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Usage of Vegetable Fibers in Disposable Hygiene Wipes: A Prospective Study

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Abstract

Responsible consumption and production are the goals of sustainable development presented by the UN. Within this framework, there is a research growth in the hygiene sector for the various applications of wipes and similar products, as well as the concern to develop such products in a sustainable way, through the use of raw materials and/or processes that preserve the environment and define the product as less polluting. The present study aims to carry out a prospect patent analysis in order to map vegetable fibers that may compose hygiene wipes. The search on the Spacenet platform highlighted filing of patents by China, whose Industrial Planning contributed to the use of bamboo fiber in 80% of hygiene wipes patents. Fibers made of eucalyptus, coconut, cotton, linen, hemp, jute, wood and bamboo have been used to manufacture hygiene wipes. The survey carried out demonstrates that planning and RD&I in companies are essential for the maintenance of an innovative ecosystem. Thus, it is understood that other vegetable fibers can be studied for the same purpose, stimulating economic activities in this segment.

Key-words: Vegetable Fibers, Hygiene Wipes, Technological Prospecting.

1. Introduction

Historical records point out that cosmetics were used to disguise bad smell, dirt and physical defects for many centuries. (Galembeck; Csordas, 2012). 4000 years BC, egyptians used in their beauty rituals a solid perfume called Kyphi (Sathler, 2018). Historians report that Queen Cleopatra

used mud from the Nile River to exfoliate her skin and goat milk to hydrate it as frequent practices (Sathler, 2018).

Baths were common habits also in Rome and Greece. Only in the 13th century baths were prohibited. The fall of the Roman Empire, the epidemic of the Black Death and the influence of the Catholic Church made the use of cosmetics a profane practice (Galembeck; Csordas, 2012). In the same period in the Middle East hygiene practices prevailed, and only on the 18th century did the practice of bathing return to Europe, remaining up to today.

In the 19th century, hygiene practices gained prominence with the use of soap and shampoo (Sathler, 2018). Since then, in order to meet personal care, the development and improvement of personal hygiene products such as deodorant, cotton swab, pads, alcohol gel and wet wipes have expanded. This last item was initially created for baby personal care and, later, the industry started to produce it for other purposes: women's personal care, aseptic cleaning, makeup remover and more recently for dry shampoo and dental hygiene. Some of these products aim on the lack of need for water, considering the need to preserve water resource (Abihpec; Sebrae, 2021).

Along with water usage reduction as one uses wet wipes as a tool for personal care, there are demands for the production of hygiene wipes that generate low environmental impact when discarded. When consulting information contained on the packaging of wet wipes, it can be seen that it is made with Nonwoven Fabric (NWF), which has natural and/or synthetic fibers in its constitution (Bastian, 2009). NWF-produced wipes can take six months to a year to degrade. Hygiene wipes can fragment into microplastics, and when discarded at sea are toxic if ingested by marine animals. In sanitary landfills, they can delay the degradation time due to the substances present on the products (Teotônio, 2020), for example, bisphenol A and phthalates.

In light of these events, companies are concerned about developing sustainable wipes, either in the complete replacement of synthetic fibers, or in a partial manner. In 2006 there was already a patent for a wet wipe containing bamboo fiber deposited by China (Ling, 2014). This fiber is a renewable material, easy to plant, fast growing, absorbs carbon quickly (Moura, 2019) and it is similar to viscose fiber (Ifrn, 2018).

It is a trend in the personal hygiene products market to promote innovation in its product considering environmental impact reduction and the use of raw materials from renewable sources. Entrepreneurs have sought to offer products and services that meet customer expectations (Jardim; Pavam, 2014), as socio-environmental responsibility becomes a strategic practice for companies to enter the ecomarket or green market (Borgo, 2014). In Brazil, companies such as Natura and Chamma da Amazônia have created projects with NGOs, Universities, Research Centers and

communities in the region where natural inputs are extracted, aiming at a sustainable forest cultivation and management (Cruz; França, 2008). This type of initiative raises the level of competitiveness among companies in the national and international market. Natura cosmetics company, for example, has standards of excellence approved and recognized worldwide, which allows it to compete internationally in the market for "green" products (Cruz; França, 2008).

