



NIPO

PATENTING ON CLOVE

Meenakshi Prajneshu Deshbandhu College, University of Delhi, and V K Gupta National Institute of Science, Technology and Development Studies New Delhi

Clove is one of the valuable spices. The present study examines the

patenting activity in clove using data from different databases, namely, US patent database, PCT database, world - wide patent database of EPO, Japanese patent database, and the Indian patent database with INSDOC and Ekaswa A and Ekaswa B patent applications databases of TIFAC. In all, there were 594 patents relating to clove. The patenting activity was largely concentrated in USA, China and Japan. The national focus of R&D and the innovative activity was also examined. Each country has evolved its own niche. The overall thrust is to make use of the properties of clove or its extract as an ingredient in flavouring food and feed products, in medicine, dentifrices, surfactants and as an essence in cosmetics. The study highlights the important technological directions and gaps for further pursuing R&D in clove.

Spices and condiments have played a prominent part in the social and economic activity since a long time. India, along with several other developing countries, have rich spice resources and has been playing a key role in the spice trade. Zanzibar, Tanzania, Indonesia, Penang, Malagasy, Seychelles, Mauritius and Sri Lanka are the other main cultivators of clove. There is an increasing scope for value addition and innovations based on technological interventions in various aspects relating to clove cultivation, extraction, purification, and applications. Its importance has significantly increased in view of the recent developments in biotechnology. In order to be competitive, each of the spice rich nations needs to take appropriate R&D initiatives to keep itself in the forefront of the technological trends as well as derive requisite benefits by commercializing the

R&D results. An analysis of the patenting activity could provide an assessment of the latest technological developments.

Several scientific investigations have been undertaken to understand the characteristics, composition and properties of clove plant as well as dried flower buds of clove¹. The analysis of dried cloves indicates its chemical constituents covering moisture, protein, fat, fibre, carbohydrates, minerals (calcium, phosphorus, iron, iodine), vitamins (carotene, thiamine, riboflavin), nicotinic acid, tannin, and oleanolic acid. The more important constituents are aromatic compounds like eugenol, ester and aglycone. Clove bud oil contains free eugenol, eugenol acetate and caryophyllene as its main aromatic constituents.

The known applications of clove include its use as aromatic and flavouring agent, as a spice, in pickling, in variety of pharmaceutical compositions, as insecticidal, molluscicidal, nematocidal, antifungal, antibacterial, antiviral, analgesic, antithrombotic, in anaesthetization, in dentifrices, salivary stimulants, gargles and chewing gums, and deodorants. It has also found place in topical formulations for the treatment of diseases like AIDS, cancer, circulatory disorders, tuberculosis, gastronomic disorders, ulcers, and tumours. Clove has also been reported to be used in cosmetics like hair and body shampoos, mosquito repellent, liquid disinfectants, medicinal creams, special brand of cigarettes, chewing materials, as preservative and anti-oxidant, as clearing agent in histological work, and manufacture of organo-metallic soluble inks. The chief value of clove lies in its oil. The clove oil is highly aromatic and is extensively used for flavouring food products like meat, baked foods, confectionery, candies, sauces, fermented beverages, soaps and toilet waters, and in perfumery. Clove forms an important ingredient in many of the Ayurvedic drugs. For example, it has been used in the treatment of male infertility, anti-inflammatory, protecting arthritis, maintenance of blood glucose levels, stress reliever and relaxant.

The importance of the results of these scientific investigations became significant in view of the recent upsurge in the patenting of technological innovations based on the bioresources. There is no study to indicate the breadth and depth of these technological innovations on clove. The analysis of patenting activity is an important tool to provide the insight into the current trends in technological innovations and to facilitate business firms and R&D organizations in making right decisions about choice of research priorities. Researchers in the areas of natural products can make use of such analysis in identifying their research topics and focus upon more significant aspects of technological innovations in competition to the global efforts.

In particular, the scientists working in R&D institutions and industrial firms in India can draw necessary leads to identify emerging technological opportunities relating to clove and take initiatives to develop competitive products and processes.

In this paper, an attempt has been made to examine the trends in patents in the area of clove, indicate the focus of research of different countries active in R&D on clove and identify emerging technological opportunities for further innovations.

