

Study on the Patent Research and Development in Chinese Pharmaceutical Industry

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Abstract—Patent is a key factor in the development of high-tech industry. Patent data is closely related to the technological innovation capability of pharmaceutical enterprises. Patents are the foundation of the survival of pharmaceutical enterprises. Basing on the number of patents in the pharmaceutical industry, the core patents and the annual growth rate of patents, this paper make an analysis using descriptive statistics methods. Reach a conclusion, from the number of patents, China's patents are in medium; From the allocation situation of patent technology resources, each category has the different emphasis, technological innovation capability is relatively good; From the annual change of patents situation, performance is not stable.

Index Terms—pharmaceutical industry, descriptive statistics, patents

I. INTRODUCTION

Twenty-first Century is the era of “knowledge economy”, and the core of knowledge economy is technological innovation. Stewart (1997) proposes that intellectual property is an important component of the core competence of an enterprise. Human's understanding of disease has gradual developed, the unknown fields and the variation of bacteria and viruses have made the demand for new technologies and new drugs increase continuously. Pharmaceutical enterprises must take technological innovation as the most important part of their development strategy. Patent information is the source of technological innovation, the survival of the pharmaceutical enterprises is the ability to truly master the core technology and whether the core technology can obtain patent protection, patent data and the technological innovation ability of enterprises are related closely. Above 90% and 95% inventions in the world have appeared in the patent literature. Fully use the patent information can save 60% research time and 40% research funding. In the research and development of a new drug, commonly it has been into the preparation stage of patent application when in the drug screening stage, patent information retrieval and analysis can not only avoid repetition of research and patent infringement, but also can effectively protect their own research. Implementing a comprehensive patent strategy can

effectively enhance the innovation and competitiveness of enterprises.

II. METHOD

Acquire patent data through the patent retrieval system of the State Intellectual Property Office (<http://www.sipo.gov.cn/zhfwpt/zljs/>), the system uses the International Patent Classification System [1]. The system included the patent data as well as citation data, family patent data and law state data of 103 countries, regions and organizations. Chinese and foreign patent data, updated every Wednesday; Family and legal status data, updated every Tuesday; Citation data, monthly update.

In order to study the medical situation, the classified category "A61" is carried on the navigation type retrieval. Part A is the necessary for human life; A61 is the medical or veterinary science; hygiene. A61 consists of 13 small classes, namely A61B-A61Q, as shown in figure 1. This paper uses descriptive statistics method to analyzes the patent data reflecting medical and hygiene with the removal of A61D that reflects veterinary conditions and A61Q for cosmetic make-up products.

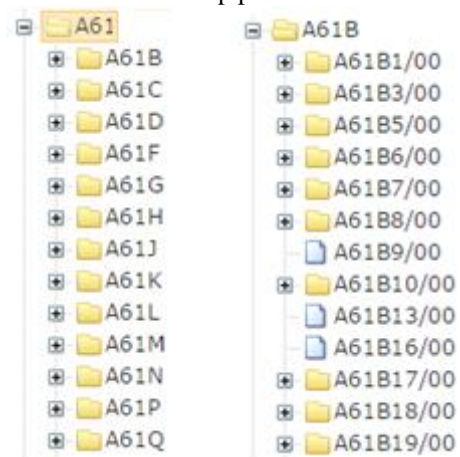


Figure 1. A61 and its subclasses.

A61B: DIAGNOSIS;SURGERY; IDENTIFICATION.

A61C: DENTISTRY; APPARATUS OR METHODS FOR ORAL OR DENTAL HYGIENE.

A61F: FILTERS IMPLANTABLE INTO BLOOD VESSELS;PROSTHESES;DEVICES PROVIDING

PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS.

A61G: TRANSPORT, PERSONAL CONVEYANCES, OR ACCOMMODATION SPECIALLY ADAPTED FOR PATIENTS OR DISABLED PERSONS; OPERATING TABLES OR CHAIRS; CHAIRS FOR DENTISTRY; FUNERAL DEVICES.

