Science Talks 12 (2024) 100400

Contents lists available at ScienceDirect

Science Talks

journal homepage: www.elsevier.es/sctalk

Patent landscape analysis: How to find information on hydrogen peroxide industrial syntheses

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ARTICLE INFO

Keywords:
Patent landscape
Patent search
Hydrogen peroxide
Industrial syntheses

ABSTRACT

The objective of this presentation is to provide an overview of the methodology employed in patent landscape analyses (PLA), with a particular focus on the patented processes used to produce hydrogen peroxide.

Patents are an essential source of technical knowledge that may not be found anywhere else. In a paper published in World Patent Information it is posited that 57 % of technical information can be found exclusively in patents. Even if the quantity of information is difficult to quantify, the rising number of patent applications demonstrates the growing importance of patents as a source of information.

A patent landscape is a specific type of patent search conducted with the objective of identifying the most recent inventions or to study the development of a particular technology.

An example of PLA is reported, focused on the industrial production of hydrogen peroxide. The search was carried out using a combination of classification schemes (IPC – International Patent Classification and CPC – Cooperative Patent Classification) and keywords.

The global patent landscape is dominated by China, the USA and Japan. The patenting trend indicates a rise in the number of filings for electrolytic and photocatalytic methods, with a notable acceleration in the latter.

These results can be beneficial for researchers and technology transfer professionals. Researchers may utilize these findings to develop new photocatalytic methods or enhance the alkyl anthraquinone auto-oxidation (AO) process, focusing on the catalytic systems and reactors utilized for the hydrogenation step, for example.

Video to this article can be found online at https://doi.org/10.1016/j.sctalk.2024.100400.

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http://dx.doi.org/10.1016/j.sctalk.2024.100400
Received 8 August 2024; Received in revised form 24 September 2024; Accepted 1 October 2024
Available online xxxx

Figures and tables

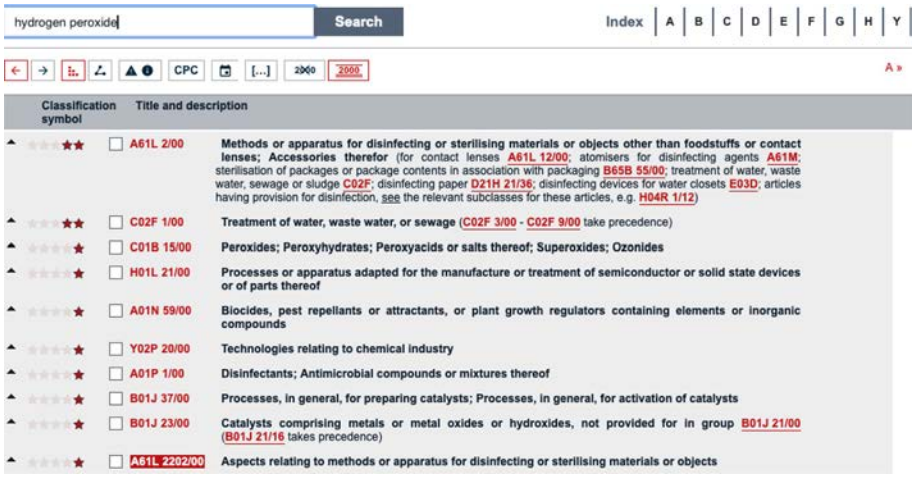

Fig. 1. The retrieval of CPC symbols can be achieved through the utilization of the "Classification search" tool, which is provided by the European Patent Office (EPO). In order to facilitate the retrieval process, it is sufficient to input a couple of keywords, which will then generate a list of results. Subsequently, it is necessary to ascertain whether the retrieved codes are pertinent.

