

TECHNOLOGICAL PROSPECTIVE STUDY OF GREEN COFFEE PROCESSING

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Abstract: This article aims to identify patents referring to coffee processing and to correlate them with the exportation scenario of the processed coffee. The research relate the keywords "coffee" and "treatment" with the International Patent Codes, in the Espacenet database. The CIP A23F5/02 has predominance, with United States figure as the largest holder (20) and Brazil with only one patent deposit. The article suggests countries that promotes research in technology become more competitive in the exportation of processed coffee, even without producing the grain, which explains the need for policies aimed at valuing research in technologies innovation in the national industry.

Keywords: Export; Coffee; Treatment.

ESTUDO PROSPECTIVO TECNOLÓGICO DO PROCESSAMENTO DE CAFÉ VERDE

Resumo: Este artigo tem como objetivo identificar as patentes referentes ao processamento do café e correlacioná-las com o cenário de exportação do café processado. A pesquisa relaciona as palavras-chave "café" e "tratamento" com os códigos internacionais de patentes, na base de dados Espacenet. A Classificação Internacional de Patentes (CIP) A23F5 / 02 tem predominância, sendo os Estados Unidos o maior detentor (20) e o Brasil com apenas um depósito de patente. O artigo sugere que os países que promovem a pesquisa em tecnologia se tornem mais competitivos na exportação de café processado, mesmo sem produzir o grão, o que explica a necessidade de políticas voltadas para a valorização da pesquisa em inovação tecnológica na indústria nacional.

Palavras-chave: Exportação; Café; Tratamento.

1. INTRODUCTION

Coffee came from Africa and was introduced in Brazil in the 17th century. Here it found a favorable climatic and social conditions to make the country reference in production. The history of the coffee grain cultivation is inherent to the country's development, it was fundamental for the generation of financial resources, social evolution and today it occupies the second place in world wealth, second only to oil [1]. According to the National Supply Company (CONAB), Brazil stands out as the largest producer and exporter of green coffee in the world [2,3].

However, some world economic references power are emerging in the world panorama, with regard to the production and export of processed coffee. A study published by the Ministry of Development, Industry and Foreign Trade (MDIC) signaled that countries as Germany, Spain, Indonesia, Italy, Mexico and Switzerland are investing in green coffee treatment technologies [4]. The study warns of the fact that Brazil has competitive advantages relationed to other countries, as it has a large and diversified coffee park, in addition to the representative number of coffee growers who respond to stimuli in technology for production [5].

The cycle of green coffee begins in the planting of seedlings, walks through the processes that involve the harvest and ends in the drying of coffee beans, after that they know as green coffee. From there, the processed coffee production cycle begins, which begins with the change from raw (green) coffee to roasted coffee, moving through the processes of removing impurities, selection of beans before and after roasting, finally ends with the grinding processes.

In view of this scenario, the objective of this paper was to elaborate a technological prospection study and map the patents deposited to correlate to the world panorama of processed coffee exports in order to assess which technologies and measures Brazil should take to become more competitive in export of processed coffee.

2. METHODOLOGY

The research was carried out in the database of the European Patent Office (Espacenet), using the keywords "coffee" and "treating" and the International Patent Classification (CIP). It was developed between the months of January and June 2020 and divided into four phases: Search for Information, Treatment of Information I/II, Representation of results and techniques to propose future scenarios.

In the first phase, it was identified that the patents of the A23F family - "Coffee; Tea; their substitutes; manufacture, preparation, or infusion thereof" and linked to patents code A23F5/00: "Coffee; Coffee substitutes; Preparations thereof", these patents adhere to the purpose of the article.

It was observed that the most frequently found CIPs were A23F5/02; A23F5/04; A23F5/10; A23F5/16 and AF23F5/2. However, the patents A23F5/04, A23F5/16 and A23F5/20 combined processes for removing unwanted substances. For this reason, CIP A23F5/04 was elected as representative of this process (Figure 1).

Figure 1. First and second phase of the methodological flow

Phase 1	Search for information <ul style="list-style-type: none"> - Search option: "Advanced Search". - Use of the keywords: "coffee" and "treating" in the "title" and "summary" fields. - Identification of patents in the A23F family. - Adoption of patents linked to code A23F5/00.
Phase 2	Treatment of information I <ul style="list-style-type: none"> - Selection of patents A23F5/02, A23F5/04 and A23F5/10 due to their relevance. - Use of the keywords: "coffee" and "treating" correlating with the patents found. - Making a table with data obtained (Table 1).

For phase 3, the patents relate to CIP A23F5/02 were eligible due the resemblance with the patents relate to the code A23F5/04 and A23F5/1. In Espacenet, the documents was select, imported with the CSVed 1.4.9 software, compiled and exported to a Microsoft Excel table as part of the analysis phase (Figure 2).