Vegetable fibers are renewable and biodegradable, an ecological advantage that artificial fibers do not have (Soares; Queiroz; Batista, 2019). Natural fibers such as elephant grass, esparto grass, sisal, abaca, jute, bamboo, ramie, coconut, hemp, curauá, pina, eucalyptus, miriti, pineapple, buntal and other woody fibers have been used to replace non-renewable raw materials in several products in the cosmetic, materials engineering and civil construction field, among others (US20150330029A1, 2015; Gonçalves, et al, 2018).

In view of the foregoing, the aim of this work is to make a patent prospection of vegetable fibers used in the constitution of hygiene wipes. It is expected to contribute to the diffusion of the use of other vegetable fibers in the production of biodegradable hygiene wipes, considering the identification of these patents with the respective vegetable fibers used in hygiene wipes and that Brazil has several natural resources. Hence, provide benefits such as: pollution minimization, reduction of energy consumption and conservation of natural resources. Above all, allow the Brazilian industry to be more competitive in the national and international market.

2. Methodology

For the present proposal of this work, the first Prospective stage consisted of a preliminary research related to the keywords: "biodegradable wet wipes", "biodegradable hygiene wipes" and "sustainable wipes". The aim is to understand if the biodegradable hygiene wipes being marketed present the same or similar products. In the second Prospective stage, a search was carried out on scientific research platforms such as Scielo and Webscience in order to understand the extent of discussion and product development related to the topic and define the strategies for technological prospecting.

In the Technological Prospecting stage, a technological research was carried out on the Spacenet platform from the year 2000 to 2019. The International Patent Classification (IPC) was used as a search strategy, a classification by area, in which the "A" section consists of the Human Needs area, and the "D" section, includes the Textiles and Paper area. For the refinement of this prospection, the IPCs used were: A61K8/02, A61P31/02, A61Q19/00, A47K10, D04H1 and D04H3/015, these

families group contents related to personal and domestic products, types of nonwoven fabrics - NWF, similar cosmetic care and skin care preparations.

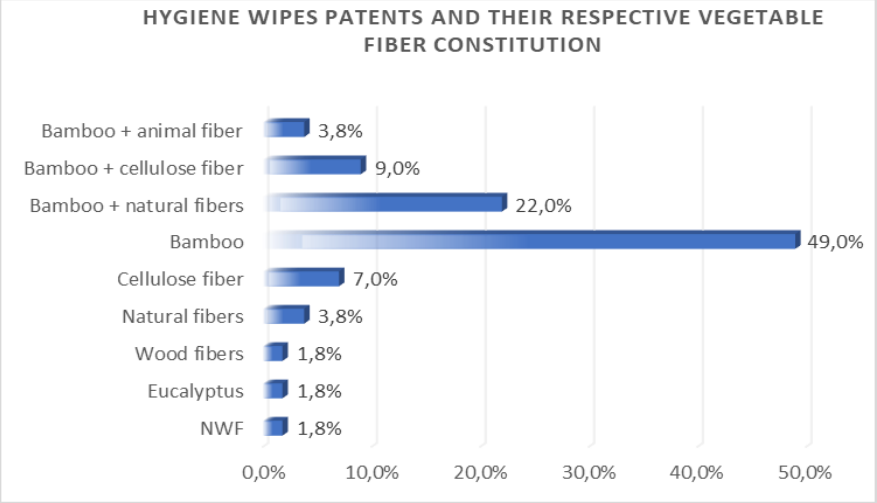
Boolean operators were also used: AND, OR and keyword combinations such as: “fabric”, “wipes”, “tissue”, “towel”, “natural fiber”, “vegetable fiber”, “sisal fiber”, eucalyptus fiber”, “banana fiber”, “bamboo fiber”, “biodegradable” and “baby wipes” in both Portuguese and English. Subsequently, data were crossed and interpreted.

3. Results and Discussion

A total of 942 (nine hundred and forty-two) patent documents were found whilst performing the technological search refinement with the use of IPCs. After the exclusion of patent duplication, the selection took place from the reading of the titles and abstracts found, using the following eligibility criteria: relation with the proposed theme: use of vegetable fibers in the constitution of hygiene wipes; and being available online in Portuguese or English. The result of this selection obtained 55 patent documents for hygiene wipes.