A61H: PHYSICAL THERAPY APPARATUS, e.g. DEVICES FOR LOCATING OR STIMULATING REFLEX POINTS IN THE BODY; ARTIFICIAL RESPIRATION; MASSAGE; BATHING DEVICES FOR SPECIAL THERAPEUTIC OR HYGIENIC PURPOSES OR SPECIFIC PARTS OF THE BODY.

A61J: CONTAINERS SPECIALLY ADAPTED FOR MEDICAL OR PHARMACEUTICAL PURPOSES; DEVICES OR METHODS SPECIALLY ADAPTED FOR BRINGING PHARMACEUTICAL PRODUCTS INTO PARTICULAR PHYSICAL OR ADMINISTERING FORMS; DEVICES FOR ADMINISTERING FOOD OR MEDICINES ORALLY; BABY COMFORTERS; DEVICES FOR

RECEIVING SPITTLE.

A61K: PREPARATIONS FOR MEDICAL, DENTAL, OR TOILET PURPOSES.

A61L: METHODS OR APPARATUS FOR STERILISING MATERIALS OR OBJECTS IN GENERAL; DISINFECTION, STERILISATION, OR DEODORISATION OF AIR; CHEMICAL ASPECTS OF BANDAGES, DRESSINGS, ABSORBENT PADS, OR SURGICAL ARTICLES; MATERIALS FOR BANDAGES, DRESSINGS, ABSORBENT PADS, OR SURGICAL ARTICLES.

A61M: DEVICES FOR INTRODUCING MEDIA INTO, OR ONTO, THE BODY; DEVICES FOR TRANSDUCING BODY MEDIA OR FOR TAKING MEDIA FROM THE BODY; DEVICES FOR PRODUCING OR ENDING SLEEP OR STUPOR.

A61N: ELECTROTHERAPY; MAGNETOTHERAPY; RADIATION THERAPY; ULTRASOUND THERAPY.

A61P: SPECIFIC THERAPEUTIC ACTIVITY OF CHEMICAL COMPOUNDS OR MEDICINAL PREPARATIONS.

Because of the importance of diagnosis, surgery, and identification, we only analyze A61B here, and similar methods can be used in other categories. In the patent database, the following major countries and organizations are available, as shown in figure 2.












Country / region	time	data	Country / region	time	data
 CN	19850910-20170517	38740031	 DE	18770702-20170413	7515818
 US	17900731-20170502	15498587	 RU	19921015-20170410	1200295
 JP	19130206-20170420	39268145	 CH	18880109-20170331	723645
 KR	19731023-20170414	4486942	 EP	19781220-20170510	5853790
 GB	17820704-20170510	3672024	 WO	19781019-20170504	4565702
 FR	18550227-20170407	3110233	 Other	18270314-20170505	15190462

Figure 2. Countries and organizations.

The quantity of patents can reflect the vitality of innovation, patent awareness and patent concerns can reflect the extent of technological innovation activities in industry and reflect the level of knowledge storage [2]. By the end of May 2017, from the total amount of A61B, there is 2190437 data altogether. Among them, China: 249040 data; The United States: 338891 data; The British: 23401 data; France: 28315 data; Japan: 566342 data; Korea: 41071 data; Germany: 106122 data; Switzerland: 3129 data; Russia: 40881 data; EPOA: 179707 data; WIPOA: 156322 data etc. Among them, Japan is the largest one, accounting for about 25.9%, the United States accounted for about 15.5%, China accounted for about 11.4%.

Each patent category has sub categories, sub categories are subdivided. And in the patent field, a patent can involve several categories. From the analysis of A61B of China patents, there are 13 sub categories: A61B1-A61B19. A61B, shown in the figure 1. according to the Brad Ford's law, the high proportion of patents can be called the core patent technology, the core patents are

important for evaluating patents by researching patent's quality and patent's value, Carpenter's research shows that a high cited patent can reflect the importance of the patent technology [3]; Lerner uses the top 4 different IPC classification number to represent the patent technology coverage area, the larger coverage area, the more innovative and higher quality [4]. Schettino's research about the scope of patent family can reflect the importance of the invention technology [5]; Ahuja and Lampert define the patents that are of top 1% citations as the breakthrough inventions [6]. A61B17 patent numbers 77358, accounting for 31.1%, A61B5 patent numbers 80946, accounting for 32.5%. This shows that key researches and development fields of China's A61B category focus on A61B5 (Measuring for diagnostic purposes; Identification of persons) and A61B17 (Surgical instruments, devices, or, methods) patent technology.