Figure 2. Third and fourth phase of the methodological flow

Phase 3	Treatment of information II <ul style="list-style-type: none"> - Exclusion of patent documents belonging to the same family. - Selected the patent code A23F5 / 02 as the focus of the objective. - Choose of the CSVed 1.4.9 software to compile the information.
Phase 4	Representation of results and techniques for reflection on the future <ul style="list-style-type: none"> - Import of document information citing patent A23F5 / 02 to CSVed 1.4.9. - Do the preview and editing of the table proposed by the software. - Export the table to Microsoft Excel. - Editing and analysis of data relevant to the topic.

3. RESULTS AND DISCUSSION

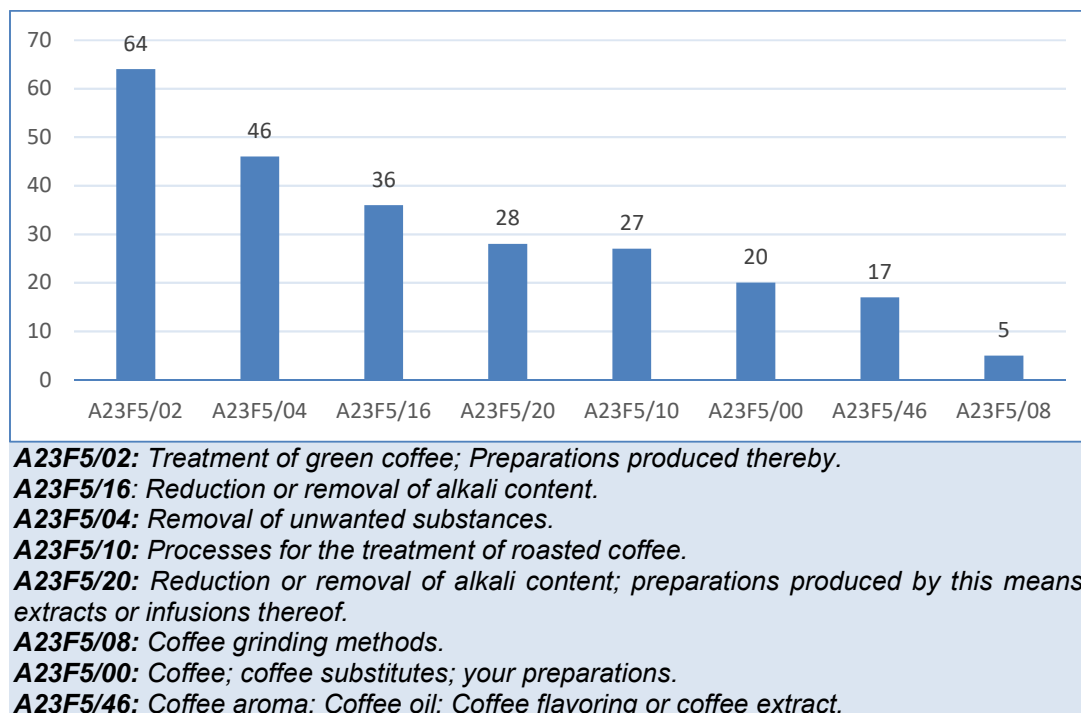
The documents founded in Espacenet based on combinations of keywords and CIP, adopted by the National Institute of Intellectual Property, which could enrich the discussion about the objectives, were described in Table 1.

Table 1. Search for patents by patents and code (CIP)

Coffee	Treating	A23F5/02	A23F5/04	A23F5/10	Total
*					10000
*	*				1015
*	*	*			64
*	*		*		46
*	*			*	27
*	*	*	*	*	5

For being restricted to one process for the treatment of green coffee, the patents whose CIP code A23F5/04 and A23F5/10 directly correlate to the CIP code A23F5/02, eligible in phase 3. This shows how it relates to the other codes related to the treatment of green coffee beans (Graph 1).

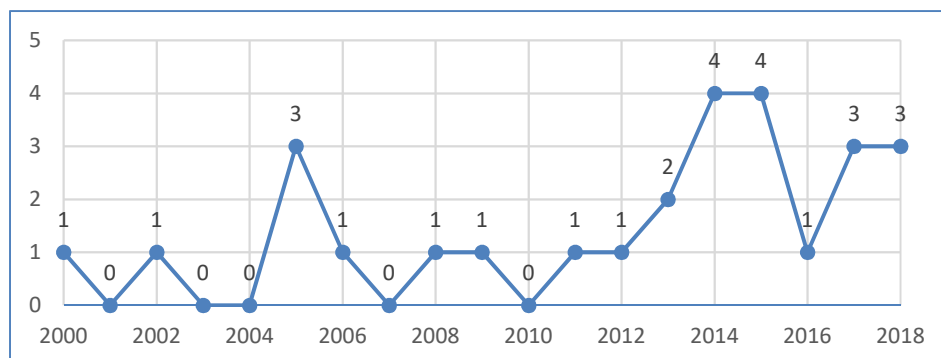
Graph1. Distribution of patents related to coffee processing by codes (CIP), found in Espacenet.



