

Technological Monitoring on Recycled Paper

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Abstract— The origin of the papermaking took place in China in the year 105 (d.C), its creator, Ts'ai Lun used a process of disintegration of fibers of various materials which resulted in the final product called paper. The discovery of this product has brought humanity several benefits. As important as water and energy, paper, has become an indispensable product in our daily life, everything that is seen, touched and used, paper is constantly present, so much is its use on a world scale that there was a concern of as we would do so that this product could be reused to avoid an environmental catastrophe, polluting our ecosystem. After Law 12,305, the Brazilian National Solid Waste Policy - PNRS sanctioned in 2010, there was a marked increase in the selective collection of this material and a high stimulus to the consumption of recycled paper. The PNRS obliges all public agencies to consume recycled material and demand is increasing, the price of recycled paper tends to fall a lot and finally paper recycling becomes one of the best investments of the sector in Brazil. Nowadays, the paper is manufactured from the extraction of cellulose, through the recycling process. Cellulose can be obtained from any fibrous material, but only a few tree species have the appropriate quality and purity. In Brazil, the most appropriate species for paper production are eucalyptus and pine. Although recycling is considered the core of a circular economy for the return of materials to the supply chain, its procedures are poorly understood. Waste recycling is considered a major source of energy savings and a promoter of CO₂ recovery. In addition, it generates jobs and changes markets around the world. This article presents a technological prospection of patent deposits that use paper recycling, as key words were used recycled paper. For the search of patents, the Espacenet database was used, obtaining a total of 244 patent documents, from 1980 to 2017. The results show that the year 2014 obtained the largest number of patent deposits, 17 records. The countries holding patents on recycling are Germany with 47 patent documents, China with 46, the United States with 42, Japan with 40. In short, patent applications in this technology branch have much to grow around the world, since the recycling industry has a high potential to generate innovation, making it an indispensable business in developed economies.

Keywords— Paper, Recycled, Patents, Technological Monitoring.

I. INTRODUCTION

Based on Law 12,305 of 2010, National Solid Waste Policy - PNR, which obliges all Brazilian public agencies to consume recycled material, the trend is that paper recycling will have more stimulus, increasing its consumption considerably and becoming a good investment in the recycling sector in Brazil, even having sustainable reforestation for the removal of pulp for paper production, can still affect Brazilian flora and fauna [1].

According to [2], Brazilian Association of Pulp and Paper, through a prospective study estimates that with the increase in pulp production from 13.4 million to 20 million tons. In the same period pulp production will increase from 9.3 million tons to 12.5 million tons, and planted forest area will increase by 25% by the end of 2017.

In most of the studies that have been analyzed, recycling is considered the core of a circular economy for the return of materials to the supply chain, its procedures are still poorly understood. Waste recycling is considered an important source of energy savings and a promoter of CO₂ recovery.

The purpose of this paper is to raise awareness of the reuse of recycled cellulose paper, which is used in developed countries, and generates several patents, since the recycling industry has a high potential to generate innovation, technologies, and great potential for economic growth. riches and, above all, to clean up the terrestrial environment.

II. THEORIC REVIEW

2.1 The Paper and its History

Humanity reveals its origin from studies of figures drawn on rocks carried by cavemen. The rupestrian paintings, probably these paintings, or graphic representations realized by the man of the caves, brought many knowledge of diverse life cycles in the planet earth.

Accompanying the development of human intelligentsia, graphic representations have become more complex, making man seek a more adequate way to reproduce his representations, according to history, first by the use of the clay tablet, then continues a systematic progression,

tissues of diverse fibers, papyrus, parchment and finally the paper [3].

Historians agree to attribute to Ts'ai Lun (105 AD), the primacy of having made the paper using rustic means, and later using plant fibers.

2.2 Evolution of Paper

After the invention of paper, many centuries have passed, increasing industrialization and economic development have brought to the planet an accumulation of incalculable waste from paper and its composition, changing from predominantly organic (vegetable fibers) to a greater quantity of elements difficult to break down chemicals. However, by means of recycling processes, the environmental impact of these wastes can be minimized [4].

