

International Patent Survey of Products and Processes Concerning Homeopathy

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Homeopathy 2021;110:2–12.

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Abstract

Background Homeopathy is a complementary medicine characterized by the use of diluted and potentized medicines. Innovations in this area are constantly being proposed in the relevant literature, such as scientific articles and patents. The objective of this study was to carry out a patent survey of homeopathic products and processes.

Methods A free and international patent database, Espacenet, was used. The search was carried out using the keyword homeop*, with two approaches: (1) no date restrictions for the search and (2) a date limit for the publication years 2008 to 2018. The patents from the limited period were organized as depositor countries, ownerships and groups, including homeopathic formulations, equipment, packaging, production procedures, and analytical methods.

Results Without date restriction, 601 patents were identified in the survey. Of these, 174 were related to homeopathy and published in the period 2008 to 2018. Technologies come mainly from the following countries: United States (55 patents), Russia (24), Germany (15), France (13), India (12), Ukraine (11), Brazil (6), and China (6). Among the ownerships, 69% of patent applications were by independent depositors, 23% by companies, 7.5% by universities, and 0.5% by company/university partnerships. New formulations represented 75.9% of technologies, whilst the others comprised 14.3% for equipment, 3.8% for drugs packaging, 3.8% for production procedures, and 2.2% for analytical methods.

Conclusions The present review helps visualize the homeopathy-related patents published in recent years, as well as the main countries and researchers investing in the field of homeopathy.

Keywords

- ▶ homeopathy
- ▶ patents
- ▶ survey

Introduction

Homeopathy, according to the World Health Organization, is a therapeutic class belonging in the category of complementary and integrative medicine.¹ It is recognized as a clinical and pharmaceutical specialty with several particularities, where the treatment occurs based on the principle of similars and the medicine is specially prepared by energizing techniques. Unlike classical medicines, which have the prin-

ciple of healing by opposites and a mechanist view, homeopathy employs a totalist and holistic approach, healing through re-establishment of physical, mental, and emotional patient balance.^{2,3}

Homeopathic therapy was created by the German doctor Samuel Hahnemann at the end of the 18th century, and followed Hippocrates' recognition that similars may cure similars.⁴ Hahnemann, through many studies, published the symptoms of various drugs tried on healthy individuals,

received

February 21, 2020

accepted after revision

May 14, 2020

published online

October 15, 2020

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Georg Thieme Verlag KG,

Rüdigerstraße 14,

70469 Stuttgart, Germany

DOI <https://doi.org/>

10.1055/s-0040-1715581.

ISSN 1475-4916.

as well as consolidated the homeopathic doctrine called vitalism and created the dynamization technique, based on serial drug dilutions and energizing techniques.²⁻⁴

Since its origin, homeopathy's development has been widespread all over the world. Depending on the country, homeopathic drugs can be prescribed by clinical professionals, including medical doctors, dentists and veterinarians, and in some cases they can also be prescribed by specialist homeopathic pharmacists.³ On the other hand, the production of medicines is done essentially by homeopathic pharmacists, according to the rules of the Homoeopathic Pharmacopeia and Good Manufacturing Practices of each country.⁵ Generally homeopathic medicines can be manufactured and marketed in two main ways: in small scale to individuals in compounding pharmacies, or on an industrial scale with dispensing in a pharmacy or drugstore.

With regard to new homeopathic products and processes, many innovations are reported in the literature, which can be observed through new formulation technologies or new production equipment, packaging and quality-control assessment methods, among others.⁶ These innovations, as in any other industrial domain, can be published in the scientific literature, or even protected by patent.⁷

It is important in the research and development (R&D) sectors of companies and universities to conduct studies on the state of the art of a given subject, and to propose innovations accordingly. The approach can be implemented via specific surveys in databases of articles and of patents. However, to clearly visualize the opportunities and the risks, it is important to adequately organize the obtained data, and to apply intellectual management tools to obtain bibliometric and technological indicators. These indicators, when well interpreted, allow the design and execution of projects without wasting time and financial resources.^{8,9} In this context, systematic reviews, prospecting studies, and technological mapping are good ways to obtain technological indicators.⁹

Since there are evidently no patent surveys in the literature concerning homeopathic technologies, this study aimed to carry out a search on the state of the art of this subject. We hope that the data provide new insights, especially with regard to risk management and innovations, improving competitiveness, reducing investment uncertainty, and underpinning new R&D decision-making. To that end, the survey was organized to highlight the number of patents by country, types of depositors and goals of content, including new formulations, equipment, packaging, production processes and analytical methods.

Methods

Data Collection

The search of patents was carried out as suggested by Rother,¹⁰ where seven steps are recommended for the preparation of a systematic bibliographic review. ► **Table 1** presents the methodological approach employed in this review.

In the first step, the free database Espacenet was selected (<https://worldwide.espacenet.com/>), as it includes results from more than 90 countries. In addition, the time interval for conducting the research was defined, in which two scenarios were chosen: (1) a search for published patents without a date limit; and (2) a search covering the period 2008 to 2018 inclusive, totaling the most recent 11 years of innovation at the time of our search. The third strategy for tracking patents was choosing the keyword, the selected one being "homeop*," where the truncation symbol "*" ensured retrieval of all records with the common word-stem "homeop". To complement the study, a survey of scientific articles was performed in the Web of Science database (<https://webofscience.com>), using the same strategies of keywords and time period used in the search of patents. Both searches were carried out in September 2019.