The annual growth rate of patents, it is the measurement of national, regional or corporate patent application amount (public volume) in a year compared

with the previous year, it is used to measure the development of technical activities in a year, which shows changes in the technological innovations increase or slow over time[7]. The calculation formula is that the annual growth rate of patent = (the number of patents in this year - the number of patents in last year) / the number of patents in last year X100%.

Because eye tracking and online search are hot topics, [8] Ophthalmology examination equipment has certain market potential. The class A61B3 is the apparatus for testing the eyes; instruments for examining the eyes, China contains 6144 patents, including 11 sub categories, major countries in the world have 89173 of these patents. From the statistics of Chinese A61B3 applicants, Canon Corporation (470), Institute of Optics and Electronics, Chinese Academy of Sciences (102) are the main applicants, Therefore, there is still a gap between China's related enterprises and Japan's related enterprises in research and development.

From the statistics of Chinese class A61B3 inventors, Yudong Zhang (99), Kang fukuma (50), Wenguang Chen (46), Yukio Sakagawa (45), the 4 men have the most patent achievements, it shows the research and development of patents have a team phenomenon, the experienced person leads the new hand, and it has continuity, and it present a phenomenon that many of patents in this type are applied by Japanese experts in China. Since the data of 2017 is not completely counted, remove the data of 2017 and the data before 2008, according to statistics published on the publication patent day, the growth rate of China's class A61B3 is as shown in table 1:

TABLE 1
GROWTH RATE OF CHINA'S CLASS A61B3

year	Quantity (unit)	Growth rate(%)
2017	251	
2016	1141	31.00%
2015	871	31.37%
2014	663	17.35%
2013	565	3.10%
2012	548	53.50%
2011	357	15.91%
2010	308	33.33%
2009	231	10.00%
2008	210	
Others	999	

Note: the data are from the patent search and service system of the State Intellectual Property Office, and the time is up to May 11, 2017.

It shows the annual growth rates of A61B3 patent all are positive, with an average annual growth rate of 24.4%, reflecting the patent protection awareness of China's A61B3 research and development enterprises continues to increase, and the technological innovation capability continues to improve. It also can shows that the annual growth rates of A61B3 patent are unstable, the growth rate is the highest in 2012, It reflects the significant technological change of the equipment in the

eyes in this year [9].

III.CONCLUSION

The patent industry in China's pharmaceutical industry is booming, new technologies and new products are emerging. The quantity and quality of patents have improved greatly, and the number of patent applications has shown an uptrend. From the number of patents, China is in medium, the degree of technical innovation activities is strong; From the allocation situation of patent technology resource, each category has different emphasis, technology innovation ability is relatively good, technology advantages gradually emerge. The therapeutic activities of medical, dental, or cosmetic preparations and compounds or pharmaceutical preparations are the key fields of medicine patent technology. From the perspective of the average annual change of patents, taking class A61B3 as an example, the annual growth rate is unstable. Taking corresponding measures against different types of patents are beneficial to improve the efficiency of research and development.

IV. DISCUSSION

In general, the more comprehensive the analysis, the richer the conclusion will be. About patent retrieval data, it can obtained from the patent retrieval system of the State Intellectual Property Office and other National Bureau of patent search entrance, such as the online patent search of American patent and Trademark Office, the online patent search of Japan Patent Office (English Edition), the online patent search of Korea Intellectual Property Bureau, the online patent search of European Patent Office, the online patent search of World Intellectual Property Organization. In addition, some organizations have integrated open source patent data, such as the world patent database for traditional drugs (WTM) ,developed by Beijing East Linden Science & Technology Co. Ltd, includes more than 40 thousand patent data related to all natural drugs and their extracts which are based on the traditional Chinese Medicine in more than 20 countries including China and the United States, the European Patent Office and the world intellectual property organization since 1985. About research and development talents. The research of Fred Pries and others pointed out that universities are important resources for inventions [10]. Therefore, we should pay attention to the university cultivation of innovative talents in the pharmaceutical industry.

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