Data and Methodology

The data for the analysis of patenting activity in clove were obtained from different patent databases, namely, US Patent database², WIPO database on PCT applications³, and Europe's network of patent databases including Japanese patent database and the worldwide patent database.⁴ The search on the US patent database was made in the full text of all US patents issued since 1976 and the full-page images of all US patents since 1796 up to 31 March 2001 using the advanced Boolean search on the title or abstract using the following search query:

t1/clove

aromaticum or t1/eugenia aromatica or t1/Eugenia caryophyllata or t1/laung or t1/ mekhak or abst/clove or abst/ syzygium aromaticum or abst/ eugenia aromatica or abst/ eugenia caryophyllata or abst/ laung or abst/mekhak

The query resulted in a list of 34 patents. Of these, the patents that did not relate to clove were removed leading to a set of only 14 patents. The search query was further refined in the US patent database by searching in the patent claims as below:

aclm/clove or aclm/syzygium aromaticum or aclm/eugenia aromatica or aclm/ eugenia caryophyllata or aclm/laung or aclm/ mekhak

The search led to 196 patents. After removing the patents that did not relate to clove or those obtained in the earlier search a set of 161 patents was obtained. Thus, in all 175 patents were taken for analysis from the US patent database that were relating to technological innovations in clove.

A search in the PCT electronic database of World Intellectual Property Organization (WIPO) was made using the query clove in the title or the abstract. This gave a list of 8 international patent applications published under

the PCT of which one patent did not pertain to clove. The search in the worldwide patent database maintained by the European Patent Office gave 369 patent applications published worldwide in over 50 countries. Of these, after removing overlaps or such patents that did not relate to clove, a set of 272 patents was obtained. Similarly, the search in the title or abstract of the Japanese patent database resulted in 147 patent publications of which 138 were relevant for the study.

A search was also made in the Indian patent database of INSDOC wherein no patents were found with the keyword clove till 1998.⁵ The search in Ekaswa - B database of patent applications notified for opposition maintained by Technology Information Forecasting and Assessment Council (TIFAC), New Delhi, did not contain any patent application on clove. However, its Ekaswa - A database of patent applications filed since 1995 showed only two applications filed in India.⁶

Thus, in all, a total of 594 patents were taken for analysis that exclusively related to the patenting activity on clove.

The analysis of the patenting activity was made at two levels. First, the data were examined with respect to the trends in the growth of the patenting activity along with the identification of countries active in R&D and patenting on clove. Second, the patent data were examined by looking into the title, abstract or patent claims to ascertain the novelty and usefulness of technological innovations. The analysis was used to further indicate the emerging technological opportunities and trends to be used by R&D scientists working on clove.

The data of the date of filing were used to identify the date of priority of the patent and analysis of the growth of patenting activity in time according to the countries granting the patents. The data of the inventors country were used to ascertain the countries active in R&D.

Trends in patenting

The data for 586 patents were analysed, since the dates of filing for 8 patents were not available. The analysis of the data indicated that countries like USA, UK and Japan had been granting patents for inventions relating to clove prior to 1950s. In all 55 patents were granted by these countries till the end of 1979. During 1980s, in all 108 patents were published. During this period, in addition to USA, UK, and Japan, which covered 96 patents, the patenting activity was also initiated in Germany, France, Russia, Republic of Korea, and China; they

published only 12 patents. A sudden spurt in patenting activity was noticed during 1990s. In all 164 patents were published during 1990-94 and 257 during 1995-2000. Of the total 421 patents, 339, i.e. 85% patents were made in USA, Japan and China.

The data from the country of the inventors were analysed in order to ascertain the countries of the research groups active in R&D on clove. The researchers from China obtained 169 patents, Japan 157 patents, USA 131 patents, UK 44 patents, and Russia 31 patents. Researchers from Germany, France Switzerland, Italy, Netherlands, Austria, Spain, Republic of Korea, Hungary, Taiwan, and India obtained the remaining 93 patents. Indian inventors received only two patents.

Focus of Research

The R&D on clove has covered a wide range of innovative dimensions. In some cases, efforts have been made to consolidate the

traditional strengths and build upon ones traditional knowledge base while in some other cases, the effort has been to innovate and protect novel products and applications from the viewpoint of purely commercial interests. In the following section, an attempt has been made to examine the national focus of research.

USA

The primary focus of patenting activity in USA is on utilization of flavouring properties of clove in consumer products like confectionery, dentifrices, surfactants, and cosmetics. For example, in confectionery, several patents have been granted for products like flavoured chewing gum, food bar, and unique flavoured candy. In dentifrices, the patents have been granted for inventions relating to clove as antioxidizing agent, lozenges, gums, flavoured mouth rinse, in medicated tooth paste, and for removing tooth deposits. In surfactants, the inventions are on the usage of clove as a germicidal or antimicrobial substance used in hand wash or for disinfecting surfaces. The essential oil of clove is the main ingredient used for this purpose. In cosmetics, clove has been used as a volatile agent in body lotions, shampoo, liquid soaps and bathing products, in hair and scalp treatment, to prevent dandruff, in conditioning hair, and for hair growth, in perfumery, fragrance with anti microbial activity, as deodorant, and in foot-powder compositions to impart warmth to the skin. A patent has also been granted for encapsulated cosmetics.