When analyzing the patents of hygiene wipes, it was noticed that more than 49% of the patents refer to bamboo fiber, 34.8% of the patents use bamboo fiber associated with another natural fiber (aloe vera, flax, chitin, cellulose, absinthe, centella, cotton, eucalyptus, soy protein and kapok) and 16.2% include patents for hygiene wipes made from eucalyptus fiber or wood fiber or NWF or natural fibers and fibers made from some type of cellulose (not specifying the plant origin), as shown in the graph of figure 1.

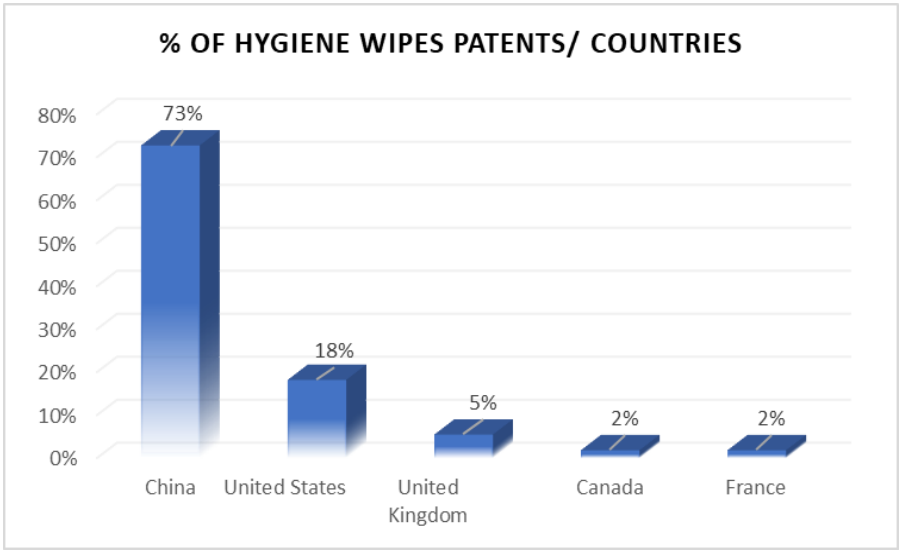
Figure 1 - Hygiene wipes Patents and their respective Vegetable Fiber Constitution



Writer’s Authorship (2022)

China, United Kingdom, United States, Canada and France (Figure 2) were identified as the countries that hold these patents for hygiene wipes. China is the country that stands out with more than 73% of patents filed. These data confirm the statistical studies presented by WIPO (2020), that point to China as the country that deposits the most patents in the world. Another aspect observed is the prevalence of the use of bamboo fiber in Chinese patents, of the 40 patents found, 35 patents use bamboo fiber in the constitution of their products, equivalent to 87.5% of patent deposits in this country.

Figure 2 - Number of Patents Filed by each Country



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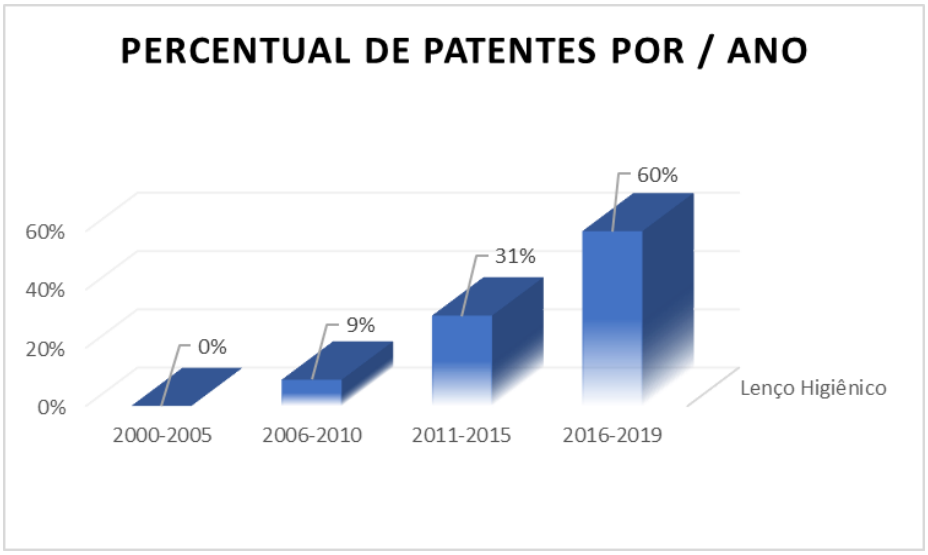
The use of bamboo fiber as a sustainable input for the development of these products is justified by the fact that China has the largest bamboo production chain in the world, and to the bamboo Industrial Planning elaborated in 2015 (Oliveira, 2018). In addition, Bamboo is of Asian origin, easy to grow and handle (Radaik, 2018). As a consequence of Industrial Planning, an increase of 25% of bamboo fiber as raw material was estimated by the year 2020 (Oliveira, 2018). There was an incentive for the innovation of products made of bamboo and several segments started to use this fiber to replace other non-renewable and/or polluting inputs. Industrial plannings like these have turned China into a pioneer "in quality innovation among middle-income economies for the eighth year in a row" (Dutta; Lanvin; Vincent, 2020). It is becoming more and more recurrent in the business environment the need to adapt its products to these demands so they can turn into international products and to guarantee their competitiveness in the market.

