



Review Article

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Indian Ayurveda vis-a-vis Global Herbal Research

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ABSTRACT

Ayurvedic practice and medicine have been on the upswing since early fifties in India often going parallel with allopathic treatment and healthcare due to promotional policies of the Government. There also is the significant popularity of Ayurveda and other herbal medicine outside India as alternative medicine. This study attempts to review the growth of Ayurveda in India and abroad in its historical perspective and seeks to carry out a comparative assessment of the thrust and priorities of various countries through their patent data on herbal research. It also reviews recent spurt in the globalisation of Ayurveda in different dimensions and growing interest of international institutions in its adoption and integration with mainstream medical practice and education. Finally taking an overview of related patent data and global research efforts on plant-based therapeutics, some vital recommendations are made that can lead India to emerge as an innovation hub for most potent drugs based on its ancient heritage and knowledgebase. A massive multi-institutional research effort with a significant amount of collaboration with other countries is recommended to stay ahead in global competition in this field.

Keywords: Ayurveda, Ayurvedic Medicine, Alternate Medicine, Herbal Medicine, Plant-Based Medicine, Patents, Clinical Research.

INTRODUCTION

Ayurveda, a heritage of India that originated in India more than 5000 years ago is currently receiving worldwide attention and acceptance largely as an alternative medicine. The products and therapies of alternative and herbal medicine are growing in demand due to their inherent safety and preventive value. The practice of Ayurveda coupled with yoga is receiving global attention due to its holistic approach to wellness. Lately, ayurvedic medicines being derived from natural plants, herbs etc., have brought research in herbal medicine to sharper focus with the techniques of modern science^[1,2].

This paper presents an overview of India's efforts on various policy fronts to revive and boost Ayurveda in the country and elsewhere. Alongside, it also presents the progress being made by other countries in herbal research. It is shown that there are numerous challenges for India and its industry, regulatory authorities and research institutions to overcome problems of quality, efficacy, safety and standardization of the known marketable products and to discover new leads to successfully compete in international market.

Historical Perspectives of Ayurveda

The Schedule I of Government of India's Act enlists 54 authoritative treatises of Ancient Ayurveda including Charak Samhita and Sushruta Samhita and several others in Siddha and Unani system^[3]. Moving from oral instructions under the master-disciple (Guru-Shishya) system in pre-historic times, Ayurveda got institutionalized in the 7th century with the establishment of Department of Ayurveda at the ancient Takshashila University^[4]. Soon thereafter, Nalanda University and Banaras also became prominent centres of learning of Ayurveda in the Indian sub-continent which attracted students from far and wide. Originating in India more than 5000 years ago, it is one of the oldest surviving complete medical systems in the world with extensive knowledge base having been described in Vedas (divine books of knowledge). To these, a few other treatises such as 'Charak Samhita' and 'Sushruta Samhita' dealing with internal medicine and surgery were added which are regarded as the original texts of Ayurveda^[4]. The popularity of Ayurveda attracted traditional healers from other communities of the sub-continent and as a result, Ayurvedic treatises were translated into Persian, Arabic, Tibetan and Chinese^[5].

Ayurveda consists of well documented Indian versions of eight disciplines: general medicine (kaya chikitsa), paediatrics (balchikitsa), psychiatry (bhutvidya), ears-nose-throat and ophthalmic specialties (urdhvangchikitsa), surgery (shalyatantra), toxicology (agadatantra), geriatrics (rasavana), and sex studies (vakikarana). In addition, it also includes extensive knowledge of veterinary medicine^[6]. All these original documents are obviously in Sanskrit, a language which is no longer in common use now other than in

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religious activities or scholarly studies. Today, English is the medium of teaching in almost all Ayurvedic colleges in India.

Rhyner in his book, 'Ayurveda: The Gentle Health System' besides describing various disciplines as outlined above and the basic concepts such as tridosha, and of specific therapeutic methods, such as panchakarma also gives a legendary account of its antiquity mentioning how the knowledge of Ayurveda was passed on to sage Atreya from gods (divinity) to save human beings from various illnesses^[6]. Atreya passed on the learnings to his disciples, Agnivesha, Bhela, Jatukarna, Parasara, Ksirapani, and Harita who all supplemented further to the original body of knowledge.