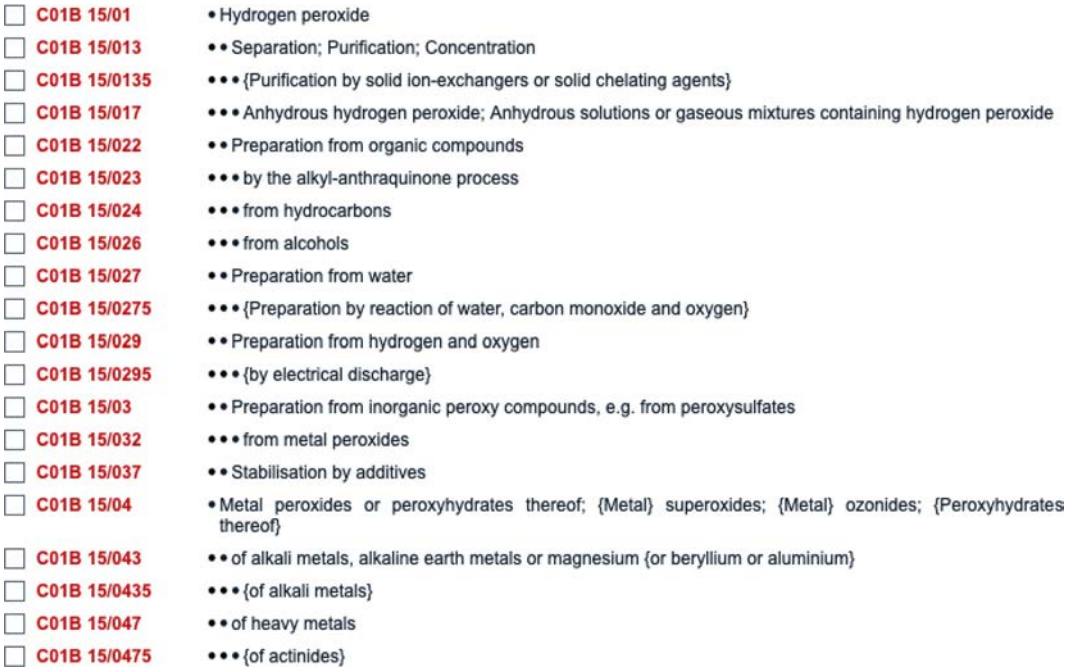

Fig. 2. The synthesis of hydrogen peroxide is classified into four main typologies: The first of these is the synthesis of hydrogen peroxide from organic compounds, which is mainly achieved through the alkyl-anthraquinone process (C01B 15/023). The second typology is the synthesis of hydrogen peroxide from water, which can be achieved through the use of photocatalytic processes (C01B 15/027) or by reacting water, carbon monoxide and oxygen (C01B 15/0275). The third typology is the synthesis of hydrogen peroxide from hydrogen and oxygen, which is achieved through a direct synthesis process (C01B 15/029). Finally, the synthesis of hydrogen peroxide can also be achieved from inorganic peroxy compounds (C01B 15/032).

Fig. 3. The WIPO IPCCAT tool may be utilized in order to retrieve IPC codes. Three parameters can be configured: the number of predictions, the classification level and the language input. The system functions more effectively when an abstract is included. Each result is hyperlinked.

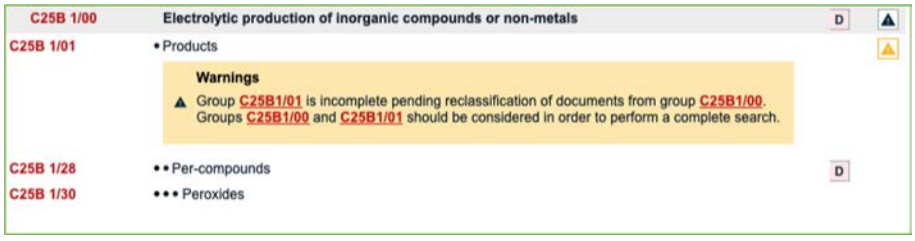

Fig. 4. The electrochemical synthesis methods of hydrogen peroxide are not classified in the C01B 15/01 subgroups, but rather in the C25B 1/30 (Electrolytic production of peroxides). To perform a comprehensive search, it is necessary to consider the main groups C25B 1/00 and C25B 1/01, since the reclassification of documents is still pending. C25B 1/30 is referred to as "peroxides" in general, and the terms "hydrogen peroxide" and "H2O2" were used in combination with the classification symbols to obtain a precise search. To retrieve the patented electrolytic processes, the following search query was employed on Espacenet: *(cpc = "C25B1/30/low" OR cpc = "C25B1/00" OR cpc = "C25B1/01") AND ctxt = ("hydrogen" prox/ordered "peroxide?")*.