Table 1 Systematic review method employed in the present study, based on the steps described by Rother¹⁰

Steps	Strategy
Question formulation	What is the homeopathy patent scenario?
Study inclusion	International scenario concerning many countries
Data collection	Patent database that encompasses more than 90 countries → Espacenet Title keyword: Homeop* Period: Without time restriction, and from 2008 to 2018 inclusive.
Critical evaluation of studies	Exclusion of patent technologies that do not fit the article's purpose. Division of documents by categories (year, country of holders, type of depositor) Categorizing by technology and not by patents (avoid repeated counting), and by innovation groups Selection criteria: patents that describe new homeopathic formulations Limiting the choice of international patents: deposit via PCT and access to the document in English
Analysis and presentation of data	Graphs and tables
Interpretation of data	Discussion of results to understand the data obtained, and comparison with scenarios from other sources: for example, scientific articles
Review refinement and update	Search database every 10 years

Data Processing

After survey completion, the patents were organized to express the results by year, by the depositing country, and by the type of depositor (independent, company, or university). In addition, organization of patents was conducted according to the content described in the patent summary, where these were divided into groups of formulations, packaging, equipment, production process, and analysis method.

Detailed Description of Technologies

To describe the homeopathy-related technologies in an in-depth way, the selection criteria were: (1) patents categorized within a group of formulations; (2) technologies described in a Patent Cooperation Treaty (PCT) application; (3) availability of the complete documents in English.

Results

The first group of results concerns the comparison of patents and articles involving the keyword “homeop*”. This keyword was chosen because it comprised documents with homeopathy or homeopathic words in the singular or plural forms in the title of documents. ►Fig. 1 shows the number of patents and scientific articles found in the Espacenet and Web

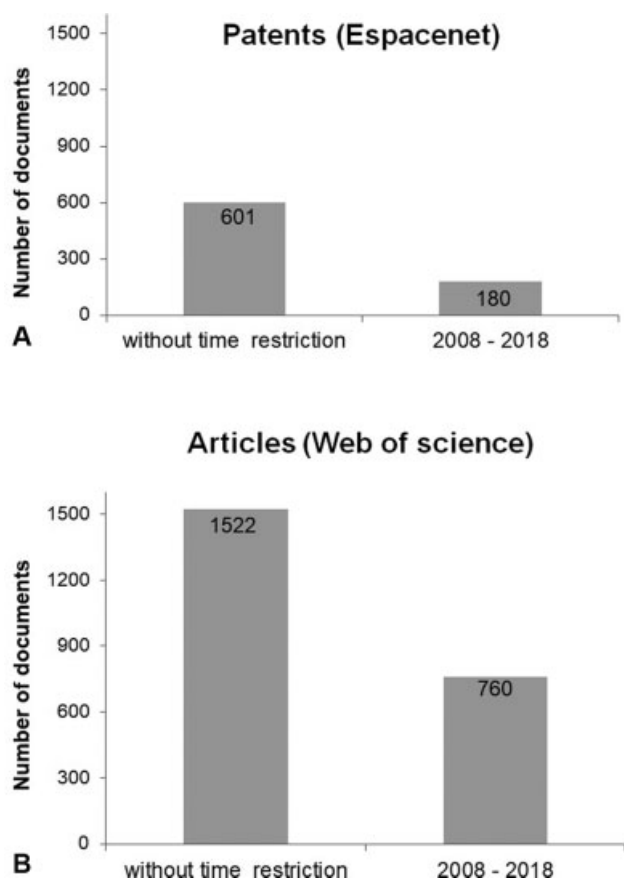


Fig. 1 Quantitative relationship of patents and articles concerning homeopathy. Data from a survey performed in *Espacenet* and *Web of Science* without time restriction, and in the period from 2008 to 2018, using the keyword homeop* in the title of documents.

of Science databases respectively. A search without date restriction revealed that innovations are 2.5 times more described in articles than in patents. Analyzing the results for the years 2008 to 2018, however, showed the comparative number of documents to be more discrepant, with scientific articles describing innovations being around four times more than the number of patents.

Continuing the approach of the present study, only the patents published from 2008 to 2018 were analyzed in depth. The patents that presented the prefix homeop* in the title, but did not reflect homeopathy-related technologies, were excluded (e.g., patents of homeoprotein). From the 180 patents found within the period of interest, 6 were excluded, resulting in 174 homeopathy-related patents (details in ►Supplementary Table S1 – available online only).

These patents were then organized and analyzed by the year of publication (►Fig. 2), nationality of applications (►Fig. 3), and types of holders (►Fig. 4). This form of data organization was chosen to observe the temporal profile of patents, as well as to map locations with economic potential in this topic area and to identify possible partners or market competitors for the homeopathy field.

As can be seen in ►Fig. 2, in the years 2008 to 2010 the number of documents was similar at 22 or 23 publications per year. As of 2011, the number of patents showed a small decline and then remained stable until 2014, with a subsequent small decline and stabilization until 2018.

Regarding the national origin of patent applicants (►Fig. 3), the most prominent countries are the United States with 55 patents, followed by Russia with 24, Germany with 15, France with 13, India with 12, Ukraine with 11, and Brazil and China each with six patents. The holders from other countries have one to four patents each.

Regarding the types of patent applicants, these can be divided into companies, universities, partnerships between companies and universities, and independent depositors (person instead of legal entity). As shown in ►Fig. 4, the most prominent depositors of homeopathic technologies were independent ones, representing 69% of patent holdings, followed by companies (23%), universities (7.5%), and partnerships between companies and universities (0.5%).