Status of Ayurveda during British India

Among the European settlers coming to India, Portuguese and Dutch relied on the thriving Ayurvedic healthcare system for their healthcare needs. Both Portuguese and Dutch governments in India had a favourable attitude towards Indian medicine which paved the way for introducing Indian botanical and medical knowledge to European medical schools. Thus, the works by Garcia da Orta (1568), Christoval Acosta (1578) and the 12 volume Hortus Malabarius (1678-1693) compiled by Adriaen van Rheede on Indian botanicals, became reference books for tropical botany and medicine for a hundred years or more^[5].

Similar was the case with British in their early days, when they found native physicians more resourceful than the newly arrived British doctors in dealing with tropical diseases. However, as the British established their foothold firmly in India, the European medical system began to play a dominant role marginalizing the Indian system to secondary status by the middle of 19th century.

Early efforts of Revival of Ayurveda as Native Medical Therapy

With the establishment of 'Indian Medical Service' based on European medical system, it became a preferred career option for the elite class of Hindus, Muslims and Christians among the Indians. Thus, Ayurveda was relegated to secondary status during the British period, but many knowledgeable and spirited scholars of Ayurveda kept their struggle alive for seeking due recognition to education and research in Ayurveda. While biographies of all such great scholars are beyond the scope of this paper, a brief mention of a few may be made such as those of Kanny Lall Dey (1831-1899) who was also later bestowed with title of 'Rai Bahadur', Kaviraj Gangadhar Roy and his junior contemporary, Ganga Prasad Sen who played significant roles to keep alive the practice of Ayurveda during their lifetime^[7, 8]. Despite indifference and lack of patronage by the Government, Ayurveda survived due to individual efforts who made recommendations that resulted in positive action by the Government. In 1827, classes in Ayurvedic medicine began at the Government Sanskrit College, Calcutta. The government of Madras started a school of Indian medicine with 80 bedded hospital in the year 1925 with facilities for clinical training. A five year degree course in Ayurvedic medicine and surgery was offered at Banaras Hindu University from 1927. Several states also started colleges to render training in Ayurveda during the pre-independence period^[4,9].

Promotion to Ayurveda in Independent India & Current Status

Planned Development of Ayurveda

Beginning the second five year plan (1956-1961) in independent India, the Central Council of Ayurvedic Research came into existence under the Ministry of Health of the Government of India whose Panel on Ayurveda advocated among other things for i) establishment of Central Council of Indian Medicine to regulate Ayurvedic education, ii) establishment of statutory Councils and Boards in all the states, iii)

iv) compilation of pharmacopoeia of Ayurvedic medicines, v) establishment of gardens of medicinal plants in various states and v) carrying out surveys of medicinal drugs already in common use for their wider application. Thus, Government support became quite visible in the sixties for Ayurvedic medicine and education^[10].

The Central Institute of Research in Indigenous Systems of Medicine (CIRISM), Jamnagar in Gujarat was established in 1954 by the Government which was merged with a few other institutions in 1967 to form world renowned 'Gujarat Ayurved University'. A postgraduate programme in Ayurveda began at Banaras Hindu University since 1963.

Subsequently, the adoption of 'National Health Policy' during the seventh plan (1985-90), with 'health for all' by 2000 as a major developmental goal brought Ayurveda into much sharper focus. It was estimated that there were at that time as many as 525 thousand institutionally trained practitioners, more than 5000 pharmaceutical units and about 200 colleges of various Indian systems of medicine in the country that was not only close by geographical proximity but also culturally well assimilated with the target communities.

Establishment of AYUSH

Despite a visible growth of Ayurvedic systems, these health programmes were seen to suffer due to poor inter-sectoral coordination and lack of standardization of Ayurvedic education and medicine. A separate Department for Indian System of Medicine & Homeopathy was therefore set up under the Ministry of Health in 1995. It was later renamed as AYUSH (Department of Ayurvedic, Unani, Siddha and Homeopathy) that continues to bring the practitioners of Ayurveda into the mainstream of modern system of medicine along with promoting Ayurvedic treatments and medical tourism involving treatments like panchakarma.

Today, the Central Council for Research in Ayurvedic Sciences (CCRAS) is a prominent autonomous apex body of Ministry of AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy) for the formulation, coordination, development and promotion of research on scientific lines in Ayurveda and other Indian systems of medicine^[11]. It has a network of about thirty institutes located in different parts of the country, each specializing in specific branches of Ayurvedic research^[12].