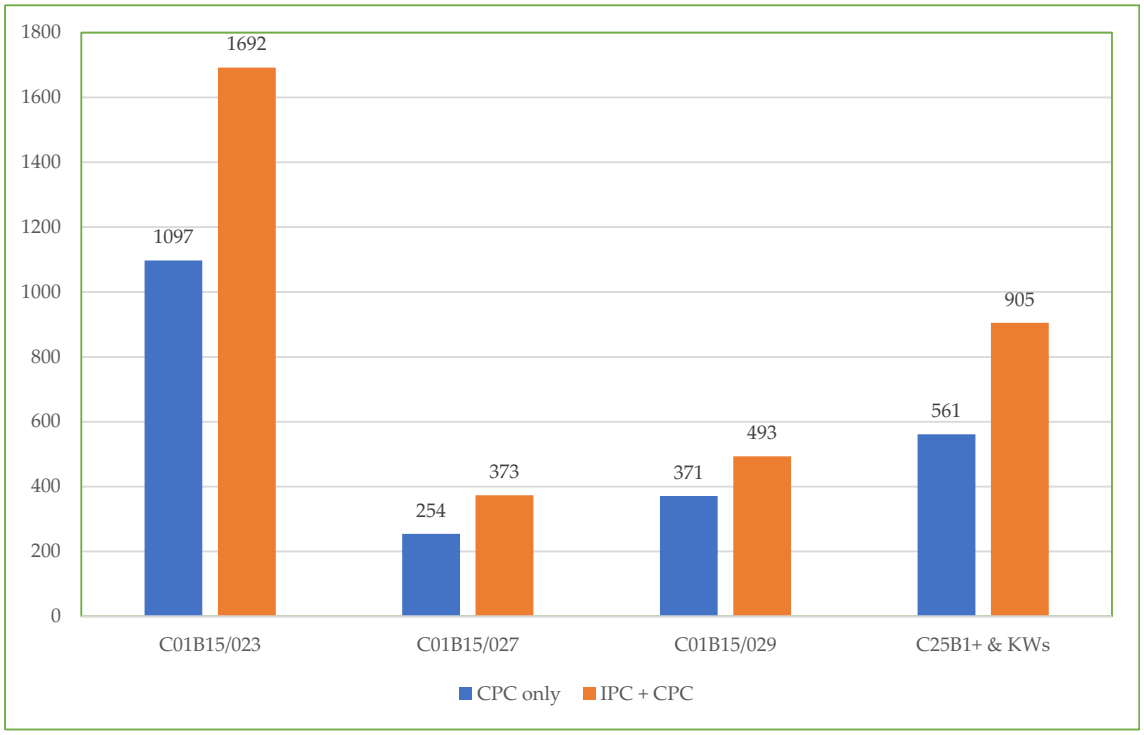

Fig. 5. It should be noted that not all patent applications are classified in the CPC scheme. Consequently, in order to conduct a comprehensive search, it is necessary to utilize both the IPC and CPC classification systems. The following figure presents a comparison between the number of patents retrieved using CPC alone and those retrieved using both schemes.