Later, the content of inventions of each patent was analyzed, and those with repeated technologies were grouped as families of patents (►Table 2). A patent family occurs when the inventor has chosen to protect its innovation in more than one country or region, generating more than one patent for the same invention. Thus, in order to avoid overestimation of the numbers in the next steps of the survey, each family was counted as only one innovation.

In reality, therefore, the 174 homeopathy-related patents represent 133 different innovations. They were then grouped according to the type of novelty. As seen in ►Fig. 5, 75.9% of the inventions refer to new formulations, 14.3% to new equipment, 3.8% to new packaging, 3.8% to new production processes, and 2.2% to analytical methods. It is important to emphasize that innovations about new treatment methods have been classified also as formulations.

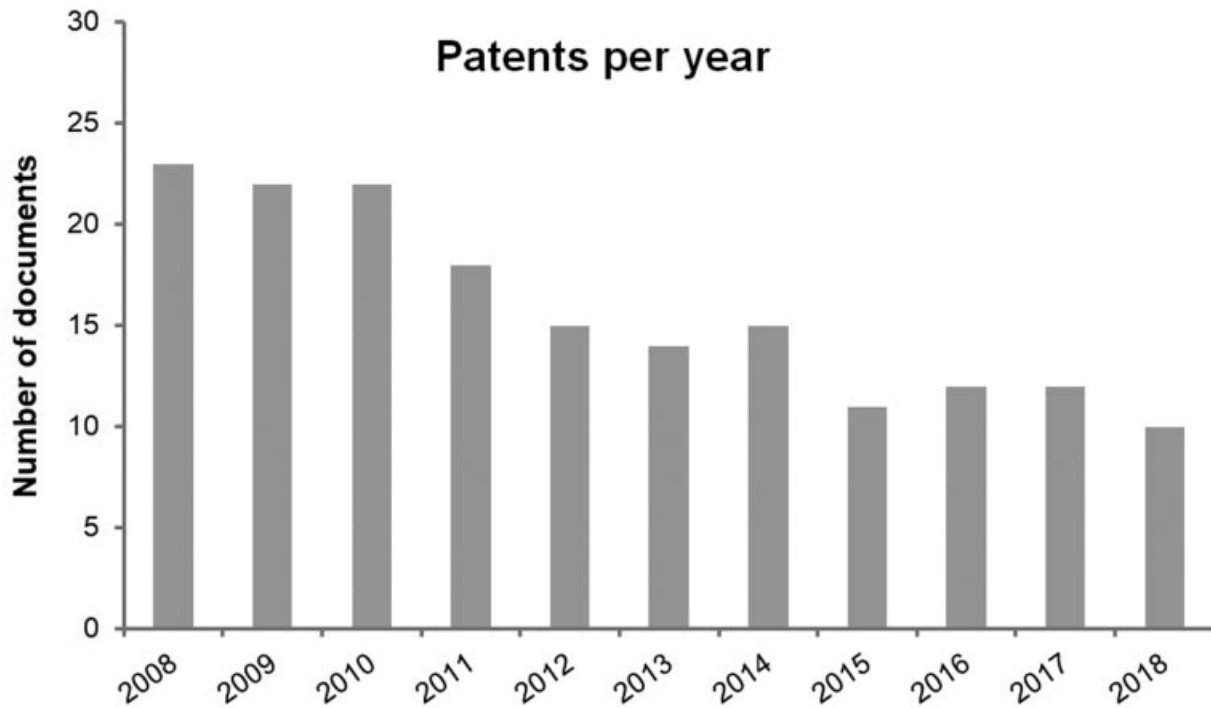


Fig. 2 Quantitative relationship of patents concerning homeopathy per year. Data from a survey in *Espacenet*, including the years 2008 to 2018, using the keyword homeop*.