The other important dimensions of the patenting activity are applications in food and medicine. In food, the inventions in clove relate to its use as food supplement in herbal formulation, as spice in health promoting refreshing tea, flavouring vinegar, as stabilizer of pigments in foodstuffs, an adsorbent, and as an odour masking agent for edible oil, and as seasoning liquid. The clove patents have also been related to inventions like smoke modifying agent in tobacco smoke filters, as preservative in herbal chew and in snuff compositions, and as ingredient in the raw material for cigarettes. A patent has been granted for hand exerciser and stress relieving device wherein clove has been used as an aromatic substance.

In medicine, the inventions in clove relate to use of clove powder for curing black foot disease, treating Alzheimer disease, oil for minor headache, treating peptic ulcers, preventing and treating stomach gastritis, as anti-viral, appetite suppressant, analgesic, anti-inflammatory, and in medicated skin patches as counter irritant. Patents also relate to inventions using clove as fungicide for soil-borne fungal diseases, insecticide, and insect repellent. Patents have also been obtained for inventions on use of clove as spice or as an ingredient in spice blends, fluidized oleoresin compositions, as solvent in novel dihydrochalcone sweetener composition, in manufacture of terpeneless essential oil from clove and for high temperature extraction of spices and herbs.

Japan

Japan has actively followed the innovative leads from the traditional knowledge to exploit the technological opportunities in developing novel products and processes from clove. A process for isolating a chemical substance, namely, 1-substituted-3-methoxy-4-oxybenzenes from clove oil was invented and a patent granted. The foremost patenting activity has concentrated on applications as drug and drug compositions. These include clove as an active ingredient for broad range of anti-viral drugs, in anti-ulcer drug, in anti-inflammatory preparations, in anti-carcinogenic agents, in anti-allergic substances, in drugs for treatment of pneumonia, in gastro-intestinal diseases, in pharmaceutical preparations having reduced cardiac toxicity, in making aroma sheets with medicinal as well as natural aroma for use in a variety of commercial articles in cars, rooms, lockers, etc. (aromatherapy), and in compositions for preventive action on arteriosclerotic diseases facilitating intake of highly unsaturated fatty acids without causing a fishy smell on long storage. In addition, the patents have also been granted for inventions using clove in drinks having diuretic activity, as anti-oxidizing agent in compositions effective in treating immune diseases particularly AIDS, as

cholagogue, i.e. liver tonic, as a stabilizer in pharmaceutical preparations, as oil soluble flavour in oral compositions (dentifrices), as an immunopotentiator against ultraviolet light-induced skin immunosuppressant, and as a oil solubilizer for chemicals used in cream-based ointments. One patent has been obtained for an extract that is purified under specific conditions so that the resultant is an active antibiotic substance specially useful for food and industrial materials. The extract is prepared by using crushed or finely cut clove flower bud and an organic solvent such as methanol, acetone, or ethyl acetate. Clove has also been used in medicines useful for dealing with infants short temperedness or cry at night or convulsions, etc.

Several patents have been granted for use of clove as an inhibitor, for example, inhibitor in filarial propagation or phosphatase inhibitor in seasoning and food. An important element of the patented innovations relate to use of clove as an anti-microbial cleaning agent, pesticide for plants, insect and animal repellent, moth-proofing agent for clothes, termite repellent, and as a bactericidal. Other unique and novel inventions include use of clove oil in a solvent to absorb an environmental pollutant such as organochlorine compound, preparation of an algicide showing excellent activity against very small algae such as *Microcystis aeruginosa*, *Nitzschia*, green algae or blue-green algae, clove oil as an ingredient of a product used to control plant disease injuries by filamentous fungi or bacteria in plant culture in agriculture or landscaping horticulture or golf fields, and as an organic solvent for an organo- group metal to prepare a metal sol ink.

