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Measurement of Technological Innovations in Nanotechnology Through Patent Deposit Analysis

Mensuración de las innovaciones tecnológicas en nanotecnología a través del análisis de depósitos de patentes

Mensuração das inovações tecnológicas em nanotecnologia através de análise de depósitos de patentes

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Abstract

In recent years, it has been realized that with the development of the market, companies are seeking to innovate, through the creation of new technologies. From this, new sciences arise, such as nanotechnology, which covers different areas, through the manipulation of atoms and molecules. Therefore, it is necessary to use the technological mapping to measure the production of these technologies. The aim of this study is to map nanotechnology-related technological innovations through the analysis of patent deposits of the European Patent Office (EPO) international base, in order to verify the progress of nanotechnology research in the world. The methodology used was the exploratory research through documentary analysis through EPO database. It has been realized with the research that many technologies are being created in different countries of the world, even more it is necessary to stimulate the partnerships between Universities and companies in the production of patents related to nanotechnology.

Keywords: Tecnologic Innovation; Nanotechnology; Patents.

Resumen

En los últimos años, se percibe que con el desarrollo del mercado, las empresas están buscando innovar, eso a través de la creación de nuevas tecnologías. A partir de eso, surgen nuevas ciencias, como la nanotecnología, que abarca diferentes áreas, a través de la manipulación de átomos y moléculas. Por eso, es necesario utilizar el mapeo tecnológico para medir la producción de esas tecnologías. Este estudio busca realizar un mapeo de las innovaciones tecnológicas relacionadas con la nanotecnología a través del análisis de depósitos de patentes de la base internacional de la European Patent Office (EPO), con el fin de verificar el avance de las investigaciones en nanotecnología en el mundo. La metodología utilizada fue a la investigación exploratoria por medio de análisis documental a través de la base de datos de la EPO. Se percibió con la investigación que muchas tecnologías están siendo creadas en diferentes países del mundo, más aún es necesario estimular a las parejas entre Universidades y empresas en la producción de patentes relacionadas con la nanotecnología.

Palabras clave: Innovación tecnológica; Nanotecnología; Patentes.

Resumo

Nos últimos anos, percebe-se que com o desenvolvimento do mercado, as empresas estão buscando inovar, isso por meio da criação de novas tecnologias. A partir disso, surgem novas ciências, como a nanotecnologia, que abrange diferentes áreas, através da manipulação de átomos e moléculas. Por isso, é preciso utilizar o mapeamento tecnológico para mensurar a produção dessas tecnologias. Diante disso, este estudo busca realizar um mapeamento das inovações tecnológicas relacionadas a nanotecnologia através de análise de depósitos de patentes da base internacional da European Patent Office (EPO), com o intuito de verificar o avanço das pesquisas em nanotecnologia no mundo. A metodologia utilizada foi à pesquisa exploratória por meio de análise documental através base de dados da EPO. Percebeu-se com a pesquisa que muitas tecnologias estão sendo criadas em diferentes países do mundo, mais ainda é necessário estimular as parceiras entre Universidades e empresas na produção de patentes relacionadas a nanotecnologia.

Palavras-Chave: Inovação Tecnológica; Nanotecnologia; Patentes.

Introduction

With the development of the market and the growing changes in the world scenario, companies are worried about their capacity for innovation (Fagerberg et al., 2013), so new technologies have been developed. And from that, the need arises to exploit these technologies inserted in the market, through studies of technological prospection, aiming to understand the advance of these in the market and to assist in the decision making.

It is understood that innovation involves much more than simple changes in technology (Lorenzetti et al., 2012), that is, it is a process that associates with the convergence of complementary knowledge, interaction processes and mechanisms to support cooperation in specific contexts (Quandt, 2012).

In addition, the most important in this context of innovations is to identify the technologies that can be inserted by the organizations to increase the value of the product in the view of the clients (Augusto et al., 2008).

Therefore, it is understood that the technological innovations developed by both companies and educational institutions can be protected by means of patents that are instruments of protection that are related to the title of temporary property granted by the State, based on the Property Law (LPI), those inventing new products, processes or improvements intended for industrial application (Jungmann & Bonetti, 2010).

Nanotechnology, on the other hand, involves the manipulation of atoms and molecules to carry out processes, construct things or construct living things (Guazzelli & Perez, 2009). Therefore, the need to analyze the growth in the production of new technologies related to the use of nanotechnology, through patent deposits, which are a means of protection of technological innovations.

In this context, the present research aims at mapping the technological innovations related to nanotechnology through the analysis of patent deposits of the European Patent Office (EPO) international base.