From 2006 to 2019, vegetable fibers were included in the development of hygiene wipes, with a significant increase in the last 6 years of patents that use vegetable fibers in the constitution of hygiene wipes (Figure 3). This peculiarity denotes companies' attention to social responsibility when seeking to develop sustainable processes and/or products. It can be observed that from 2000 to 2005 there were no patents filed for hygiene wipes that have vegetable fibers in their constitution as mentioned above. Only from 2006 onwards, there is an increase in the filing of patents until 2019. Although, when comparing the period from 2006 to 2010, in which 9% of patents were filed, there was a 3-fold increase in the filing of patents between 2011 to 2015 and an increase of 6.6 times from 2016 to 2019, confirming the incorporation of practices that encompass social responsibility and product innovation.

Figure 3 - Patents Filed per Year



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This increase in patent applications for hygiene wipes with vegetable fibers in the last 6 years is due to new market segments with consumers who value "green" products (Abihpec; Sebrae, 2021); the competitive strategy of companies that consider socio-environmental responsibility as a strong competitive feature (Borgo, 2014); the most current demand, the use of renewable, non-toxic and non-polluting inputs by companies, as well as the consumption of low or no pollution products by consumers (Isaac, 2016); and due to the increase in the use of hygiene wipes (Abihpec; Sebrae, 2021).

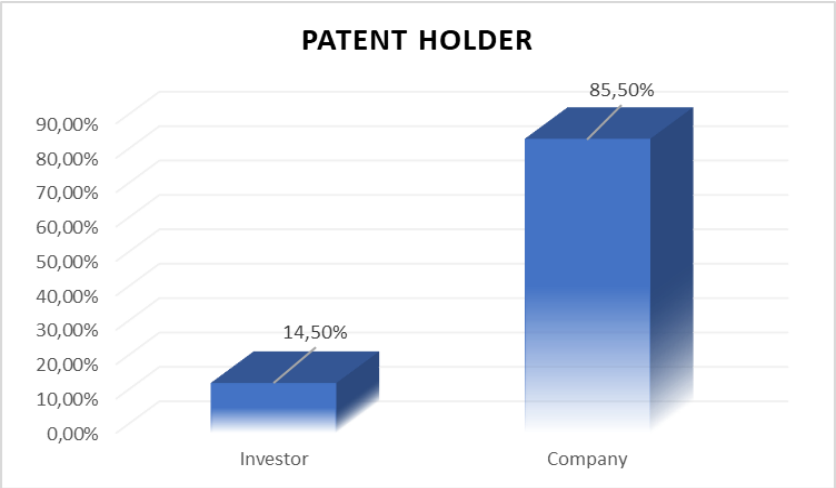
Economic and demographic growth are part of today's world, resulting in a negative impact against nature, so for future generations to have quality of life, there must be sustainable development

associated with the development of economy, environment, and consequently, society. The Paris Agreement, in 2015, may be another factor that generated a greater increase in the filing of patents for hygiene wipes, since one of its aims includes sustainable patterns of production and consumption (Brasil, 2017).

