

Material study

The Use of Essential Oils and Terpenics/Terpenoids in Cosmetics and Perfumery

A study identifies the major uses of essential oils and terpenics/terpenoids through granted patents

Adailson da Silva-Santos^a, Adelaide Antunes, Luiz D'Avila, Humberto Bizzo, and Leila Souza-Santos

Throughout history, ancient civilizations (such as the Egyptians, Babylonians, Hebrews, Greeks, Romans and Chinese) used essential oils and their terpenics/terpenoids constituents as ointment or bathing for cosmetics purposes.^{1,2} This tradition survived, and today essential oils and their terpenics/terpenoids are still the most important natural products used by the cosmetic and perfumery industries.^{3,4}

Today, technological forecasting is extremely valuable for companies and governments because it allows them to foresee future situations and environments.⁵ Currently, cosmetic and perfumery companies are investing in bioprospective research to find new compounds to synthesize new lead products. Patents are the main mechanism used by companies to protect these investments.^{6,7} Due to a particular interpretation by the patent systems and legislatures, the combination of essences and chemical products for the elaboration of a fragrance or perfume are considered to be obvious — absent of inventive step (a pillar of the patent system). Thus, fragrances and perfumes are not protected through patents.

This work aims to show the relevance of elaborating a database consisting of patents through a study during the period 1980-2003 about the cosmetic and perfumery uses of essential oils and terpenics/ter-

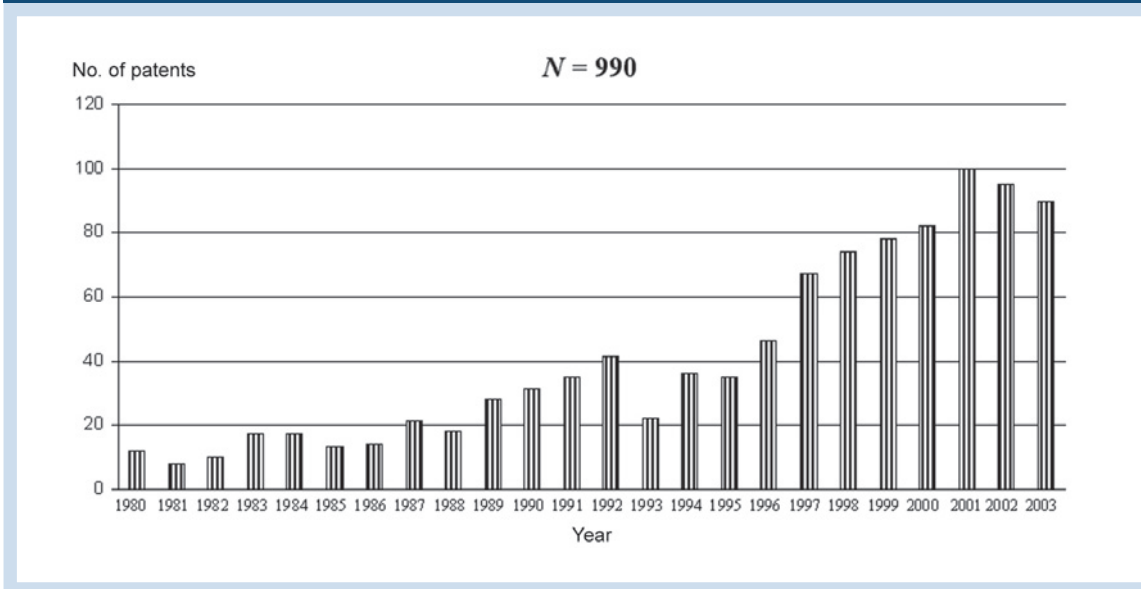
penoids compounds.^{8,9} Also, it is possible to identify technological areas, owners, inventors, varieties of essential oils, terpenics/terpenoids, etc.