During the research, the CIP most found was code A23F5 / 02, which refers to the process of treating green coffee (coffee in its post-harvest state) in general and its preparations. Then the codes for the removal and treatment of impurities and residues, whose codes A23F5/04, A23F5/16 and A23F5/20. Finally, with 5 citations, the code A23F5 / 08, which refers to coffee grinding methods.

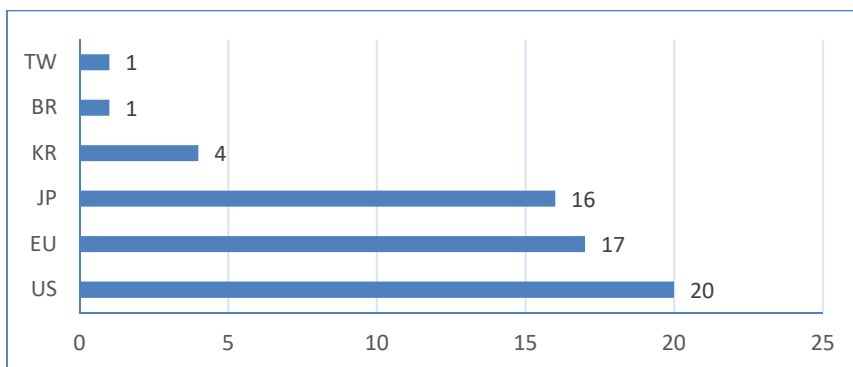
Patent filings related to the treatment of green coffee dated since 1912, with significant growth in the last two decades, with the years 2014 and 2015 standing out with 4 filings (Graph 2).

Graph 2. Evolution of patents in the last two decades, found in Espacenet



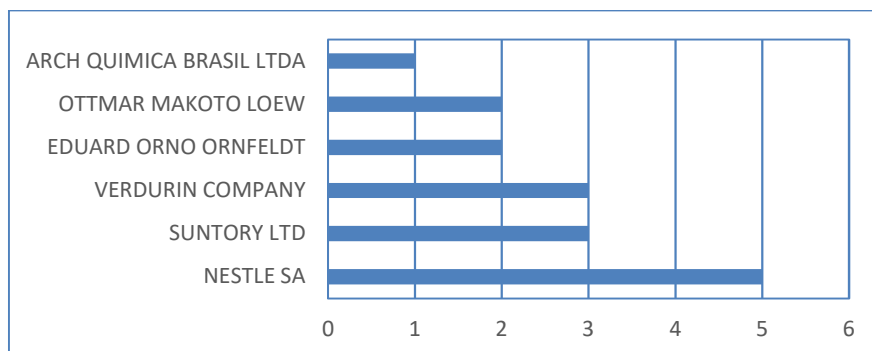
Brazil is the author of only one deposit, dated in 2007. The United States (US) stands out, with 20. The European Union (EU) emerges with 17. In Asia, Korea and Japan are the leaders, with 4 and 16 patents respectively (Graph 3).

Graph 3. Countries with the highest number of patent filings



The depositor with the highest number of patents for the treatment of green coffee is Nestlé S.A., a Swiss company, responsible for 5 patents. The American Verdurin Company and the Japanese Suntory LTD are soon followed (Graph 4).

Graph 4. Companies responsible for the largest number of patent filings



According to the United States Department of Agriculture (USDA) in 2020, Brazil it is the largest coffee producer in the world (Table 2) [6,7].

Table 2. The highest coffee producers in the world

Position	Country	2019/20 Ton-60kg Bag	2020/21 Ton-60kg Bag
1	Brazil	59.300	67.900
2	Vietnam	31.300	30.200
3	Colombia	13.800	14.100
4	Indonesia	10.700	10.300
5	Ethiopia	7.450	7.500
6	Honduras	5.600	6.125
7	India	4.890	5.310

The country's leadership it is also see in the ranking of green coffee exports (Table 3) [6,7].