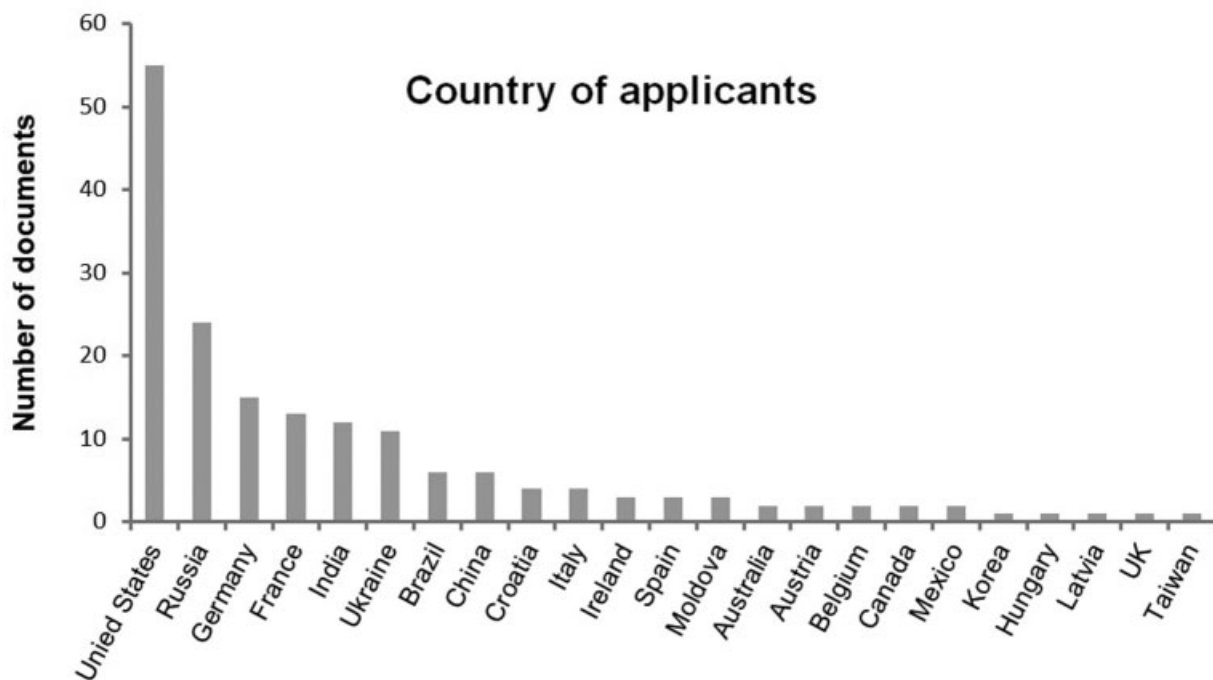


Fig. 3 Quantitative relationship of homeopathy-related patents by nationality of applicants. Data from a survey in *Espacenet*, including the years 2008 to 2018, using the keyword homeop*.

As a final step of this study, 12 innovations from the group of formulations were selected based on previously established criteria that included “patent with PCT filing” and “document written in English”. These patents are presented in more detail in ► **Table 3**.

Discussion

Publications of articles and patents are extremely relevant to measure the scientific and technological impact of specific topic areas. However, a similar number of publications from

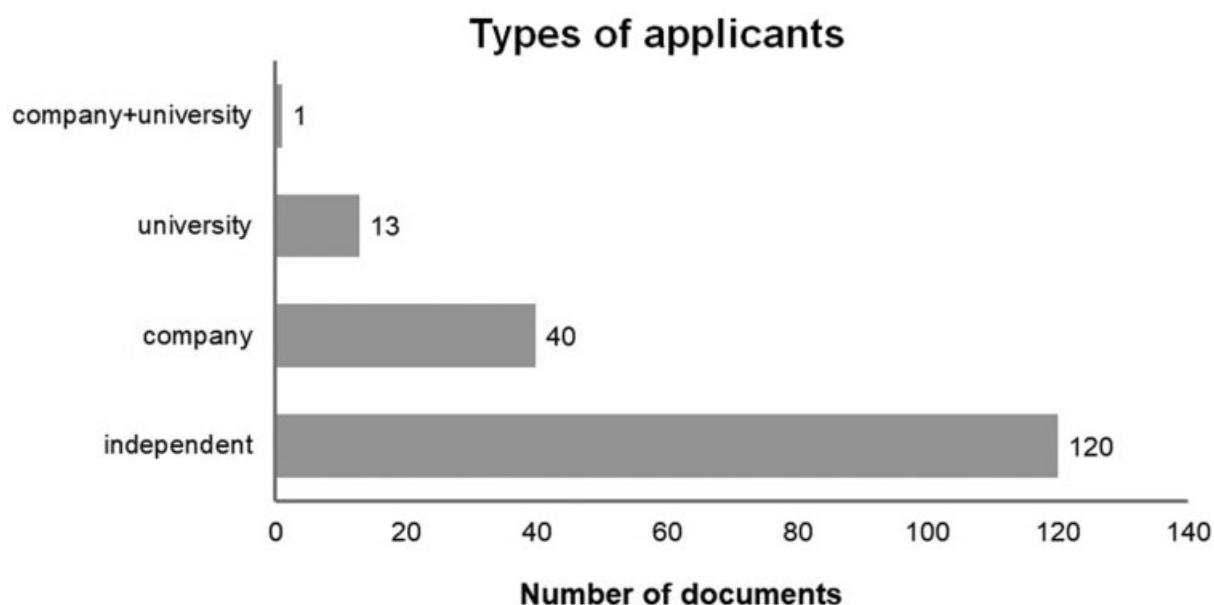


Fig. 4 Quantitative relationship of applicants of patents about homeopathy. Data from a survey in *Espacenet*, including the years 2008 to 2018, using the keyword homeop*.

Table 2 Patents found in the survey organized as families

Name of technology	Patents from the same family	Applicant	Origin of the applicant
Homeopathic agent for the prophylaxis of diseases caused by parasites	US2008095801 (A1) ZA200704884 (B)	Andrea Weineck	Germany
Homeopathy-based formulation	WO2008139487 (A1) US8163308 (B2)	Rajesh Shah	India
Homeopathic medicament useful for immunomodulation.	WO2008109972 (A1) EP2134368 (A4) US2010226863 (A1)	Roberto Piraino	Brazil
A homeopathic formulation	CA2722121 (A1) MX339704 (B) ZA201006909 (B) CN102014939 (A) SG190594 (A1) JP2014062106 (A) IL208902 (A) MY161415 (A)	Gunvant Oswal and Pooja Oswal	India
Homeopathic complex	IE86322 (B1) IES20100493 (A2)	Thomas Farrington and Daniel Farrington (independent)	Ireland
A homeopathic complex	IE20080829 (A1) US2010316737 (A1) US2016000917 (A1)	Thomas Farrington and Daniel Farrington	Ireland
Homeopathic remedies for use before and after aesthetic injectable and surgical procedures to minimize swelling and bruising	WO2009073612 (A3) US2010310654 (A1)	Andrew Jacono	United States
Homeopathic therapeutic method	CA2734502 (A1) MX2011002266 (A) AU2014202778 (A1) AU2016204207 (A1)	Nancy Josephine Polich	United States
Process to obtain a homeopathic medicament and use thereof	WO2011029170 (A1) US2012237553 (A1)	Felicio Lourival	Brazil