Efforts to Integrate Ayurveda with Modern Medicine

One of the charters of CCRAS happens to integrate Ayurvedic medicines and treatment with modern medical practice. Since the IX plan period (1997-2002), the focus of CCRAS has been on developing new drug formulations based on Ayurvedic principles and knowledge as well as developing formulations that have traditionally been used in the Indian system for treatment of illnesses for which there is no effective remedy in modern system of medicine duly validated with detailed tests for safety and efficacy followed by necessary clinical trials wherever required. There also is a due focus on patenting the new formulations as well as keeping a watch on patents being filed in India and other parts of the world with respect to Ayurveda^[13].

Focus on Medicinal Plants

On the medicinal plants front^[14], a National Medicinal Plants Board has already been established and is responsible for coordination of all matters relating to medicinal plants, including drawing up policies and strategies for conservation, proper harvesting, cost-effective cultivation, research and development, processing, marketing of raw material in order to protect, sustain and develop this sector^[15]. The board also maintains a database of medicinal plants found in India on its website^[16].

Under the ongoing 'National Mission on Medicinal Plants' being implemented by National Medicinal Plants Board, support for the cultivation of prioritized medicinal plants in identified clusters through farmers/growers in more than 18 states. The Board has also identified 32 species for priority cultivation such as Amla, Ashwagandha, Brahmi etc. This ongoing programme is likely to result in the production of 2,50,000 tonne of additional raw material for the ayurvedic industry. The potential for total production of medicinal plants in the country has been estimated to be about 3,19,000 tonne. Most of the medicinal plants are currently sourced from the forest and wastelands. It has also been reported that about 960 medicinal plants are actively traded of which 178 species have annual consumption of more than 100 tonne.

India is estimated to have around 6000 species of medicinal plants, of which around 2000 are documented in Indian Systems of Medicine. Further, 4000 species are estimated to be used by rural and tribal communities in their local health practices. As per another Ethno-biology survey carried out by the Ministry of Environment and Forests in 1995, around 7,500 plant species are used by 4,635 ethnic communities for human and veterinary health care.

The mission of National Medicinal Plants Board is being accomplished through various state-level Boards promoting cultivation of medicinal plants on intensive scale through the following measures:

- support of cultivation of medicinal plants on private lands through farmers.
- implement and support certification mechanism in medicinal plants cultivation through the adoption of Good Agricultural Practices (GAP), Good Collection Practices (GCP), and Good Storage Practices (GSP).
- support setting up processing zones.

Recognition of Ayurvedic Education

Besides the establishment of CCRAS and other programmes of AYUSH, the country has also established Central Council of Indian Medicine (CCIM) which is a statutory body constituted under the Indian Medicine Central Council Act, 1970 to regulate education curricula in Ayurveda and other Indian systems of medicine. Thus, all the Colleges of Indian systems of medicine including Ayurveda affiliated to various universities in the country are required to adhere to minimum standards of course work and syllabi prescribed by CCIM.

Clearly, the country has made big strides in promoting its ancient heritage of Ayurveda within the country in recent times by developing the infrastructure for education in Ayurveda, enhancing the cultivation of medicinal plants on large enough scale and creating an eco-system for research and development on Ayurvedic therapies and plant-based Ayurvedic medicines. In line with these developments, the approved outlay for the concerned department/ministry was increased from Rs. 7.75 billion in the X five-year plan (2002-07) to Rs. 39.88 billion in the XI five-year plan (2007-12) and AYUSH is now a full-fledged ministry^[17].

Globalization of Ayurveda

Teaching Courses in different countries

There has been dramatic surge in popularity of Ayurveda all over the world during last three decades largely initiated with scholarly visits of many a personalities connected with yoga, spirituality and Ayurvedic practice such as Vaidya Vasant Lad, Deepak Chopra, Robert Svoboda, David Frawley, Acharya Manfred Junius, Ben Hatai, Pandit Shiv Sharma, Dr PNV Kurup, Vaidya Bhagwan Das, DrKN Udupa and Prof HS Sharma^[18]. Many of them extensively travelled in countries like America, Japan, Australia, Italy, Germany etc. and set up their clinics and training

institutes offering a variety of short courses. Some of these efforts have also been complemented by indigenous academic centres of Ayurveda, such as Gujarat Ayurved University, Jamnagar and Banaras Hindu University offering short courses for students from foreign countries to fillip the demand. Soon many centres in neighbouring Nepal, Sri Lanka and Bangladesh also opened their Ayurvedic facilities for foreign nationals. This trend which started with a mushroom growth of Ayurvedic centres in the USA and in and around India did not stop here but percolated in many countries around the world^[18-21].