Methodology

The database was made by the keyword [essential oil(s), terpenic(s) and terpenoid(s)] search mechanism in the fields of 'claims' and 'abstracts' of the United States Patent and Trademarks Office's (USPTO) granted patents documents. The technological knowledge for the use of essential oils and terpenics/terpenoids compounds in the cosmetic and perfumery sectors is indexed by the International Patent Classification (IPC) in subclass A61K (preparations for medical, dental, or toilet purposes), pertaining to section A (human necessities) of IPC, through group A61K 7/00 (cosmetic or similar preparations for personal hygiene).¹⁰ A methodology of analysis of the patent documents, combining bibliographical information in front page of patents with data described in the abstract and claims fields, was also established. This analysis enabled the identification of the following items:

- Historical series
- Essential oils
- Terpenics compounds
- Terpenoids compounds
- Nature and nationality of the owners of patents rights

^aAdailson da Silva Santos is updating his background in the post-graduate program at the Escola de Química/ Universidade Federal do Rio de Janeiro as D.Sc. student under orientation of Adelaide Maria de Souza Antunes (D.Sc.), and Humberto Ribeiro Bizzo (D.Sc.), researching the totality of industrial applications of essential oils besides the knowledge rolled in utility patents documents. This article belongs to this work.



- Identification of the main owners
- Application that destines the invention

Results and Discussion

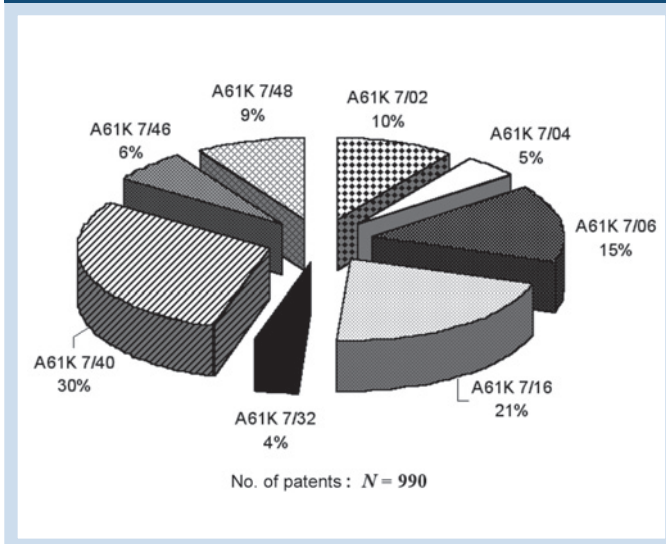
For the period of 1980-2003, 990 patents were found (F-1). F-2 details the distribution of patents across the eight most important subgroups from A61K 7/00:

- Make-up materials (and preparations for removing them) or body powders (A61K 7/02)
- Manicure or pedicure compositions (A61K 7/04)
- Preparations for care of the hair or to promote hair growth or to shaving (A61K 7/06)
- Preparations for cleaning the teeth or mouth (A61K 7/16)
- Antiperspirants or body deodorants (A61K 7/32)
- Barrier compositions or chemical agents brought into direct contact with the skin for affording protection against external influences (e.g. sunlight, X- or other active rays, corrosive materials, bacteria, insect stings) (A61K 7/40)
- Perfume compounds (A61K 7/46)
- Preparations for the care of the skin (A61K 7/48)

The study revealed that there is a predominance of essential oils and terpenics/terpenoids compounds applied as active ingredients for the products and processes patented in the areas of the cosmetics and perfumery. The application of essential oils and terpenics/terpenoids compounds in the cosmetic and perfumery sectors are detailed in F-3.

Essential oils and terpenics/terpenoids compounds: The information identified in the abstract and claims fields disclosed that amongst essential oils, 15 showed up in 94.71 percent of 1,034 registered bibliographical citations, including:

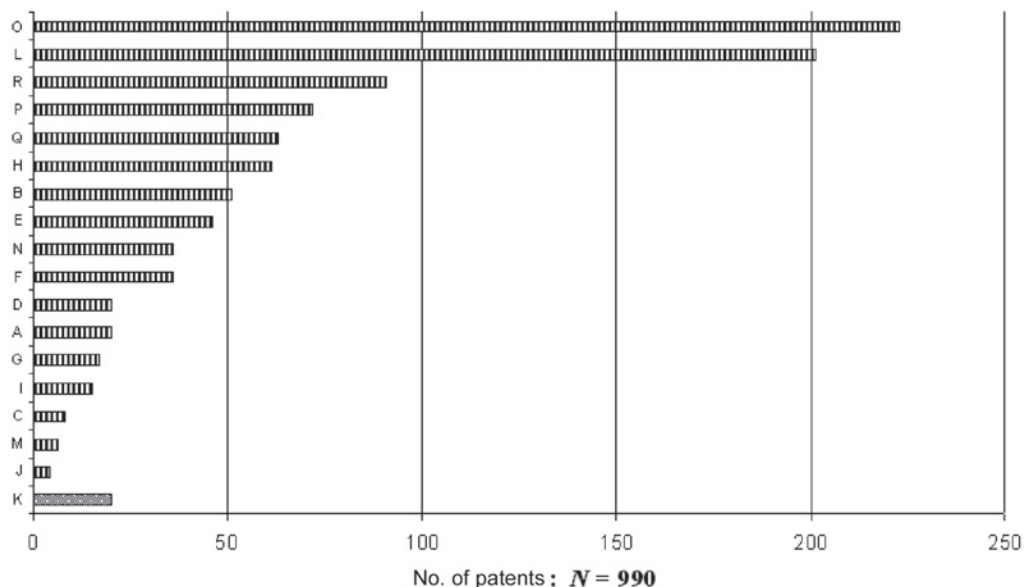
Subgroups from A61K 7/00 applied in USPTO granted patents for the use of essential oils, terpenics/terpenoids compounds in the cosmetic and perfumery sectors during 1980-2003



- Citrus essential oils (orange, lemon, grapefruit and bergamot), 269 citations
- Mints essential oils (peppermint and spearmint), 253 citations
- Essential oils used as condiments (sesame, clove, nutmeg), 191 citations
- Essential oils extracted from cedar, pine and eucalyptus, 127 citations
- Floral essential oils (rose and rosemary), 76 citations

Types of treatment described in the USPTO granted patents for the use of essential oils, terpenics/terpenoids compounds in the cosmetic and perfumery sectors during 1980-2003

F-3



A - to make-up or to embellish the skin of the face; B - to make-up or to embellish the lips; C - to make-up or to embellish the eyes; D - to make-up or to embellish the skin of others body parts; E - manicure or pedicure compositions; F - preparations for washing the hair; G - preparations for molding the hair; H - preparations for dyeing the hair; I - shaving preparations; J - depilatories; K - others (preparations for care of the hair or to promote hair growth etc.); L - preparations for cleaning the teeth or mouth; M - preparations for cleaning dentures; N - antiperspirants or body deodorants; O - topical sun or radiation screening or tanning preparations; P - barrier compositions; chemical agents brought into direct contact with the skin for affording protection against microorganisms or insect stings; Q - perfume compounds; R - preparations for the care of the skin

Most important essential oils by subgroups of A61K 7/00 group from IPC

T-1

Essential oils	Subgroups from A61K 7/00 – N = 1,034								%
	A61K 7/02	A61K 7/04	A61K 7/06	A61K 7/16	A61K 7/32	A61K 7/40	A61K 7/46	A61K 7/48	
sesame	1.55	0.39	2.42	0.58	0.48	1.84	0.00	2.03	9.28
orange	2.71	0.68	2.22	4.35	0.58	0.68	0.97	0.48	12.67
peppermint	0.10	0.10	1.55	12.67	0.00	0.19	0.29	0.39	15.28
lemon	0.00	0.00	1.55	5.22	0.00	0.97	0.97	0.48	9.19
pine	0.00	0.29	1.26	0.87	0.19	0.87	0.68	0.39	4.55
eucalyptus	0.10	0.00	0.19	3.58	0.87	0.29	0.68	0.39	6.09
spearmint	0.10	0.00	0.00	8.99	0.00	0.00	0.39	0.19	9.67
clove	0.19	0.00	0.00	6.96	0.19	0.39	0.39	0.29	8.41
rosemary	0.00	0.00	0.58	1.64	0.10	0.48	0.48	0.29	3.58
rose	0.48	0.10	0.97	0.58	0.29	0.58	0.48	0.29	3.77
grapefruit	0.10	0.00	0.00	1.74	0.29	0.39	0.10	0.29	2.90
bergamot	0.19	0.00	0.39	0.77	0.19	0.39	0.39	0.29	2.61
sassafras	0.00	0.00	1.06	1.93	0.00	0.10	0.10	0.10	3.29
cedar	0.00	0.00	0.87	0.10	0.10	0.29	0.19	0.10	1.64
nutmeg	0.00	0.00	0.29	1.26	0.00	0.10	0.10	0.00	1.74
									94.71