Table 3. The highest green coffee exporters in the world

Position	Country	2019/20 Ton-60kg Bag	2020/21 Ton-60kg Bag
1	Brazil	32.700	37.000
2	Vietnam	24.000	24.000
3	Colombia	12.000	12.400
4	Indonesia	6.096	5.900
5	Honduras	5.500	5.575
6	Uganda	4.000	4.500
7	Peru	4.360	4.265

However, the country is limited to the supply of raw material (green coffee) to exporters of processed coffee [8]. In this second cycle of coffee, some countries focus on investing in research and technology to add value to the product, according to the ranking of processed coffee exporters. In this ranking it is possible to identify the importance of the Nestle SA company patent filings to the relevance of Switzerland in the exportation of processed coffee world scenario, country that do not have appropriate climatologic and geographic characteristics to cultivate the bean. (Table 4) [6,7].

Table 4. The highest exporters of processed coffee in the world

Position	Country	2019/20 Ton-60kg Bag	2020/21 Ton-60kg Bag
1	Europe	1.775	1.500
2	Switzerland	1.425	1.400
3	Vietnam	550	550
4	Colombia	120	300
5	Mexico	230	230
6	Indonesia	56	50
7	China	25	25
8	Brazil	24	24

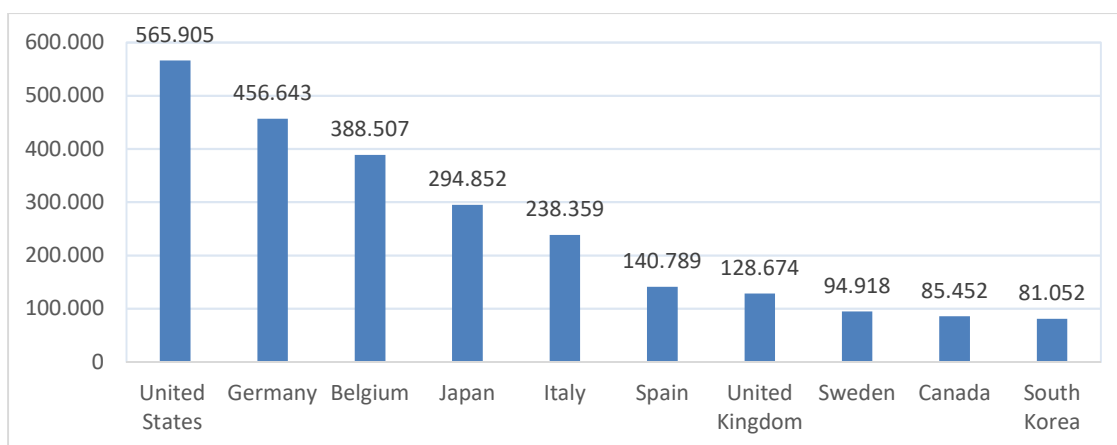
According to the study, the focus of these countries is on technologies aimed at the selection of grains and removal of unwanted substances, CIP A23F5/04, both for green coffee and for subsequent processes of changes in the impurities of the grain after roasting or grinding.

This observation serves as a guide for the use of policies to may encourage research and technology development that can change the production criteria from a focus on volume to a focus on quality and identity [5]. Strategy that have to be initiate by cooperatives or associations with supply administrative, technological support to producers and support by the local government [9,10].

The National Council of Coffee Exporters of Brazil (CECAFÉ), released the ranking of the destination of Brazilian green coffee (Graph 5), it is possible to notice the presence of the countries that hold the largest number of patent deposits related to the processing of green coffee, previously shown in Graph 3.

The analysis corroborates with the Secretariat of Agriculture, Livestock, Irrigation, Fisheries and Aquaculture (SEAGRI), in a 2011 report, where the authors state that most producers, especially small ones, do not use the most modern technologies available for coffee growing, especially with regard to coffee processing [11].

Graph 5. The highest destinations for the Brazilian green coffee bean



4. CONCLUSION

Although the country stands out as the largest coffee producer in the world, the number of patents related to the treatment of green coffee reflects data from the world panorama of processed coffee. In Brazil, the coffee is exported and used as an input for the expansion of the industrial sector in other countries, which in some cases, do not even have a geographical and climatic condition for planting. This reinforces the thesis that there are ways to add value for the green coffee and have to be adopted in small and medium coffee industries in the country.

Reference countries in technology and innovation invest in research in order to add value in the product. The United States, for example, has 20 patents filed. Brazil, despite being the world's largest coffee producer, has only one deposit, made by a chemicals company in the biotechnological industry.

Thus, it is possible to affirm that Brazil has the potential to figure as an important exporter of processed coffee in the world, however for this panorama to become reality it is necessary for Brazil to mirror itself in countries that invests in technologies and research, such as the countries with largest number of patent filings. There is a favorable broad market to the country that can boost the generation of jobs and strengthen national technology, while favoring the Brazilian economy.

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