Benchmarks for Training in Ayurveda

Clearly there is a great deal of variety in these offerings and a complete lack of standardisation with regard to quality and content of learning not only with regard to available knowledgebase but with regard to the contemporary needs of the society. This problem has been seized by the World Health Organization which promptly came out with 'Benchmarks in training in Ayurveda'^[4]. Understandably, the framework of this draft for benchmarks is prepared by India but reviewed and vetted by as many as 274 reviewers, experts and national authorities spread across in 114 countries as stated in its acknowledgement.

The WHO benchmarks for training in Ayurveda and traditional medicine essentially focus on four areas: i) Concepts and Principles of Ayurveda along with Ayurvedic pharmacology, pathology and therapeutics, ii) Training of Ayurveda practitioners, therapists and dieticians, iii) Training for dispensers and distributors of Ayurveda and iv) Safety issues in use of Ayurvedic medicines with safe use of metals, minerals, poisonous substances etc.

Global Recognition to Traditional Medicine and Intellectual Property

The knowledge of Ayurveda and its best practices spread around in the 6th century BC to Tibet, China, Mongolia, Korea and Sri Lanka, through the Buddhist monks. Indigenous communities in distant lands such as Africa, China etc. also slowly developed their own knowledge base observing the properties of local flora and fauna coupled with Ayurvedic knowledge. Today, Ayurvedic and herbal medicine of any source is known as alternative medicine and is becoming popular all over the world with the support of agencies like World Health Organization (WHO) and the World Intellectual Property Organization (WIPO) giving due recognition to intellectual property to traditional medicine^[22]. While the earlier directive of these world bodies provides member states to protect their bio resources against misappropriation by third parties, the later directive clearly wants member states to protect their bio-resources by enacting appropriate laws of intellectual property. Thus, research, innovation and intellectual property based on medicinal plants have now become all too important for all member states.

Traditional Knowledge Digital Library

With growing demand for traditional medicine, bio-resources all over the world are under threat of bio-piracy and many cases of misappropriation of traditional knowledge regularly make headlines in the media. Ayurvedic medicines, herbs and formulations which find an incognito description in Ayurvedic texts are nonetheless in common use in India. This situation has often lead to wrong patents being granted by authorities not having access to Ayurvedic texts. The case in point is that of a patent granted by USPTO on turmeric which is used in India as an essential ingredient in Indian meals as well as for a variety of Ayurvedic treatments. Encouraged by the success of getting revoked this patent as a result of public outrage, India launched the project on Traditional Knowledge Digital Library (TKDL).

TKDL is a pioneering joint initiative of India's Council of Scientific & Industrial Research and AYUSH to prevent misappropriation of country's traditional medicinal knowledge at international patent offices. Its software translates the information contained in ancient Sanskrit texts of Ayurveda as well as that of other non-English Indian systems of medicine to half a dozen international languages comprehensible to Patent Examiners in Europe and USA. It also has its own elaborate classification system which is compatible with International Patent Classification (IPC). As of now, TKDL includes about 212 thousand medicinal formulations of Indian systems of medicine including Ayurveda extracted from as many as 148 books (in Sanskrit and other Indian languages) available in public domain, the database of which extends to something like 34 million A4 size pages [23].

Standardisation of Value Chain of Traditional Medicine

The focus on 'innovation, research and intellectual property' with respect to plant sources in the latest resolution of the World Health Assembly is a new emphasis that encourages member states to put more resources in developing new herbal and plant-based therapeutic products. There has been a spurt in herbal research throughout the world in recent years which is evident from the patent data.