A61K 7/02 - make-up materials (and preparations for removing them) or body powders; A61K 7/04 - manicure or pedicure compositions; A61K 7/06 - preparations for care of the hair or to promote hair growth or to shaving; A61K 7/16 - preparations for cleaning the teeth or mouth; A61K 7/32 - anti-perspirants or body deodorants; A61K 7/40 - barrier compositions or chemical agents brought into direct contact with the skin for affording protection against external influences (e.g. sunlight, X- or other active rays, corrosive materials, bacteria, insect stings); A61K 7/46 - perfume compounds; and A61K 7/48 - preparations for the care of the skin

Terpenes and terpenoids compounds	Subgroups from A61K – N = 1,069								%
	A61K 7/02	A61K 7/04	A61K 7/06	A61K 7/16	A61K 7/32	A61K 7/40	A61K 7/46	A61K 7/48	
menthol	0.55	0.00	2.10	14.16	1.64	1.37	1.28	1.19	22.28
squalene	1.64	0.09	1.19	0.09	0.09	1.74	0.09	0.64	5.57
camphor	1.28	2.92	3.11	1.28	0.91	14.43	0.37	1.64	25.94
limonene	0.27	0.27	0.00	2.56	0.27	0.18	0.91	0.27	4.75
pinene	0.09	0.09	0.91	1.28	0.27	0.27	0.27	0.09	3.29
thymol	0.29	0.27	0.46	7.67	0.91	0.27	0.46	0.37	10.41
eucalyptol	0.09	0.00	0.18	6.76	0.73	0.09	0.18	0.09	8.13
retinol	0.18	0.00	0.55	0.00	0.00	1.28	0.00	0.91	2.92
geraniol	0.00	0.00	0.91	0.73	1.10	0.09	1.37	0.00	4.20
linalool	0.00	0.00	0.91	1.64	1.10	0.00	1.46	0.09	5.21
citral	0.00	0.00	0.09	1.19	0.37	0.00	0.37	0.09	2.10
menthane	0.00	0.00	0.09	0.27	0.46	0.37	0.09	0.00	1.28
carvone	0.00	0.00	0.00	1.37	0.18	0.00	0.27	0.00	<u>1.83</u>
									97.90

A61K 7/02 - make-up materials (and preparations for removing them) or body powders; A61K 7/04 - manicure or pedicure compositions; A61K 7/06 - preparations for care of the hair or to promote hair growth or to shaving; A61K 7/16 - preparations for cleaning the teeth or mouth; A61K 7/32 - antiperspirants or body deodorants; A61K 7/40 - barrier compositions or chemical agents brought into direct contact with the skin for affording protection against external influences (e.g. sunlight, X- or other active rays, corrosive materials, bacteria, insect stings); A61K 7/46 - perfume compounds; and A61K 7/48 - preparations for the care of the skin

Also found in the research was sassafras essential oil (34 citations), which is rich in safrol — a non-terpenic phenyl ether compound.

T-1 shows the distribution of the uses of these 15 main essential oils found in this search, amongst the eight main subgroups of the IPC listed in F-2. The last column in T-1 indicates the percentage of participation of each essential oil of the total of 1,034 joined citations. The last line designates the joint participation of 94.71 percent for these same essential oils.