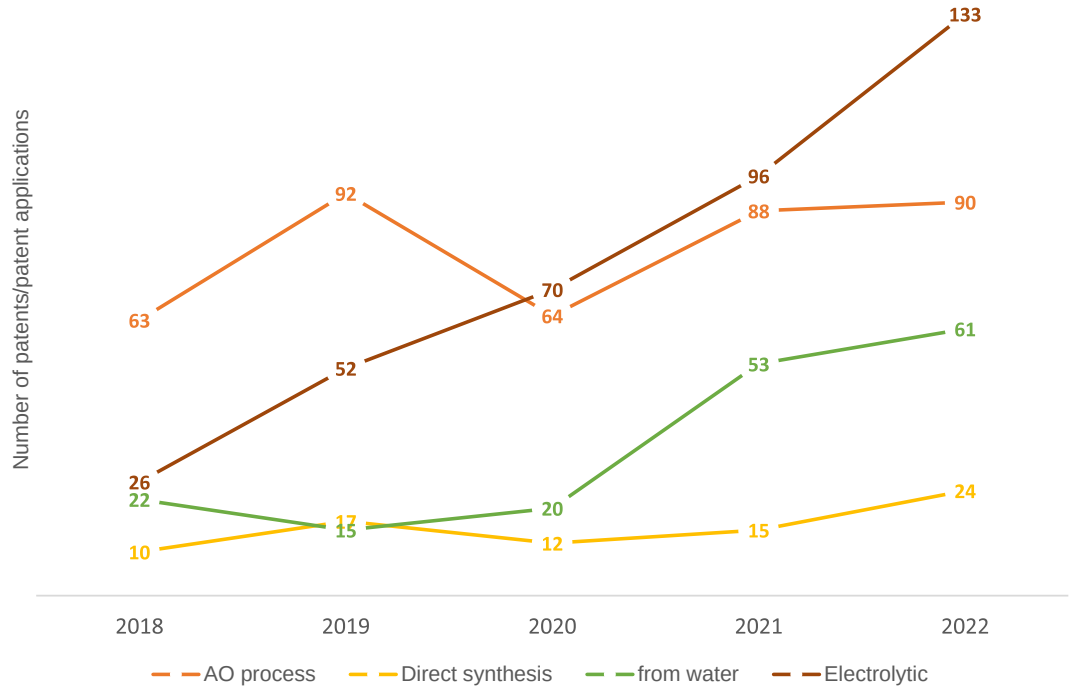

Fig. 6. The figure illustrates the patenting trend over the period 2018–2022. It can be observed that electrolytic processes are the most patented, followed by photocatalytic methods. However, the AO process continued to be the subject of study and patenting.

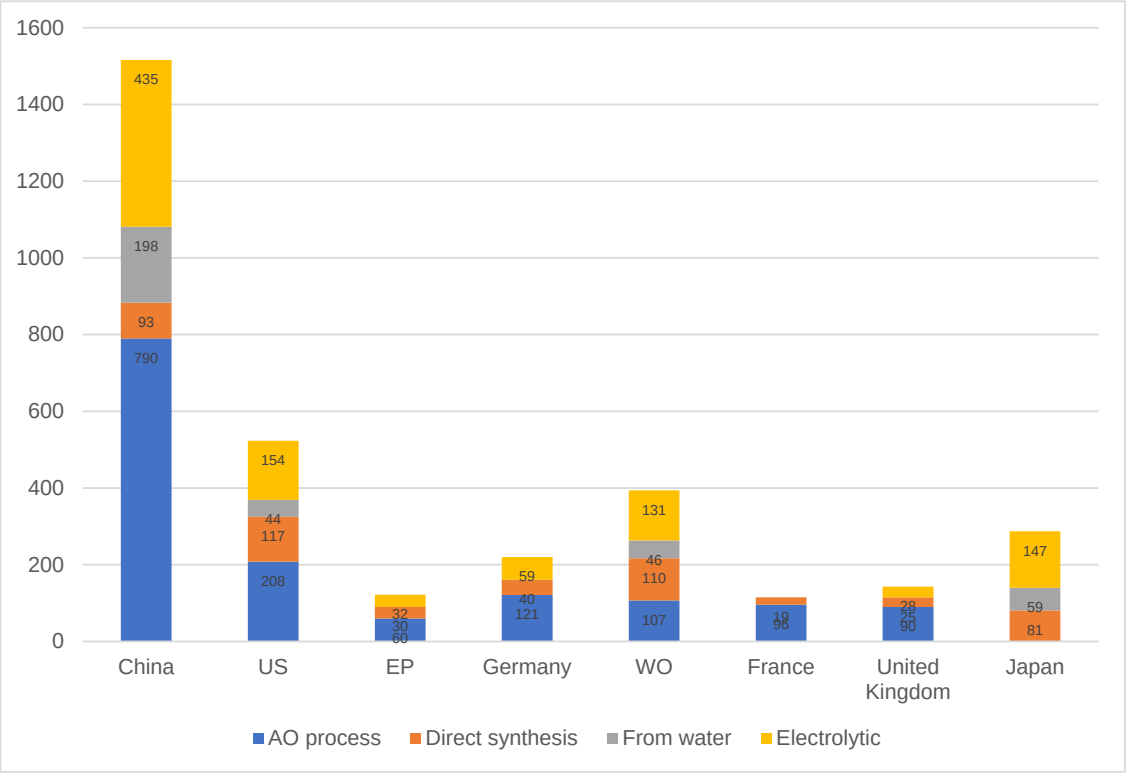

Fig. 7. The following graph presents data related to the number of patents and patent applications filed in the top priority countries. Priority applications are defined as the first filings. Except for the direct synthesis of H_2O_2, China ranks first for all processes. The USA, on the other hand, ranks first for direct synthesis.