In turn, the incorporation of sustainable production and consumption practices increases the mobilization of the industry in RD&I strategies, which result in the development and improvements of products and/or processes emerging as holders in patent deposits. In Figure 4, companies account for 85.5% of patent holders, which demonstrates an active participation of companies in Research, Development and Innovation (RD&I) and the articulation of sustainable and innovative actions in the hygiene sector. In China, 85% of the patents filed were held by companies, a probable reflection of the bamboo industrial planning. In addition, it should be considered that in many countries, companies are the sector that invest the most in RD&I, unlike Brazil, where the highest percentage of investment comes from the government (Klafke et al, 2014). The United States, the second highest international applicant country in 2019-2020 (Wipo, 2021), is also the second country with the most patents on hygiene wipes in this survey. An important fact is that 81% of US scientists are employed by companies. The holder of 70% of patents are companies. The absorption of scientists in the companies' staff confirms the interest and involvement of companies in the quest to develop and innovate their products and processes.

There is a predominance of companies holding the patent as Figure 4 demonstrates. This is a trait of developed countries in which the high investment of companies in research and development aims to promote innovation in products, processes and services offered.

Figure 4 - Patent Holder



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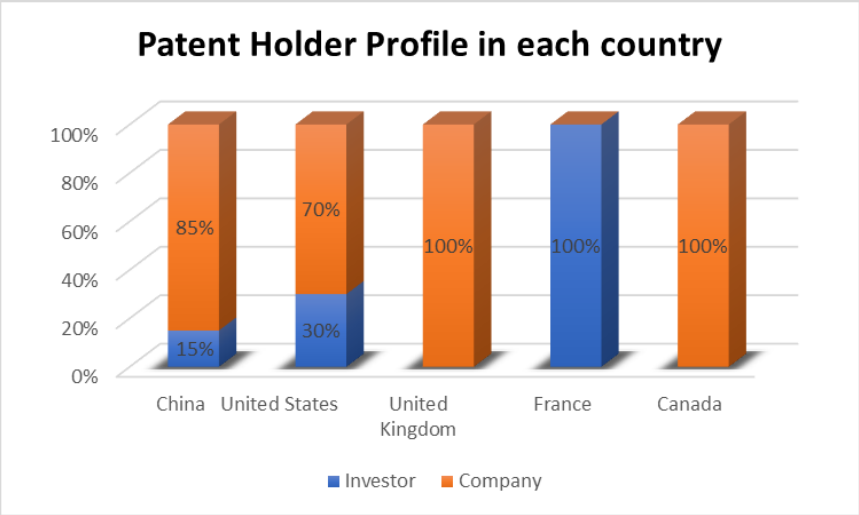
In addition, figure 5 confirms what Negri (2020) addresses in its publication: according to OECD data, in 2017 in the USA, 62.5% of investments were made by private companies and 23.1% by the public sector, which was similar to Europe, and in China, private companies invested 78.9% and the public sector 20.4%. In Brazil, however, there is an inversion, data from the Industrial Research on Technological Innovation of the Brazilian Institute of Geography and Statistics (Pintec/IBGE) indicate that the private sector invested 33.8% and the public sector 66.2%. Countries that have greater investment in RD&I have greater potential to be a competitive economy, especially at an international level.

Figure 5 - Patent Holder Profile in each Country



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Scientific investment is related to technological progress and reflects on the country's competitiveness worldwide. Companies, universities and research centers are capable of accumulating resources and skills necessary for this progress. The structuring of a partnership between business segments and research, undergraduate and graduate areas in related areas becomes an important strategy to boost a nation's research, development and innovation. In universities and research centers there is extensive knowledge that can provide the solution to various demands of industry and society; the business sector, in turn, has inputs, market experience and the ability to scale solutions to meet society's demands. Universities and research centers together with companies can convert knowledge into economic activity by fostering innovation ecosystems. Therefore, the key to economic growth is the triple helix of innovation and entrepreneurship, since the interaction between university, industry and government reflects on economic and social development. The university

with the second academic revolution starts to play an entrepreneurial role in order to combine knowledge and research with economic and social development. The government, while establishing legislation and incentives that benefit these dynamics of the triple helix, becomes a mediator that makes it possible to solve society's demands, as well as a more expressive positioning of the country in the foreign market. And finally, companies with their productive force generate innovation when they translate this scientific knowledge into income generation.

Investments in RD&I by companies became the path to competitiveness. Thus, companies take into acount this activity in their medium and long-term planning. With the technical support of other areas, the ability to innovate is expanded, and will result, for example, in the development and/or improvement of new products/processes, cost reduction, better product/process quality and identification of business opportunities. Brazil still moves slowly when compared to European, North American and Asian countries, regarding companies investing in RD&I, the author Negri, (2020) indicates that only 0.12% of Brazilian companies invest in RD&I. To reach a broader market, RD&I must also consider consumer demand: needs, values, cultural context and, since the beginning of the 21st century, environmental awareness.