Among the terpenics/terpenoids compounds (T-2), 13 accounted for 97.90 percent of 1,095 citations, like limonene (extracted from citrus essential oils), camphor (extracted from camphor essential oil), menthol (extracted from mints essential oils) and pinene (extracted from essential oils of the species pine or eucalyptus).

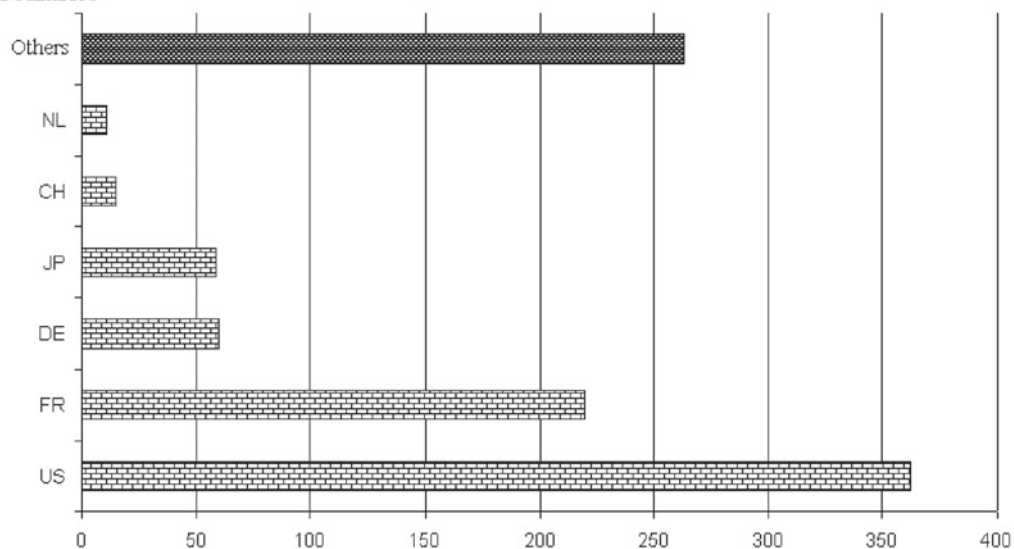
T-2 shows the distribution for the uses of these 13 main terpenics/terpenoids compounds, amongst the nine main subgroups of the IPC listed F-2. The last column in T-2 indicates the percentage of appearance of each compound of the total of 1,095 joined citations. The last line designates the joint participation of 97.90 percent for these same substances.

Patent owners: Among the owners of the 990 patents, 148 legal persons (companies, governmental agencies, universities and researches centers) accounted for 94.95 percent (940 documents), while 50 patents (5.05 percent) were individually owned

Geoeconomic distribution for the USPTO granted patents owners related with the use of essential oils, terpenics/terpenoids compounds in the cosmetic and perfumery sectors during 1980-2003