Literature Review

The nanotechnology is understood to be the science of materials for the domain of particles and interfaces with extremely small dimensions, which is about one to one hundred nanometers (Quina, 2004). These nanoparticles have a surface area and often exhibit distinct mechanical, optical, magnetic or chemical properties of macroscopic particles and surfaces. This exploitation of these properties in technological applications forms the basis of material nanotechnology (Quina, 2004).

Although in the 1990s many scientists were already working with nanotechnology, this technology had a worldwide repercussion since 2001 due to the launch of the American National Nanotechnology Initiative (NNI) program (Plentz & Fazzio, 2013).

The Nanotechnology is an intensification area that also covers areas of medical and dental applications (Jain et al., 2013), and the accelerated growth of the field of nanotechnology in medicine has generated new alternatives for both diagnosis and treatment of diseases (Londoño, 2015).

In Brazil, nanoscience and nanotechnology products (N & N) are marketed both in pigments for paints, hair dryers and pencils, as well as water sterilizers, cosmetics and insoles (Faria & Oliver, 2014). In this way, the consumer will benefit from the diversity of products based on nanotechnology, which will improve people's quality of life (Ferreira & Rangel, 2009).

Methodology

This research was classified as exploratory, quantitative approach, which used documentary analysis through the collection of data on the basis of the European Patent Office (EPO).

In order to seek patents on nanotechnology, the EPO was used as it covers a large number of countries, which makes it possible to verify of more deposits.

This research involved the acquisition of information such as the year of filing of the patent, country of deposit, inventors, profile of depositors, patent quantities, and International Patent Classification (IPC), being which the word nano cover all nanotechnologies Developed, with a concentration of patent applications, as highlighted in Table 1, which presents the keywords used in the search for the data.

Table 1. Quantitative patent deposits at EPO bases

Keywords	EPO
Nano	10.000
Nanotechnology	1.344
Nanotechnology and Medicine	66

Source: prepared from the EPO database (2016).

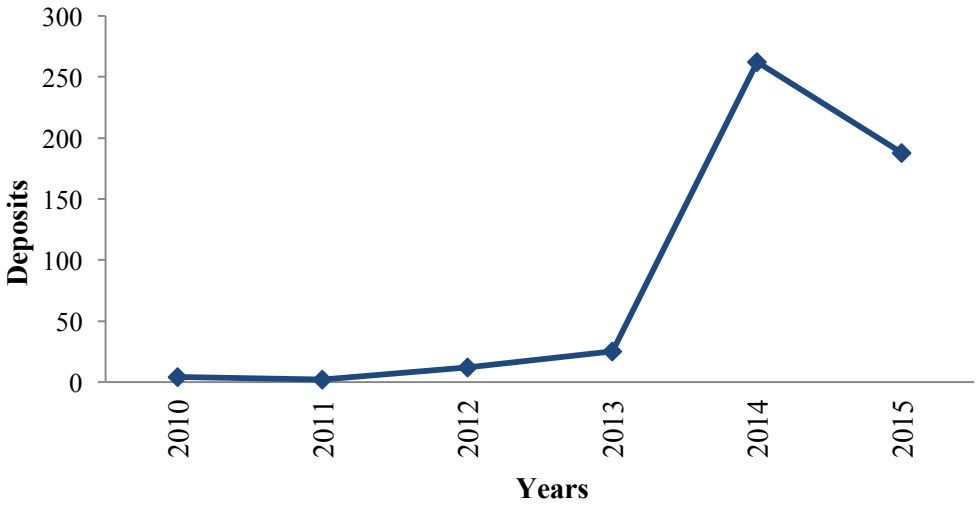
Results and Discussion

As for the analysis in the base of the EPO, were found 10,000 documents with the word nano, but this base only gives an approximate estimate of how many documents it has, and only makes available 500 access deposits; As only deposits appeared from 2008 to 2015, a temporal cut was made, highlighting only the documents from 2010 to 2015, totaling 493.

The Figure 1 shows the annual evolution of deposits between 2010 and 2015. It was verified that from 2010 to 2011 there were few deposits, with 4 and 2 respectively, with leverage occurring in 2012, but in 2014 there were the largest number, with 268 patents filed.

That is why since 2012 nanotechnology has become common in the production of manufactured goods, as well as applications in medical treatment and Life Sciences will have significant participation, through new drugs, medical devices and diagnostic tools (ABDI, 2010). In the case of this research, this development of new drugs and medical devices is important for improving the effectiveness of currently offered medical treatments.