Regulatory authorities in western countries view Ayurvedic and traditional medicines which have not been scientifically validated with some concern even if they have been in common use for centuries in other parts of the world. It is necessary to conduct pre-clinical and clinical research to obtain scientific evidence to support efficacy, safety, and quality of Ayurvedic medicine and therapies to get global acceptance. Many laboratories of CSIR in India are doing just that, though it needs to be done on a larger scale and with due priority jointly with experts from Ayurvedic and modern medicine. Patwardhan *et al* provide a lucid description of how China has successfully overcome the problems of unwanted adulteration, inadvertent contamination of toxic heavy metals and pesticides in licensed traditional Chinese medicine with a high degree of global acceptance [24]. In fact, China has been able to take care of entire value chain of traditional medicine business with Good Agricultural Policies (GAP) and Good Manufacturing Practices (GMP) being put in place that demand standard operating procedures for cultivation of right germplasm in pollution free soil environment and manufacturing as per the guidelines laid down by China's State Drug Administration (SDA). In contrast, there is much to be desired yet on standardization and quality assurance of standard Ayurvedic medicine. The reported cases of adulteration in Ayurvedic samples with synthetic anti-inflammatory drugs like phenylbutazone, indomethacin and/or corticosteroids and contamination with heavy metals such as mercury, arsenic and lead contamination have already put the glory of Ayurveda to considerable disrepute [24].

India has already established world-class expertise and facilities for organic synthesis, natural products isolation and structure elucidation, biological screening, toxicological testing and pharmacokinetics. Within the space of herbal medicines, attention is focused on isolating active ingredients and standardizing the herbal formulations. There also are quite a few institutes engaged in developing new varieties and agro-technology for the cultivation of medicinal plants. It is important to select the best variety that suits various climatic zones in the country.

Global Trends in Patenting in Botanicals and Herbal Research

To gauge as to what an extent India has made its mark globally in herbal and plant based research or related fields, we may see global trends in patents vis-a-vis the contribution made by India in this field. In a reply to a parliament question (unstarred no. 2330 dated 24 July 2009) [14] on TKDL, the global growth of patents in medicinal plants was

stated to be 4896 in 2000, which rose to 15000 in 2003 and 35587 in 2005 indicating a dramatic growth in this area.

There are several reports indicating strong growth of patents in India during the last three decades, especially after Indian patent law became TRIPS compliant though the majority of patents filed in India continues to be by foreign applicants. It is important to note, however, that among the Indian patent filers in India, the most preferred field for protecting the intellectual property of their research findings in India happens to be 'chemical and pharmaceutical'. This fact need not appear surprising in view of considerable strength and infrastructure India has been able to create in the field of chemical and pharmaceutical research [25-27].

The World Intellectual Property Organization (WIPO) releases trends and statistics on patent filing under the Patent Cooperation Treaty (PCT) on annual basis. In its latest report, it presents the Relative Specialisation Index (RSI) of foreign-oriented patent families in different fields as filed from different countries, ranking them in terms of above or below the average filing [28]. This may be regarded as an important indicator of the innovative capacity and relative strength of the concerned countries in specific fields.

Figure 1 shows the top-most rank in RSI attained by India in pharmaceuticals ahead of Switzerland, Belgium, Spain, USA, France, UK, Sweden, UK, Canada etc. meaning thereby India is actively patenting globally preferentially in the pharmaceutical field. India has been consistently leading in RSI ranking in pharmaceuticals since 2008 which clearly indicates India's strong innovative capacity in this sector.

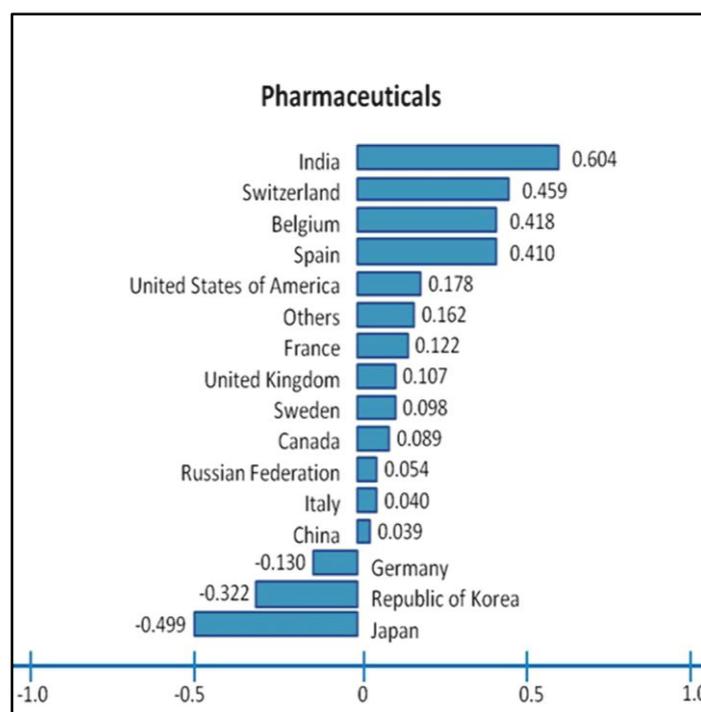


Figure 1: Relative Specialisation Index (RSI) of foreign-oriented patent families