Table 2 (Continued)

Name of technology	Patents from the same family	Applicant	Origin of the applicant
Homeopathic composition comprising <i>Hypericum perforatum</i> extract and essential oils for the treatment of neuropathic pain	CA2743967 (A) US2012128787 (A1) US2015374773 (A1) US2018055903 (A1)	Origin Biomed INC	United States
Homeopathic medicament comprising phenacetin for the treatment of cancer	WO2011128245 (A1) US2013079416 (A1)	Boiron	France
Formulation based on sulphiride and a synergistic homeopathic composition for the treatment of depressive syndrome	WO2011148203 (A1) EP2575807 (A1) AU2014202778 (A1)	Maja Novak	Croatia
Homeopathic therapeutic method and compositions	CA2828883 (A1) AU2012223195 (A1) CN103930119 (A) US2015147381 (A1) CN107184980 (A) JP2018048195 (A) US2016228381 (A) US2016324910 (A) US2018280314 (A)	Nancy Josephine Polich	United States
Homeopathic compositions for treating back, sciatic, or lumbar pain	CA2839901 (A1) US2014134268 (A1)	Jean-Pierre Mageren	Belgium
Homeopathic procedure for the neutralization of damage from cigarette smoke and "neutralized" cigarette obtained therefrom	CA2942458 (A1) AU2015239726 (A1) US2017020187 (A1) PL3125704 (T3)	Claudio Colombo	Italy
Homeopathic agent allowing smokers to quit smoking	WO2016005563 (A1) CN106714815 (A)	Marianna Gross	Germany
Homeopathic topical gel for transdermal delivery of colchicine formulations and method of use	WO2016011104 (A1) US2017119707 (A1)	Gensco Labs LLC	United States
Homeopathic method for treating colic, gas, and upset stomach in infants	WO2016118243 (A1) EP3247372 (A1) CN107683141 (A)	Jacqueline Courtiol and Timothy Lawrence	United States

Note: Each family contains the patents that describe the same technology and were applied by the same person or company in more than one country.

Data were obtained from a survey on *Espacenet* with the keyword homeop*, publications in the years 2008 to 2018 inclusive.

each of these two methods of dissemination is desirable, because institutions generally seek an economic impact of innovations in the international market, and this is possible mainly through patents.

The results presented in ► **Fig. 1** show a discrepancy in the number of articles and patents concerning homeopathy. However, we suggest that this is not only related to the lack of intellectual protection from new homeopathy innovations. As reported by Şenel in 2019,¹¹ many published scientific articles on homeopathy are not about new inventions, but are related to findings about homeopathic therapy, including case reports, clinical trials, and reviews.

From the data obtained in a literature review study, whether of patents or articles, its researchers can observe the state of the art of the subject, and then propose new projects. A scientometric analysis of articles concerning

homeopathy was recently published;¹¹ however, a literature review about patents has not been performed until now.

The period of publication dates for eligibility of original articles for a systematic review is an important facet of its study design. For an analysis of patents, it is important to note that they have protection periods, generally being a maximum of 20 years from the filing date. For this reason, the most relevant patents identified in a mapping study are those with the most recent publication dates. Thus, a review of patents reveals which technologies cannot be exploited economically by third parties without authorization of their inventors. Considering this, the present study critically analyzed the patents published during the years 2008 to 2018, due to the fact that they will remain valid for several years more. This kind of time restriction, considering a recent decade of innovation, has also been a basis for patent reviews