The consumers' choices reflect the ecological and social weight of using sustainable products. A survey done by Mintel in 2017 found that 29% of participants prefer to buy from companies that have incorporated sus tainable actions into their operating practices; the Kantar Worldpanel survey in 2018 indicated that when it comes to personal care, 50% of consumers choose products with ingredients of natural origin; in another survey by Euromonitor International in 2016, more than half of the consumers interviewed believed that they can make choices and actions that will make a difference to the planet (Abihpec; Sebrae, 2021). Therefore, conscious consumers combine their consumption with personal well-being and socio-environmental impact (Jardim; Pavam, 2014). At the end of the 1980s, it was noticed the beginning of a worldwide concern for the environment through individual actions, at the beginning of the 21st century, this practice was extended to organizations in order to seek ways in business practice to contribute to environmental conservation and maintenance (SILVA, 2018). This positioning of organizations ends up meeting the demand of a consumer profile that is more attentive to environmental impact generated by products consumed.

4. Conclusion

In this prospective study, some observations regarding the patents of hygiene wipes are highlighted. When searching for patents between the years 2000 and 2021, 83.8% of patents were

deposited in the last 5 years, of which 85% are of Chinese origin with prevalence of bamboo fiber, an input available in China. In addition, more than 85.5% of patents have companies as holders.

It has come into sight that as the use of hygiene wipes increases, the waste generated by them also grows, creating a demand to develop biodegradable products generating less pollution. Therefore, the improvements resulted in a trend to carry out future strategies that include investment in research for innovation, and the high rate of companies holding patents confirms this statement. Moreover, China, when structuring a plan that meets the goals of the SDGs, sought to use the input available in its territory, bamboo, justifying the increase of Chinese patents with the use of bamboo.

As environmental awareness and more ecological and preservationist practices grow, the tendency for vegetable fibers to be increasingly valued in the RD&I processes of various industrial segments seeking to invest in biodegradable raw material, as well as in developing eco-friendly products and practices also grow.

This research found that China, followed by the United States, leads the number of patents of hygiene wipes. The Chinese lead is evident because there is a strategic plan for the future of both the government and the companies, which consider the production of less polluting products as a goal. When surveying the profile of patent depositors, it became evident that there is a strong performance of companies in the promotion of innovation, which indicates the appreciation of RD&I in their internal policy. These data allude to the fact that planning, research and development are essential for innovation to happen.

5. Future Perspectives

Hand hygiene habits have became more frequent with the pandemic scenario triggered by SARS-CoV-2 virus, and should be maintained in the post-pandemic period. One of the resources used is hygiene wipes. Once used only for baby personal care, it is currently used for other purposes, ranging from makeup remover, women’s pesonal care, hand asepsis to hair and dental cleaning. It is possible to perceive a trend of vegetable fiber use in the constitution of these products for the coming years, when analyzing the patents of hygiene wipes that have vegetable fiber in their constitution.

Considering that in the contemporary world the growing search for more sustainable products and processes is a reality, and that Brazil has more than 20% of the planet's biodiversity, companies in the hygiene sector can use this to their advantage. Therefore, it would be necessary to establish strategies that allow companies, especially startups, to innovate, obtaining inputs with conscious and sustainable practices, strengthen family farming and add value to vegetable fiber use, including public

policies that encourage and finance studies to the development and improvement of these products, considering partnerships between universities and companies.

In Brazil, Brazilian companies import inputs to make finished products that the company supplies. This implies financial costs that are attributed to the final price of the goods. The cost of production can be reduced if all inputs can be obtained in the Brazilian territory. Analyzing the patents obtained in this study, it was observed that the constitution of hygiene wipes were based on combinations of natural fibers. The development by Brazilian companies of new biodegradable wipes can be based on studies of natural fibers of Brazilian origin that, when combined, may have traits that meet the desired specifications in the production of hygiene wipes.

Lastly, since it is a market trend to search for renewable raw materials that generate biodegradable and less polluting products, the search for Brazilian natural fibers that can be used in the combinations for the production of hygiene wipes can be a successful path for the emergence of Invention Patents and/or Utility Models, as well as the expansion of competitiveness of Brazilian companies in the personal hygiene sector and in the international market.

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