Figure 1. Annual evolution of EPO patent deposits



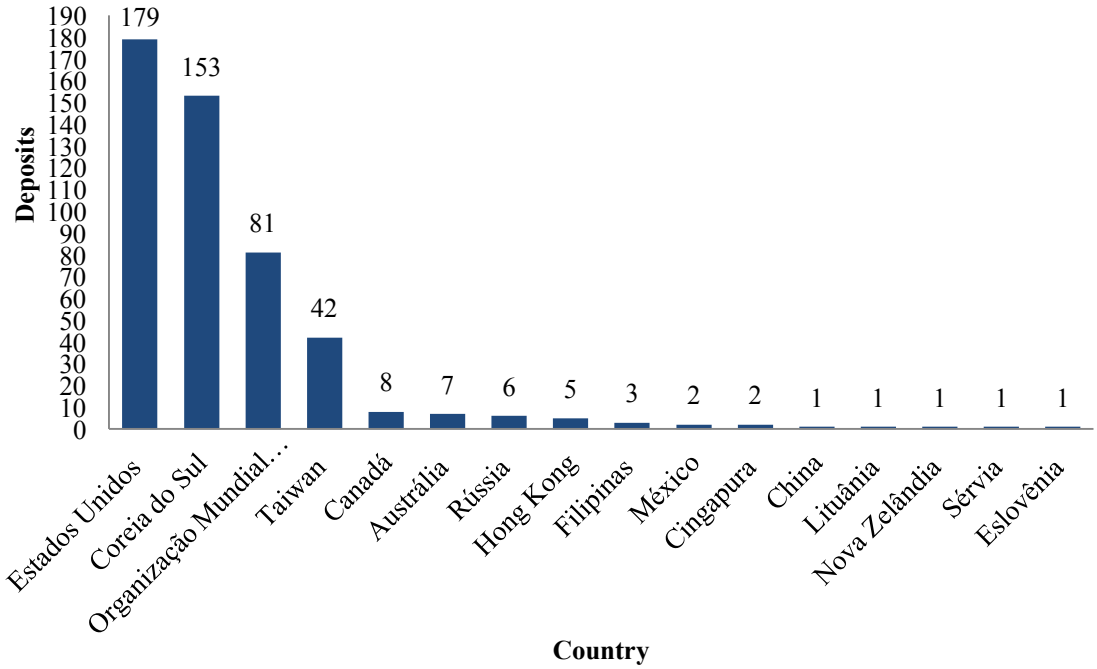
Source: Based on data collection in the EPO (2016)

The Figure 2 highlights the depositor countries, with the United States with 36% and South Korea 31% being the largest depositors.

As for the largest depositor, the United States, as well as the European Union and Japan have been presenting a higher level of development in nanotechnology (Zanetti-Ramos & Creczynski-Pasa, 2008), showing that, in addition to the United States growth in nanotechnology, Invests in the production of patents in this area.

It was also verified that there were no deposits of Brazil on nano in the base of the EPO, showing the need that the country has to invest in the in-depth development of research in this respective area.

Figure 2. Distribution of deposits by country of origin



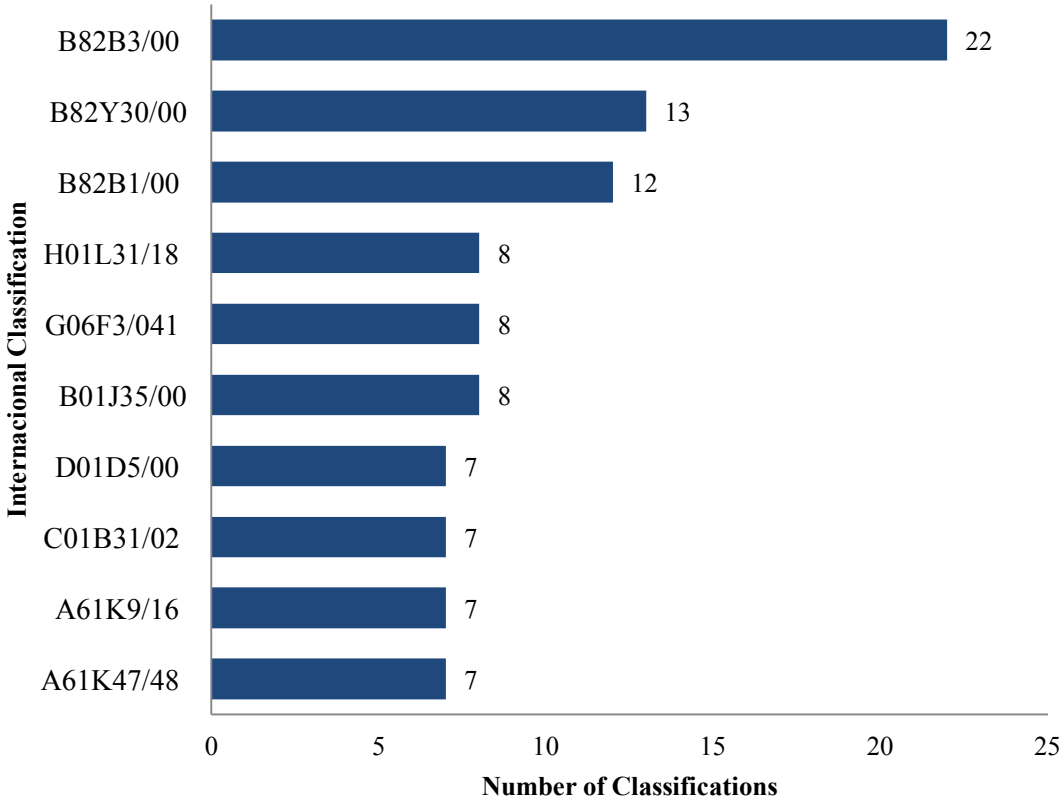
Source: Based on data collection in the EPO (2016)