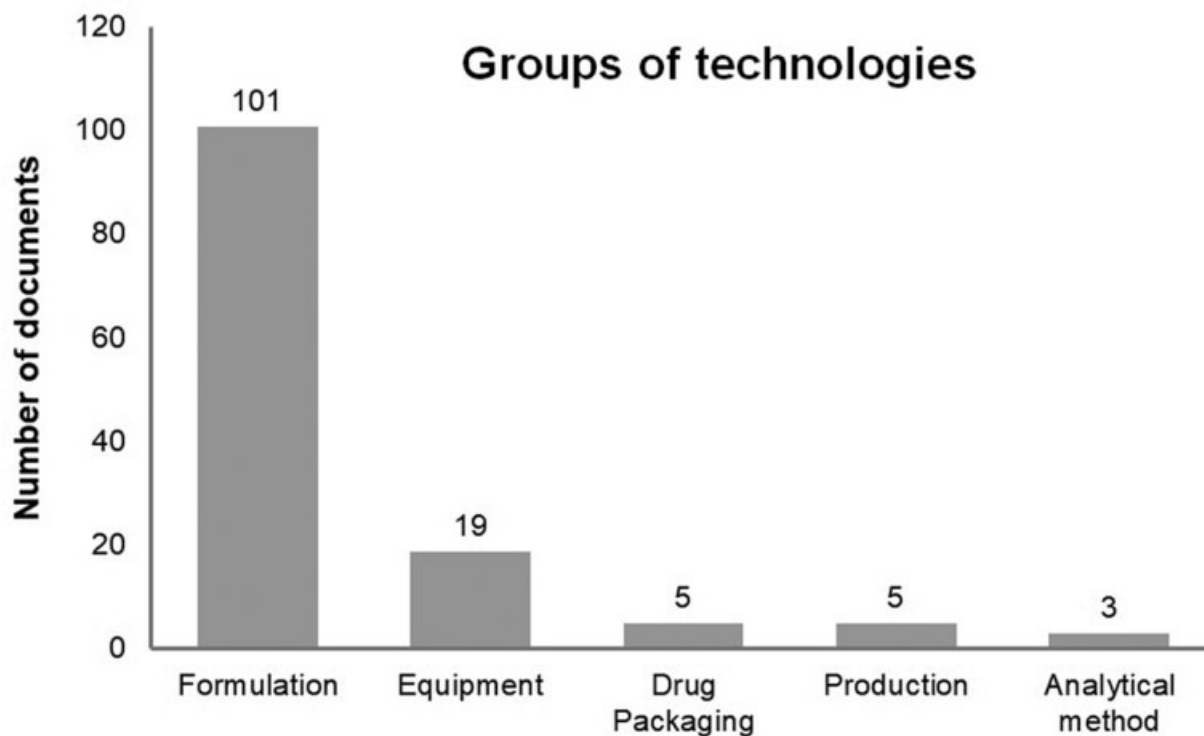


Fig. 5 Quantitative relationship of technologies by groups: formulation, equipment, drug packaging, production process, and analytical method (data including the years 2008 to 2018, with the keyword homeop* in *Espacenet*).

Table 3 Relationship of technologies published in *Espacenet* concerning new formulations of homeopathy

	Technology	Patent number	Applicant	Origin of the applicant	Description
1	A delivery system and method to deliver homeopathic complexes comprising homeopathic colored pigment products for cosmetic use	WO2008140872 (A1)	Henry Steven and Luria Elizabeth Joy Luria	United States	Topical-release cosmetic compositions containing at least two homeopathic active ingredients in different potencies and pigments forming a differentiated release system in the skin. It can be introduced in cosmetic formulations such as foundation, blush, eyeliner, lipstick, sunscreen, among others. Some examples of applications are for skin with hypersensitivity, psoriasis, and acne.
2	Homeopathy-based formulation	WO2008139487 (A1)	Rajesh Shah	Índia	Homeopathic formulation for allergic skin and other immune deficiencies. The composition uses a mixture of lichen planus tissue (biotherapeutic) and histamine in different potencies. It presents examples of clinical cases.
3	Homeopathic medicament useful for immunomodulation	WO2008109972 (A1)	Roberto Piraino	Brazil	Homeopathic formulation that helps the immune system, existing in different dosage forms. It is mainly directed at macrophages to produce TNF- α . Indicated for immunocompromised patients having cancer, AIDS, hepatitis C, rheumatoid arthritis, among others. Pre-clinical and clinical trials were carried out.
4	High volume and alternative methods of delivering homeopathic remedies	WO2008091265 (A1)	Floyd Taub and	United States	Modified-release pharmaceutical forms (e.g., micelles) containing the homeopathic medicine <i>Taurox SB</i> , to

Table 3 (Continued)

	Technology	Patent number	Applicant	Origin of the applicant	Description
			Char Tara Albert		reach lymphoid tissues associated with mucosa such as oropharynx, stomach, intestine, and thus have local action. It can be effective for ulcers, inflammatory diseases of the gastrointestinal tract. Reports some clinical cases.
5	Homeopathic remedies for use before and after aesthetic, injectable, and surgical procedures to minimize swelling and bruising	WO2009073612 (A3)	Andrew A. Jacono	United States	Homeopathic formulation to help reduce swelling and bruising from cosmetic or surgical procedures. Such formulation is formed by tablets containing <i>Arnica montana</i> dynamized in high potency and addition of bromelain, hyaluronic acid, glucosamine, vitamin C, and zinc.
6	Process to develop a homeopathic medicament and use thereof	WO2011029170 (A1)	Valsanic Enterprises LLC (company)	Brazil	Process to develop a biological response modifier, particularly a medicament obtained from highly diluted vegetable, mineral and animal extracts, aiming to make use of its medicinal characteristics, internally and externally, in treatment, prevention, control and elimination of diseases. Reports some pre-clinical studies.
7	Formulation based on sulphiride and a synergistic homeopathic composition for treatment of depressive syndrome	WO2011148203 (A1)	Maja Novak (independent)	Croatia	Formulation, with different dosage forms, for depression. The active ingredients are sulphiride and different homeopathic potencies (on a decimal scale) of components of the Krebs cycle and herbal extracts.
8	Homeopathic method for treating colic, gas and upset stomach in infants	WO2016118243 (A1)	Jacqueline Courtiol and Timothy Lawrence	United States	Complex homeopathic formulation formed primarily by <i>Passiflora incarnata</i> , <i>Nux moschata</i> and <i>Carbo vegetabilis</i> in different compositions and scales. Indicated for reducing cramps, gas, abdominal bloating, heartburn and discomfort in infants and newborns.
9	High potency homeopathic gel formulation	WO2018017813 (A1)	Nancy Josephine Polich	United States	Formulation containing a hydrophilic homeopathic aqueous active (HASA)-gel matrix nanostructure.
10	Method of using homeopathic kit containing gel, rinse, and spray for management of post-oral surgical recovery and maintenance of oral health	WO2017176464 (A1)	StellaLife Inc	United States	Gel, rinse and spray to maintain oral care as well as reducing inflammation, pain and bruising after oral surgery with a homeopathic recovery kit.
11	Homeopathic topical gel for transdermal delivery of colchicine formulations and method of use	WO2016011104 (A1)	Gensco Lab LLC	United States	Homeopathic gel formulation for transdermal distribution of colchicine. Indication for treatment of acute gout. The components of the formulation have already been published and previously known for the treatment of pain and inflammation, distributed by the Gensco laboratory. In addition to the well-known activity of colchicine, to attenuate gout attacks by blocking the formation of uric acid crystals.