There are a wide-range of patents for cosmetic related inventions. For example, as a ceramide production- accelerating agent (moisturizer) in human body, skin aging alleviator, oil component in bathing products, perfume in aroma compositions and deodorants, perfumed fine powders, cigarette ingredient, fragrant tissue paper preparations, anti-androgenic agent, for treatment of acne, eliminating dandruff, hair growth inhibitor, and also as an ingredient in hair growing agent. In food and feed, the inventions have covered applications of clove as a spice for human as well as livestock, as liquid sterilizer for spices, spice ice cream, as a preservative in sauce and seasonings, as a food additive to mask smell, for making fragrant tea, and for obtaining delicious health vinegar.

China

The Chinese have expeditiously responded to the changing IPR regime in protecting their traditional knowledge in medicinal herbs. Chinese have used clove as an important medicinal herb. They have obtained patents mostly in

China itself on the salient aspects of the wide range of traditional applications based on clove. In particular, the inventions have

related to use of clove in Chinese medicinal preparations for curing gynecologic inflammation, and for treating hepatitis B, nasal polyp, frostbite ointment, oil solutions for treating angina pectoris Chinese transdermal technology based on treating internal disease through external treatment ointment for treating rheumatic arthritis, bone- knitting powder medicine with no side effects and a quick analgesic, promoting blood circulation, and removing blood stasis and in skeleton growth, medicine for curing enteritis and intestinal chilliness, medical health care whip for curing spondylitis and pain in the lumber spine, as additive in food to remove dizziness while traveling, sachet medicine for a variety of health functions, medicated magnet therapeutic health care shoe pad, herbal bag for infantile diarrhoea, and malnutrition, liniment for curing rheumatoid arthritis and nephritis, oral liquid for treatment of esophagus disease, medicinal jacket for lungs, and for prevention of venereal infection. Patents have also been taken for health care tea for detoxication and cold tea for replenishing the water content and electrolyte of human body. Various types of plasters used in traditional Chinese medicament have also been patented, for example, asthma curing plaster, navel plaster for treating stomach diseases, etc. Clove has found many applications in cosmetics. Chinese have taken patents on clove for blackening of hair, hair removing substances, shampoo, preparation of soap, acne creams, skin refreshing cream, as

moisturizer, face cleanser, and atomizer. Other significant patents on clove have been its applications as stabilizer in hardening substances for affected tissues of the digestive system, as colour retaining agent for clothes, as a spice in ketchups and food materials, as condiment, liquid seasoning, preservative, as therapeutic component in liquor, as low cost non-toxic fungicide, bactericidal to eliminate body smell, multi-purpose insecticidal spray, cockroach repellent, intensifier in synthetic detergent, and health care cigarette with no tar and nicotine.

Europe

In Europe, researchers have taken the patents from UK, Germany, France, Switzerland, Italy, Netherlands, Austria, Spain, and Hungary. United Kingdom granted patents in early 40s and 50s relating to use of clove in dentifrices, in perfumes and as essential oil. In recent times, the thrust of R&D has been on use of cloves in antimicrobial compositions with applications in surface cleaning and detergent powders, as ingredient in perfumery compositions and

flavourants. Clove oil can be used as a composition to maintain levels of polyunsaturated fatty acids (PUFAs). The main orientation of patents from Germany is in use of clove for medicinal purposes. The inventions relate to treatment of benign prostate hyperplasia, antacid preparations, in aromatherapy, mouth rinse and pharmaceutically active substances, which have proved an effective therapeutic against the immunodeficiency disease (AIDS). On regular administration of low doses for several months it may lead to complete clinical recovery from AIDS. Other uses in compositions as arthropod repellent, for processing organic specimens (clearing agents in histological works), bath oil preparations, and process for the preparation of clove spice extracts have been patented.

Researchers from Switzerland have been involved in patenting use of clove as an antioxidant substance, in fat-compositions comprising herbs as spice for flavouring nuts and seeds, in liquid moth repellants, and in the manufacture of plant-based redox catalyst. The main focus in France is on inventions in the domain of cosmetics. For example, the patents have been taken for use of clove in hair removal paste, composition for stiffening and darkening hair, shampoo, toothpaste, inhaler as essential oil, cockroach repellent, and for making artificial cigarettes. Other countries from Europe, namely, Netherlands, Spain, Italy, Austria, and Hungary have taken only one or two patents each and relate to use of clove in toothache, surface cleaner, perfume, and in drugs which might be taken to gradually remove the desire to smoke.