F-4

Countries



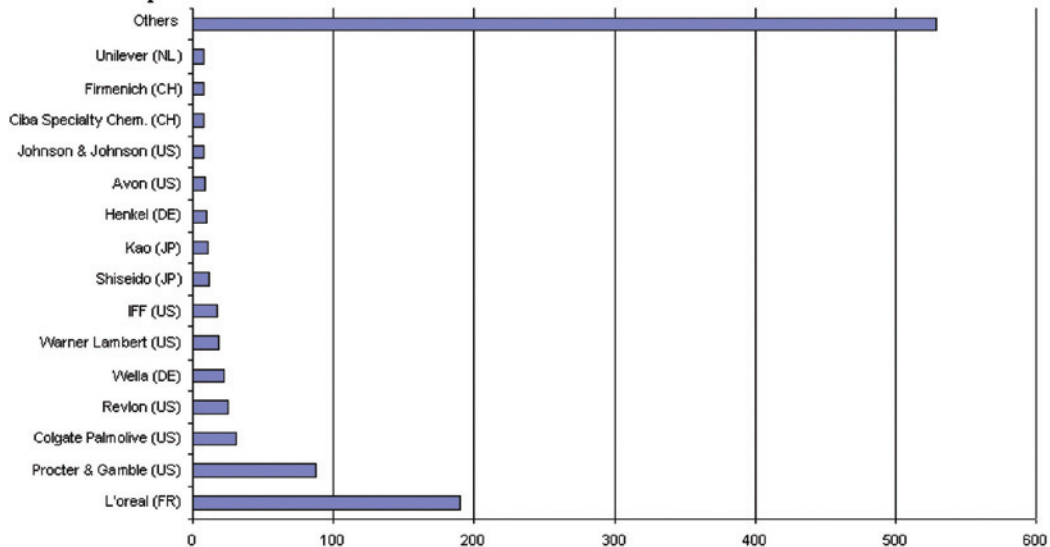
No. of patents : $N = 990$

CH - Switzerland; DE - Germany; FR - France; JP - Japan; NL - Netherlands; US - United States of America. 'Others' means Argentina, Australia, Austria, Belgium, Canada, China, Colombia, Cuba, Denmark, Great Britain, Greece, Hungary, India, Ireland, Israel, Italy, Mexico, Norway, Paraguay, Poland, Portugal, South Korea, Singapore, Spain, Sweden, Taiwan and Uruguay

Top 15 USPTO granted patents owners companies related with the use of essential oils, terpenics/terpenoids compounds in the cosmetic and perfumery sectors during 1980-2003

F-5

Companies



No. of patents : $N = 990$

CH - Switzerland; DE - Germany; FR - France; JP - Japan; NL - Netherlands; US - United States of America

patents (IOP). F-4 shows the geoeconomic distribution of the owners, specifying the United States (36.57 percent), France (22.22 percent), Germany (6.06 percent) and Japan (5.96 percent). Among 50 patents that belong to IOPs, 80 percent have a North American inventor as owner. Others inventors listed came from Canada, France, Germany, Italy, Japan and Spain.

For the majority of the companies listed in this research, 89.86 percent (or 133 companies) accounted for 53.43 percent (or 592 documents) of the 990 patents, showing a 1:3.98 ratio between the total number of companies and the total number of patents. F-5 shows the top 15 companies, with an average ratio of more than eight patents per firm.

Conclusions

This study identified 990 granted patents from the United States Patent and Trademarks Office related to the use of essential oils and terpenics/terpenoids compounds in the cosmetic and perfumery sectors during 1980-2003. The major uses were in the topical sun, teeth/mouth cleaning, skin care, anti-insect stings, perfume compounds and hair dyeing areas. Among the essential oils, three groups were the most cited: citrus, mints and condiments; among terpenics/terpenoids compounds: menthol and limonene.

Address correspondence to Adailson da Silva-Santos, Avenida 28 de Setembro, 210, Cobertura-01, Vila Isabel, Rio de Janeiro, Brazil, CEP: 20551-031; e-mail: adailson@inpi.gov.br or adsantos2005@yahoo.com.br.

References

1. C. Reinbothe, B. Diettrich and M.J. Luckner, *Plant Physiol.*, **137**, 224 (1990).
2. A.A. Craveiro and D.C. Queiroz, *Quim. Nova*, **16**(3), 224-228 (1993).
3. A. Silva-Santos, *Perfum. Flav.*, **29**(3), 38-43 (2004).
4. D. Joulain, *Perfum. Flav.*, **18**(5), 3 (1993).
5. D. Archibugi and J. Michie, *Cambridge J. Economics*, **18**, 121-140 (1995).
6. R.S. Lozano, *Economía Industrial*, **343**, 97-109 (2002).
7. V.M.R.H. Araújo, *Ci. Inf.*, **13**(1), 53-56 (1984).
8. Uspto - United States Patent and Trademarks Office. <http://www.uspto.gov>, 2002/2004.

9. R.M. Wilson, *World Patent Information*, **9**(1), 18-26 (1987).
10. WIPO - World Intellectual Property Organization. International Patent Classification. <http://www.wipo.int/classifications/en>, 2002/2004.