Abbreviations: PCT, Patent Cooperation Treaty; TNF, tumor necrosis factor.

Note: Data were collected from 2008 to 2018, found using the keyword "homeop*", that presented a patent deposit via PCT and document written in English.

by authors in other topics.¹²⁻¹⁴ In the present study, 174 homeopathy-related patents were found for the period analyzed. In an original way, the patents were analyzed by nationality and type of applicants.

The World Intellectual Property Organization (WIPO) published a survey in 2017 considering different fields, and reported that the global ranking of the countries or regions that invest the most in patents comprises China, United States, Japan, South Korea, Europe, India, Russia, Canada, and Australia.¹⁵ Comparing the WIPO data with the results reported herein about the national origin of the applicants of homeopathy-related patents, it is notable that the main countries that protect their homeopathy technologies also are listed in the top 10 patent offices in the world. Furthermore, when comparing the data from the present study with those described by Şenel in 2019,¹¹ reporting the main countries that published articles on homeopathy, we may note that the five nations with the major scientific productivity (United Kingdom, United States, Germany, India, and Brazil) are also amongst the largest worldwide patent holders in this field.

Considering the types of patent applicants, we found that independent inventors are the most common in the homeopathy field. As França and Vasconcelos report,¹⁶ this category may be formed by researchers who are either autonomous or connected to a small institution or company. The choice to file patents as an independent inventor, and not as a legal entity, is generally based on the smallest filings and maintenance fees that are found in this kind of patent application.

The patent applicants most frequently found in the present review are Nancy Josephine Polich, Gunvant Oswal and Thomas Farrington, who hold 12, 7 and 5 patents respectively. A simple search on *Google* about the profile of these researchers was therefore carried out:

Nancy Josephine Polich is an American engineer, co-founder of Cearna Aesthetics and a university professor. Her research is based on studies about products to treat cutaneous traumas after aesthetic procedures.¹⁷ From the 12 patents published by her on homeopathy between 2008 and 2018, 7 are from the same family of patents (same technology), entitled *Homeopathic Therapeutic Method and Compositions*, which describes a composition comprising a homeopathic aqueous active substance (HASA) and at least one hydrophilic gelling agent. The HASA-gel matrix could be in the form of a sheet or fluid and is applied to the damaged tissue. Studies in humans with bruises were performed and reported in the patents.

Gunvant Oswal is an Indian doctor who has spent the past 40 years studying neurological disorders and other chronic conditions. Together with his daughter Pooja, Oswal developed the *G-Therapy*, which includes a mixture of homeopathic and ayurvedic medicines, essentially based on a substance extracted from plants.¹⁸ They are the applicants of 12 homeopathy-related patents published during the years 2008 to 2018. All of these patents are representative of the same technology, entitled *A Homeopathic Formulation*, where it describes a simple or compound dynamized drug,

with a potency ranging from tincture to all the decimal, centesimal, and fifty-millesimal scales up to 30 dH, 30 cH, and 1 LM, impregnated or not in inert globules, to treat different neurological disorders. The products have been tested in clinical studies.

Thomas Farrington is an Irish veterinarian qualified in homeopathy with 30 years of experience, co-founder of HomeoPet LLC, a company that produces homeopathic medicines for animals.¹⁹ All of his homeopathic patents published during 2008 to 2018 are representative of the same technology, entitled *A Homeopathic Complex*, which describes a product for human or veterinary use to treat infections or regeneration of injured tissues. The formulation has a simple or complex composition involving several active ingredients with at least one derivative of silica, mercury, snake venom, spider venom and/or sulfur, in the decimal, centesimal, and fifty-millesimal scales. The main route of administration is topical when in low potencies, and oral when in high potencies. The focus of use is mastitis, a common infection in dairy cows, but the products have been tested in both human and animal patients.

Concerning the companies that filed homeopathy-related patents, the one with the largest number of innovations is Boiron, holder of three patents. This company was founded in 1932 in Lyon, France, by the pharmaceutical brothers, Jean and Henri Boiron. It is recognized for being a world leader in homeopathic medicines and is responsible for distributing those medicines to more than 80 countries; it has approximately 4,000 employees worldwide.²⁰ The patent number WO2011128245 (A1) describes a homeopathic formulation composed of phenacetin (metabolite of paracetamol), in potency 4 cH, for the treatment of cancer (mainly melanoma, carcinoma, thyroid, breast, and prostate cancer). The patent FR2995534 (B1) describes a homeopathic composition for the treatment of neurodegenerative disease, composed of Gelsemium (plant) or its major constituent in different concentrations, with neuroprotective action, and more specifically for Parkinson's disease. The patent FR2961106 (A1) describes a homeopathic formulation from the medicinal plant *Ruta graveolens* (Arruda) with cytostatic activity, in dilution 9 cH. All documents present results of pre-clinical studies.

Among the main universities that hold patents on homeopathy, the most prominent is the National University of Pharmacy in Ukraine with nine patents, followed by one of the Federal Research Institutes from Russia with three patents. The patent found regarding the partnership between university and company was FR2995534(B1), developed jointly between Boiron and the University of Strasbourg from France.

Once each patent has a territorial characteristic of protection, when inventors want to protect their technologies in different regions it is necessary to perform the filing in each country and patent office of interest. As a result, all patents of the same invention are called a "patent family".²¹ This strategy is used when the applicant has the intention to explore its technology economically in more than one location, in anticipation of the innovation having a broad impact.