Russia

The focus of R&D in Russia covers mainly application of clove as an active ingredient in foodstuff and beverages. Patents have been granted for inventions like retaining the characteristic hot flavour and

aroma in mustard, production of alcoholic beverages with aromatic taste and curative ingredients, adding original citrus-clove aroma to vodka resulting in improved quality, decreased cost, and consumption of nondeficient plant raw material. Clove has been used as a disinfectant in a composition to contain the fungal and bacterial diseases in the damaged honeycomb-frames. Novel inventions resulted in patents using clove as curative ingredient in multicomponent ointment as antibacterial, analgesic and as osmotic effect. A patent was granted for invention relating to cosmetic composition for stiffening and darkening hair.

Republic of Korea

The research in Republic of Korea mainly focuses on the use of clove in medicinal compositions for applications in gastric diseases, acne, face cleanser, hair regeneration and treating dandruff. Research has also been conducted to use clove in food related products as seasoning material and as preservative. An important invention was to prepare an extract from the bark, dried flowers and stems of clove.

India

India has very limited patenting activity on clove. Its inventors have obtained only two patents in USA, which relate to pharmaceutical dental formulation of therapeutical effect and general health promoting herbal composition, respectively. Another inventor has filed an

application in India, which relate to use of clove as an ingredient in composite spice formulation to make digestive and palatable cooked food. One foreign company has also filed a patent in India for use of clove in perfumery.

Technological Opportunities

The national focus of R&D and the innovative activity pertaining to clove indicate that each country has established its own niche. In case of USA, it is oriented more towards consumer products in food and medicine. In Japan, the innovations have mainly ranged in the fields of drugs, cosmetics, pesticides, food and feed additives. The thrust of R&D in Europe has been on use of cloves in antimicrobial compositions with applications in surface cleaning and detergent powders, as ingredient in perfumery compositions and flavourants. China has a large number of patents using clove as a medicinal herb, which is an indication of its concern to protect its traditional knowledge. Russia covers mainly application of clove as an active ingredient in foodstuff and beverages. The research in the Republic of Korea is mainly towards use of clove in medicinal compositions. There is no particular focus in India. The individual inventors have patents for pharmaceutical dental formulation and health related applications.

The analysis of patenting activity also reflects that there are ample technological opportunities based on R&D on clove. The overall thrust of the technological applications is to make use of the properties of clove or its extract as an ingredient. The unique characteristics that has been exploited commercially relate to its use in flavouring food and feed products, in medicine, dentifrices, surfactants and as an essence in cosmetics. The other significant developments relate to novel developments and applications in products for

repelling insects, cockroaches, animals and birds, moth, ingredient as raw material in cigarettes to reduce smoking, as an adsorbent of edible oil, in maintaining PUFA levels, manufacture of plant based redox catalyst and in tackling several important diseases like AIDS, hepatitis B, and benign prostrate hyperplasia.

Although the scientific investigations indicated the use of clove in many directions for which

patents have also been taken, still there are some gaps where no patents have been filed. For example, the use of clove in diabetes or tuberculosis, as mulluscicidal, and nematicidal. There are two new and unique technological applications for which patents have emerged, namely, use of clove as algicide and as an anti- pollutant pointing out opportunities to further R&D in these directions.

Conclusions

India has rich spice resources. The patenting activity indicates a spurt in R&D activity by other countries to exploit these vast traditional bioresources for commercial gain leading to innovative products, processes and applications. The analysis of patenting activity on clove explicitly brings out the emerging technological directions covering a wide range of its applications. It is observed that

countries like USA or Japan have followed their respective niches in R&D from the viewpoint of commercial and industrial interests. However, the resource rich countries like India have not made any impact in this direction. In comparison, China has protected most of its traditional knowledge by granting patents although it raises the basic question of the criteria of patentability as all the traditional knowledge for which patents have been given in China may not stand the scrutiny in terms of novelty.

The scientific community and the science policy makers in India need to draw lessons from these developments and take practical measures to establish a niche for themselves. The study highlights the important technological directions and gaps for further pursuing R&D on clove.

References

- . 1 Wealth of India CD ROM Database, National Institute of Science Communication, New Delhi, 2000

- . 2 US Patent database, United States Patent and Trademark Office, Washington D.C. (www.uspto.gov)

- . 3 PCT patent database, WIPO, Geneva (<http://pctgazette.wipo.int>)

- . 4 Europes network of patent databases: (i) Worldwide documents, and (ii) Japan, European Patent Office, Munich (<http://ep.espacenet.com>)

- . 5 CD-ROM database on Indian patents up to 1998 , INSDOC, New Delhi

- . 6 Ekaswa A & Ekaswa B database, Patent Facilitating Centre, TIFAC, New Delhi (www.indianpatents.org)