2.3 Recycling and Technological Monitoring of Paper

According to [5], the industrialized countries have large monetary capital facilitating the recycling of paper, for example selective recycling (separation by manufacturing, recyclable, non-recyclable and organic) and their reuse for several and countries with low financial resources if Brazil has a shortage of financial resources and makes it impossible to recycle paper with innovative methods, lack of an educational policy and adequate collection equipment, unfortunately many selective collection is unfeasible, but on the other hand has a high availability of cheap and unskilled labor that causes companies to seek the recovery of recyclable paper by conventional methods through waste pickers (people who collect recyclable waste with animal or human traction carts), lack of monitoring and technology more efficient.

Even with the method used in the recycling, unconventional is one of the solutions found for the problems generated by the final disposal of the waste, because it prevents potentially re-usable materials from being grounded or incinerated, preserving the environment [6].

According to [7], economic efficiency and the environment must meet three conditions of satisfaction: technological efficiency, product choice efficiency and allocative efficiency. In a perfectly competitive market, it is assumed that companies seek to minimize costs between profits and labor, achieving technological efficiency when it reaches maximum production using productive methods with minimizing costs.

In terms of this reciprocity of the functioning of the economy, the expenses faced by producers are equivalent to social expenses, not causing any damage to nature, therefore, recycling of pulp paper verified the effective environmental pressures all innovation strategies and technologies respect environmental taxes [7].

III. METHODOLOGY

The research methodology, used for the purpose of tracking patents related to recycled paper. Firstly, the database was defined, which involved the European Patent Office (EPO). The keyword "recycled paper" was used in the title and truncation symbols, so they could help find as many documents as possible. We found 245 results that were exported to Microsoft Excel.

IV. RESULTS

Figure 1 shows the number of patents found per year, we can observe that there was an oscillation in the number of deposits between 1990 and 2017, especially in 2014 with the largest number of deposits.

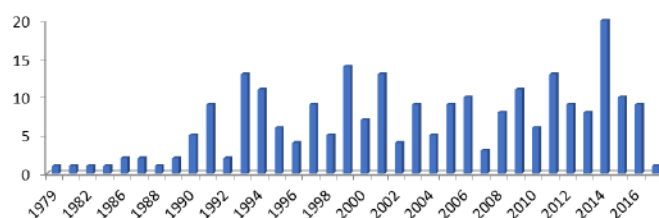


Fig. 1: Patent filing number per year

Source: Prepared by the authors.

By evaluating the documents obtained, as for the countries that develop technology for the subject under study, it was observed that Germany, China, the United States and Japan are the big holders of technology related to recycled paper, according to Figure 2.

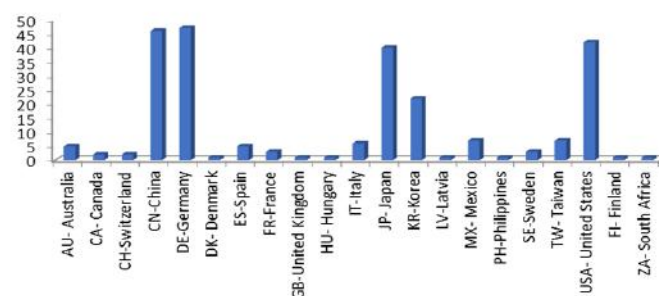


Fig. 2: Patent filing number per year

Source: Prepared by the authors.

In an analysis of the International Patent Classification (IPC), it was possible to know the most cited codes, according to Figure 3. According to the keyword used in the search, the most used base code was the "D21C" which is related to "Production of cellulose by removing non-cellulose substances from cellulose container materials; regeneration of pulp liquors; apparatus", then "D21B", which refers to "fibrous raw materials or their mechanical treatment" and the code "D21H", relating to "Pulp compositions; the preparation not covered by subclasses d21c or d21d; impregnating or coating paper;

paper finishing not covered by class b31 or subclass d21g; paper not provided ".

