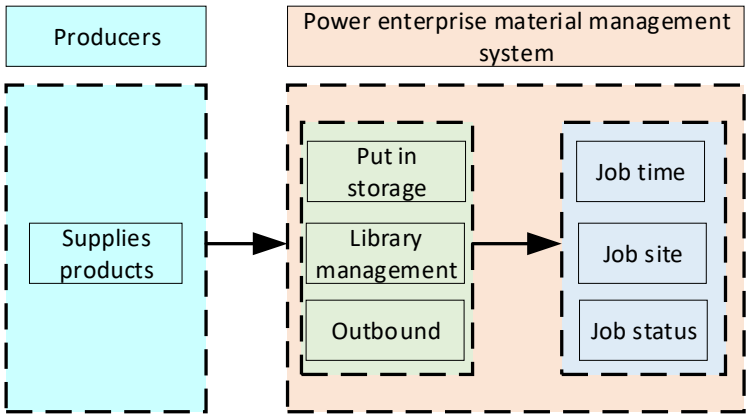

Figure 7. Material management system flow chart

Table 2. Synchronize information after delivery

Material information	
place	Telephone pole No. ×× Town, ×× District, ×× City
time	2019.5.30——2020.1.21； 2020.1.22—
state	Normal operation
State of repair	It has been repaired once on January 21, 2020;
Damage reason	Short circuit
producers	×××× Co., LTD

5. Conclusion

The lean production of electric power enterprises needs to be optimized and improved from all aspects, among which one of the most important links is the storage of electric power enterprises. In this paper, based on the electric power enterprise storage shelves, in-warehouse, in-warehouse management and post-warehouse management to summarize and put forward more efficient optimization scheme design.

(1) The collection of storage shelves is designed in an ascending way from left to right and from bottom to top, which can reduce the space occupied by various materials and products and greatly increase the storage quantity of materials;

(2) Stacker and AGV are used to take charge of different areas of the shelves and work at the same time to improve the efficiency of in-out and warehouse-in operations to a certain extent;

(3) Within the warehouse management and after the warehouse management, the positioning and tracking of single material products can be carried out. In addition to accurate quality inspection, the information of material products can be timely understood, and products can be replaced and repaired regularly to further ensure the stable operation of the power system.

Acknowledgments

This work was financially supported by the project materials development of 3D Visual Control System Based on Panoramic Monitoring Environment(2019-LHKJ-016).

References

[1] Zhang Jun. Problems existing in storage management of electric Power Materials and Optimization Countermeasures [J]. Enterprise Reform and Management, 2018, 18: 46 - 68.

[2] Hou Li, Zhang Yifei, Wang Zheyuan, etc. Analysis of existing Problems and Countermeasures under modern electric power economic Operation conditions [J]. Chinese Market. 2016 (16), 14 - 15.

[3] Yang Shu. Optimization of Material storage management in modern electric power enterprises [J]. East China Science and Technology, 2015 (7) : 23 - 25.

[4] Zhao Jinbin. Problems existing in storage management of Electric Power Materials and Optimization Measures [J]. Chinese and Foreign Entrepreneurs, 2018, 625(35):16.
[5] Meng Xiaolin. Improvement and Innovation of Storage Management of Electric Power Materials [J]. Science and Technology Innovation Guide, 2018, 15 (20): 158 - 159.
[6] Fang Dianjun. Analysis on the Development Trend of Chinese and Foreign Warehousing and Logistics Technology (Part 1) [N]. Modern Logistics Report. 2020 - 8 - 3.
[7] Logistics Engineering and Management, 2015, 37(11): 98-99. [7] Wang Yupeng. Current Situation and Suggestions of Logistics Management in Electric power Enterprises [J].
[8] Nian Tian Tian. Overview of Storage and Distribution in Power Enterprises [J]. Science and Technology Wind, 2019 (32).
[9] Meng Xiumei. Application of 6S Management in college Catering Training Room Management [J]. Management Observation, 2020, No.766 (23): 124 - 125.
[10] Zhang Libo. Research on Warehouse Management Optimization of Shanxi Electric Power Company [D]. Shanxi University, 2018.
[11] Jia Shouwu. Analysis of daily maintenance and maintenance Means of electric Power operating equipment [J]. Technology and Markets, 2018, 25 (4): 100 - 101.
[12] Hu Yang. Discussion on intelligent Storage of Electric Power Materials [J]. Automation Application, 2019 (9): 58.
[13] Sun Wenkai. Research on Intelligent Warehousing and Distribution Management of electric power Enterprises [J]. Sme Management and Technology (Mid-Month), 2018, 554 (10): 26 - 27.
[14] Ning Bo, Zhao Qingkai, Xu Hang. Visualization Research and Application of Electric Power Material Storage [J]. Logistics Engineering and Management, 2020,07:101 - 103.
[15] Yang Yang. Design and Implementation of warehouse Management System of municipal electric power Company [D]. 2019.
[16] Cui Xueda. Analysis of Storage management problems of Electric Power Materials and Optimization Countermeasures [J]. Business News, 2019 (18): 73.