In analyzing the International Patent Classification (CIP) codes, as shown in Figure 3, the most present classification in the EPO base data was B82B 3/00, which corresponds to the manufacture or treatment of nano structures formed by Individual manipulation of atoms, molecules, or limited groups of atoms or molecules as discrete units.

It is important to emphasize that CIP is a search tool for retrieval of patent documents by intellectual property offices (Garcia & Chacon, 2008).

It is noticed that of the eight large areas (sections) that highlight the rankings found through the EPO survey, the area that was present in the deposits was section A and B. Section A represents human needs and B represents operations processing and transportation.

Figure 3. Number of patents per EPO international classification code



Source: Based on data collection in the EPO (2016)

Table 1 - International Patent Classifications found at INPI

Classification Code	Meaning of classifications
B82B 3/00	Manufacture or treatment of nano structures formed by individual manipulation of atoms, molecules, or limited groups of atoms or molecules as discrete units
B82Y30/00	Nano technology for materials or surface science, p. ex. nano composites
B82B1/00	Nano structures formed by individual manipulation of atoms, molecules, or limited groups of atoms or molecules as discrete units
H01L31/18	Processes or apparatus specially adapted for the manufacture or treatment of such devices or parts thereof
G06F3/041	Digitizers, p. ex. For touch screens or for mem- bers ("touch pads"), characterized by the means of transduction
B01J35/00	Catalysts, in general, characterized by their shape or physical properties

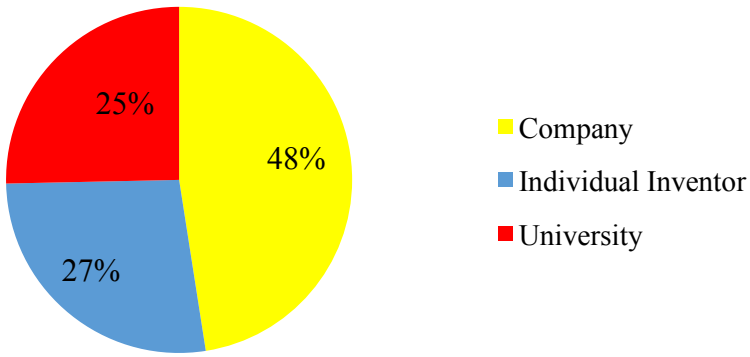
D01D5/00	Formation of filaments, threads or the like
C01B31/02	Preparation of carbon (using ultrahigh pressure, eg for diamond formation, B01J 3/06; by crystal growth C30B); Purification
A61K9/16	Agglomerates; Sprinkles; Microgranules
A61K47/48	The non-active ingredient being chemically bound to the active ingredient, e.g. ex. Conjugated polymeric drugs

Source: Based on data collection in the INPI, 2016

In addition, of the 1,612 classifications found through the deposit analysis, 233 are related to section A, about 14% of the CIPs and 375 are the section B, involving 23% of the CIPs. This can be explained since there can be more than one classification in a patent, after all this code refers to the field of action that a particular patent has.

It has also been found that most of the classifications that have appeared most frequently are related to subclass A61K, which involves preparations for medical, dental or hygienic purposes and the subclass B82B related to nano structures formed by individual manipulation of atoms, molecules, or limited groups of atoms or molecules as discrete units; Manufacturing or its treatment. Table 1 shows the meanings of the IPCs highlighted in Figure 3.