In the present study, repeated patents were organized in families to ensure that the next level of data organization was not overestimated. Thus, 18 families of patents were observed from the 174 homeopathy-related patents. A patent family does not necessarily occur when patents have merely the same name. For example, the technologies entitled “Homeopathic complex” and “A homeopathic complex” are classified as two different families in the present study; this is because, even though they are applied by the same inventors and have similar titles, their content is distinct. “Homeopathic complex” is represented by the patents IE86322(B1) and IES20100493(A2) and describes an invention to treat anxiety by a homeopathic complex and its use in the treatment of fear, phobias, anxiety, or anxiety-related symptoms or mental health disorders. Ideally, the anti-anxiety homeopathic complex comprises a homeopathic tincture—or dilutions thereof—of *Aconite*, *Avena sativa*, *Pasiflora incarnata*, *Scutellaria lateriflora*, *Stramonium*, *Valeriana*, and optionally *Phosphorus* and its associated salts or acids. On the other hand, the technology “A homeopathic complex” is represented by the patents IE20080829(A1), US2010316737(A1) and US2016000917(A1), and present an invention related to a homeopathic complex for the treatment of various diseases or disorders, including their use as anti-infective agents and/or in the regeneration of diseased or damaged tissue. Ideally, the anti-infective homeopathic complex of the invention comprises a homeopathic tincture—or dilutions thereof—of *Hepar sulphuris calcareum* or other similarly profiled *Calcarea* or sulfur salt or acid, *Lachesis muta* or other remedy with a similar profile, *Mercurius solubilis* or similar mercury-containing remedy, and *Silica* or other silica-containing compounds.

To better understand all homeopathic innovations found in the survey, the content of technologies was analyzed finally, based on the abstracts of patents, and the innovations were categorized in different groups. With this strategy, it was found that innovations related to new formulations, new equipment, new packaging forms, new processes of production and new analytical methods. As expected, the largest number of homeopathic innovations is related to new formulations, corresponding to 75.9% of the documents. Many of the patents, however, are written in languages such as Russian, Chinese and Korean, which are not familiar to the present authors: in order to read the documents in a complete form and to report the technologies therefore, our strategy of data selection was based on patents filed with a PCT form and written in English.

The criterion for choosing patents with PCT applications was based on the impact that this system presents in the international context of innovations. There are two ways to file a patent. One of them occurs when the inventor prefers to protect the patented technology directly and individually in each country of interest. But in some cases, the inventor has the intention of protecting the technology in many countries at same time and thus prefers to file with the PCT system to facilitate the process. The choice of deposit method to use is often based on a commercial strategy and balanced by cost considerations. Usually, a patent with PCT application

indicates that the holder has a strong intention to explore its technology commercially, highlighting the importance and relevance of the innovation.

As shown in ► **Table 3**, most of the patents filed via the PCT system that concern homeopathic formulations have innovations about new active substances, delivery systems, pharmaceutical forms for oral and topical use, and cosmetic products. Formulations destined for both humans and animals are found in the patents, and the main medicinal uses are related to repairing the immune system or promoting anti-inflammatory activity. Inventions involving homeopathic products were also identified for treatment of skin cancer, depression, and tobacco addiction. Most of the patents present pre-clinical and/or clinical studies, as well as clinical case reports.

As a final point to discuss, it is important to highlight some limitations of this study. The data are representative of a survey conducted on the Espacenet database with a systematic and specific method. Thus, the results are not representative of all worldwide patents. Searches performed with other databases (e.g., Derwent, USPTO), other time restrictions (e.g., 20 years), or other keywords (e.g., “high dilutions” or “serial dilutions”) would result in differently focused or additional data collection. Besides, even if Espacenet has the advantage of showing patents published in more than 90 patent offices, it has the disadvantage of not presenting the legal status for all documents (granted or pending). To explore these matters, other studies are needed.

Conclusions

Due to the wide importance of technological prospects to develop new projects and research opportunities, the present study was conducted to review patents referring to products and processes in the area of homeopathy. The results presented here relate to patents published in the years 2008 to 2018, providing a current international overview of the subject. The analysis used in the survey helps to visualize the state of the art, as well as the main countries and researchers investing in the homeopathy field.

The countries that most frequently protected homeopathy technologies in the period analyzed were the United States, Russia, Germany, France, Ukraine, China, Brazil and India. The most prominent applicants were those with the status of independent inventor; the applicants with the largest number of patents were from the United States, India, and Ireland. The innovations of homeopathy-based patents were linked to new formulations, drug packaging, production procedures, and analytical methods. The patent content about new formulations was mainly related to new compositions with more than one active constituent, which have been dynamized in different scales and potencies of dilution.

The numerical discrepancy we observed between the scientific and technological literatures on innovations may be related to the low industrial impact that homeopathic products possess, since most treatments are of a

personalized and individualized character, where the main locations for production of medicines are the compounding pharmacies.

It is important to emphasize that in order to maintain current awareness about technological innovations involving homeopathy, an updated survey and analysis of patents should be carried out every 10 years.

Supplementary File

Supplementary Table S1 Patents concerning homeopathy products and processes found in the *Espacenet* database.

Highlights

- A patents review about homeopathy was performed.
- Inventors from the United States and Russia are the major applicants of homeopathy-based patents.
- Independent persons are the most common kind of applicants of homeopathy-based patents.
- The largest number of homeopathy-based patents involves new formulations.

Conflict of Interest

None declared.

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