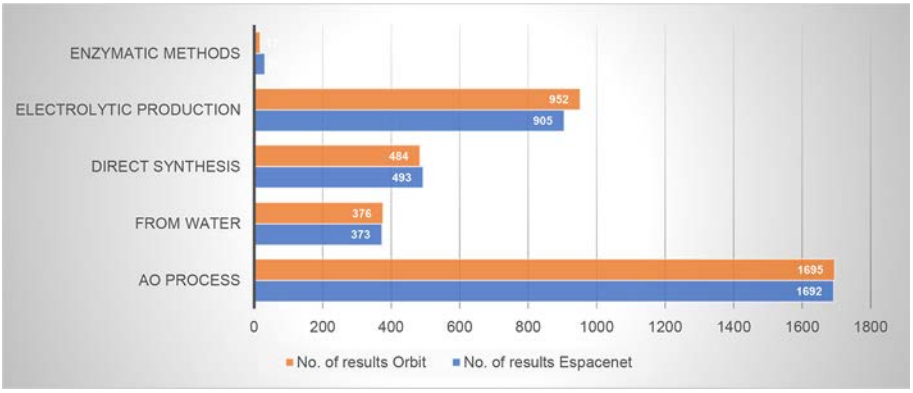

Fig. 8. The total number of patents is reported in this figure. The four main industrial processes previously considered were augmented by the addition of enzymatic methods. However, as can be observed, the number of patents for enzymatic methods is relatively low.

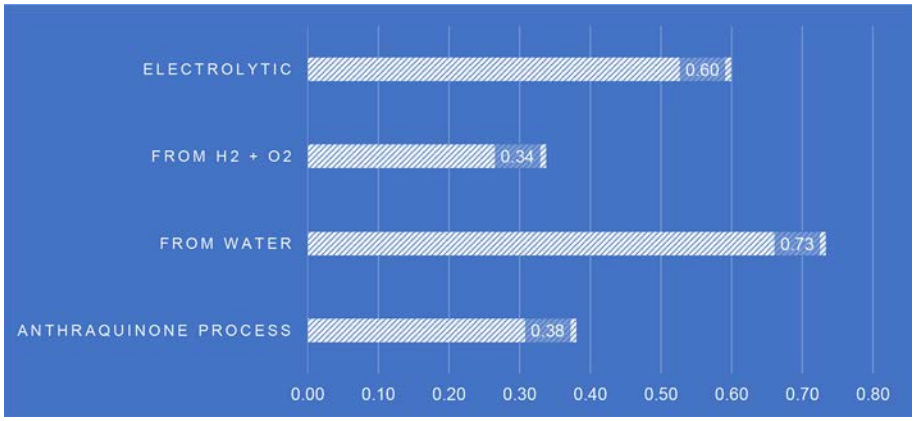

Fig. 9. The figure represents the acceleration indicator for each process involved in the production of H_2O_2. The acceleration indicator, defined as the ratio between the number of patents with a first application year after 2020 and the number of active patents/patent applications, allows for the identification of patented technologies that have experienced the greatest increase in the number of filings over time. The photocatalytic methods received the most significant impulse, followed by electrolytic methods.

Conclusions

In this video tutorial, the methodology for conducting a patent landscape analysis is presented. This approach can provide an overview of the patent activity and trends in a given field of technology.

The search for industrial processes for producing hydrogen peroxide was conducted by combining highly precise keywords (utilized in the Title/Abstract/Claims field) and classification symbols (IPC and CPC). Both Boolean and proximity operators were employed. Classification codes constitute a language-independent tool that enables an almost complete recall and retrieval of patent information. Consequently, if classification symbols can be identified, the search will be more comprehensive and accurate.

The patent databases Espacenet and Orbit were utilized in the search.

The global patent landscape is dominated by China, the USA and Japan, as priority countries.

A review of patent data reveals that electrolytic processes are the most patented, followed by photocatalytic methods. However, the AO process remains a subject of ongoing study and patenting.

The findings of this study may prove beneficial to both researchers and technology transfer professionals. Researchers may leverage these findings to develop innovative photocatalytic methodologies or optimize the AO process, with a particular focus on the catalytic systems and reactors employed for the hydrogenation stage.

CRediT authorship contribution statement

Massimo Barbieri: Writing – original draft, Methodology, Data curation, Conceptualization.

Data availability

Data will be made available on request.

Declaration of interests

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Further reading

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