Figure 4. Profile of depositors at the base of the EPO



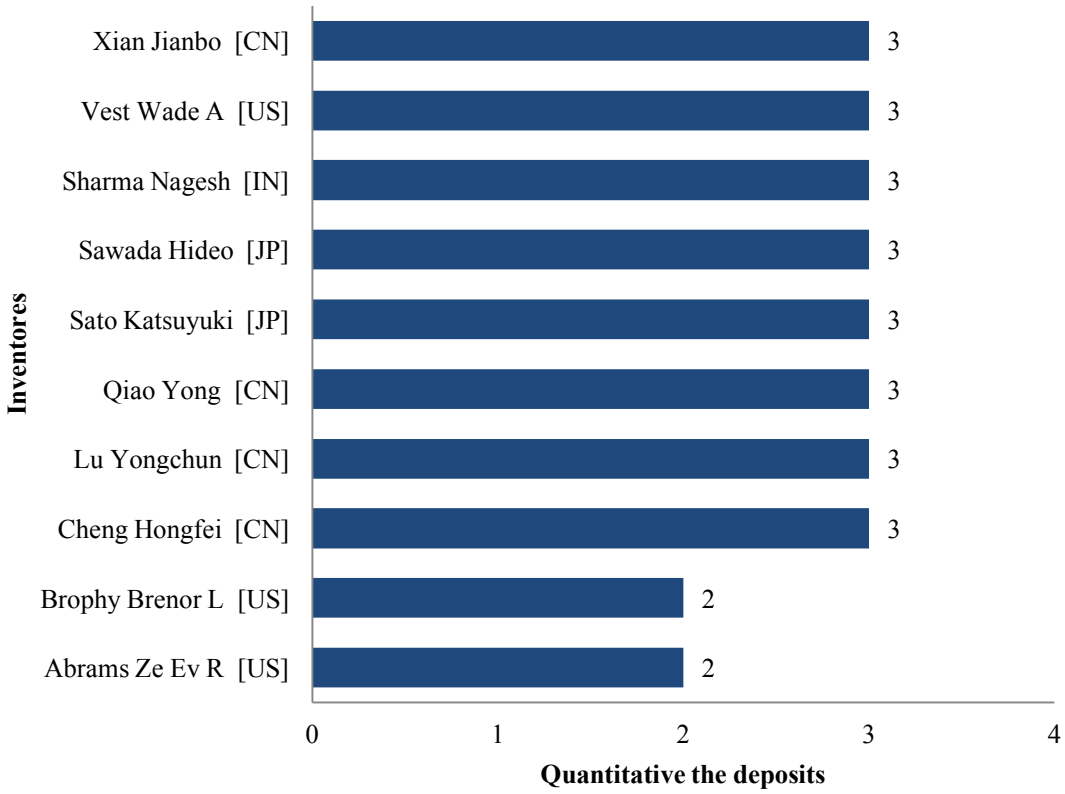
Source: Based on data collection in the EPO (2016)

In addition, Figure 4 highlights the profile of the depositors found in the base of the EPO, where it was observed that the majority of these are companies, with 48% of depositors, 27% is independent inventors and 25% are universities.

These data reveal that there is still a deficiency in the investments made by universities in research on nanotechnology and its patent protection. In addition, it is understood the need to stimulate partnerships between companies and universities, to boost the effective production of new technologies that can be inserted in the market. The question universities establish stronger ties with the company, arises to seek alternative sources of financing (Schugurensky & Naidorf, 2004).

Still, it would be interesting for these universities to partner with companies to boost their scientific and technological researches.

Figure 5. Patent filings by inventors on the base of EPO



Source: Based on data collection in the EPO (2016)

In addition, Figure 11 shows eight inventors who carried out the largest number of patent filings on the EPO base, with three deposits each. The others highlighted in the figure only 2 (two) deposits.

Conclusion

From the mapping carried out around nanotechnology, it can be observed that of the five years analyzed, 2014 obtained a greater predominance in patent deposits, covering technologies aimed at the manufacturing or treatment of nanostructures. However, few deposits were made in 2015, but this can be explained due to the period of secrecy of deposits, where the document is not seen through public consultation based on which the technology was deposited.

The measurement of data showed that there was a predominance of deposits carried out by companies, which shows that organizations are seeking to develop products or processes through nanotechnology. However, there is still a need for partnerships between companies and universities to foster the emergence of new technologies, as it would allow the promotion of scientific and technological development in this area that covers different areas of activity.

Thus, countries such as the United States and South Korea have been developing nanotechnology technologies and protecting their innovations through patent filings. However, further exploration of this area is necessary, covering studies aimed at the use of nano in medical treatments and the commercialization with emphasis of these products in the market, since in addition to producing and protecting these products it is necessary to distribute them to consumers.

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