Relative Specialisation Index (RSI) of foreign-oriented patent families by origin and technology (2011–2013) {Source: World Intellectual Property Indicators, 2015, P. 47; World Intellectual Property Organization (WIPO)}

Much of this growth and aggressive patenting by India in pharmaceutical field is the result of the end of the sole dependence of Indian pharmaceutical sector on production and marketing of generic drugs since Indian patent regime became TRIPS compliant in 2005. As a result, Indian pharmaceutical companies are obliged to invest heavily in new drug discovery programmes to stay in the market, even though Indian pharmaceutical industry is still too small and accounts for about

2.4 per cent of the global pharmaceutical industry in value terms and 10 per cent in volume terms and is expected to expand at a compound annual growth rate of 15.92 per cent to US\$ 55 billion by 2020 from US\$ 20 billion in 2015 [29]. This innovative capacity in chemical, pharmaceuticals and more specifically in new drug discovery programmes created with an eco-system of innovation by way of huge talented scientific manpower, impressive array of institutions of scientific research with mutually reinforcing policies and programmes of the government, and industry should propel the country to emerge as a leader in pharmaceuticals on which Ayurved and herbal medicine sector can very well append itself.

To see how the global effort in herbal research is shaping in recent times, we turn to relevant patent data and its growth trend. 'Espacenet' the worldwide patent database of European Patent Office which has a collection of patent data of more than 90 countries together is most representative for our purpose here. The year-wise patent publications in this database which have been assigned A61K36 as the Cooperative Patent Classification code belonging to a broad category of 'herbal medicine' can be seen in Figure 2 below. It can be seen that with about a few hundred patent applications in early nineties, the growth in this area peaked since the turn of the century and currently the global research effort is contributing nearly 4000 patent applications on yearly basis (Please ignore the incomplete data for the year 2016). The Indian contribution to this global pool is no more than a few hundred or less every year, which is not in line with the glorious past of Ayurveda or the impressive research infrastructure created by India or with its iconic image of frontrunner in pharmaceutical patents.

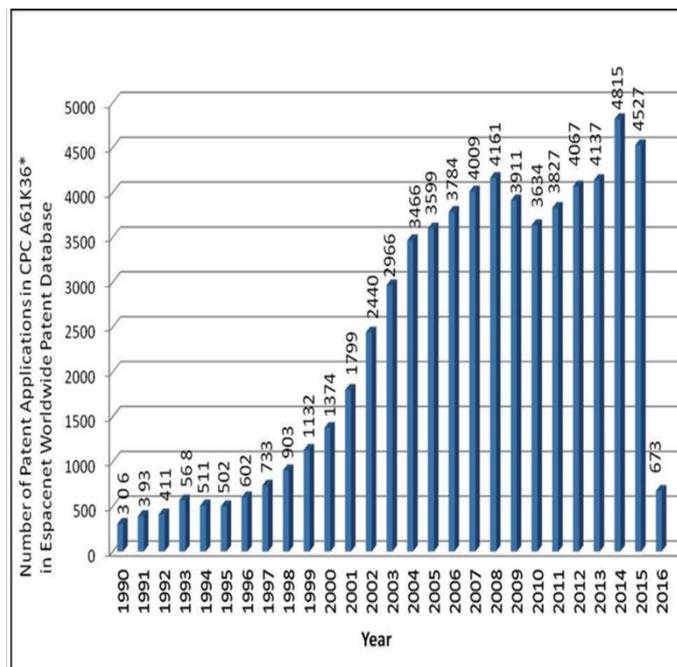


Figure 2: No. of Patent Applications in CPC A61K36* in Espacenet

Taking a cue from Subrat et al about the most actively traded medicinal plants in India, these were identified and the patents around them searched and analysed from the Espacenet, the worldwide patent database for each of these popular herbs [30]. While the detailed analysis in terms of the geographical spread of patents being filed on these herbs is given in Table 1, the graphical presentation of the data for the first two dozen countries including India is shown below in Figure 3, which is self-illustrative.

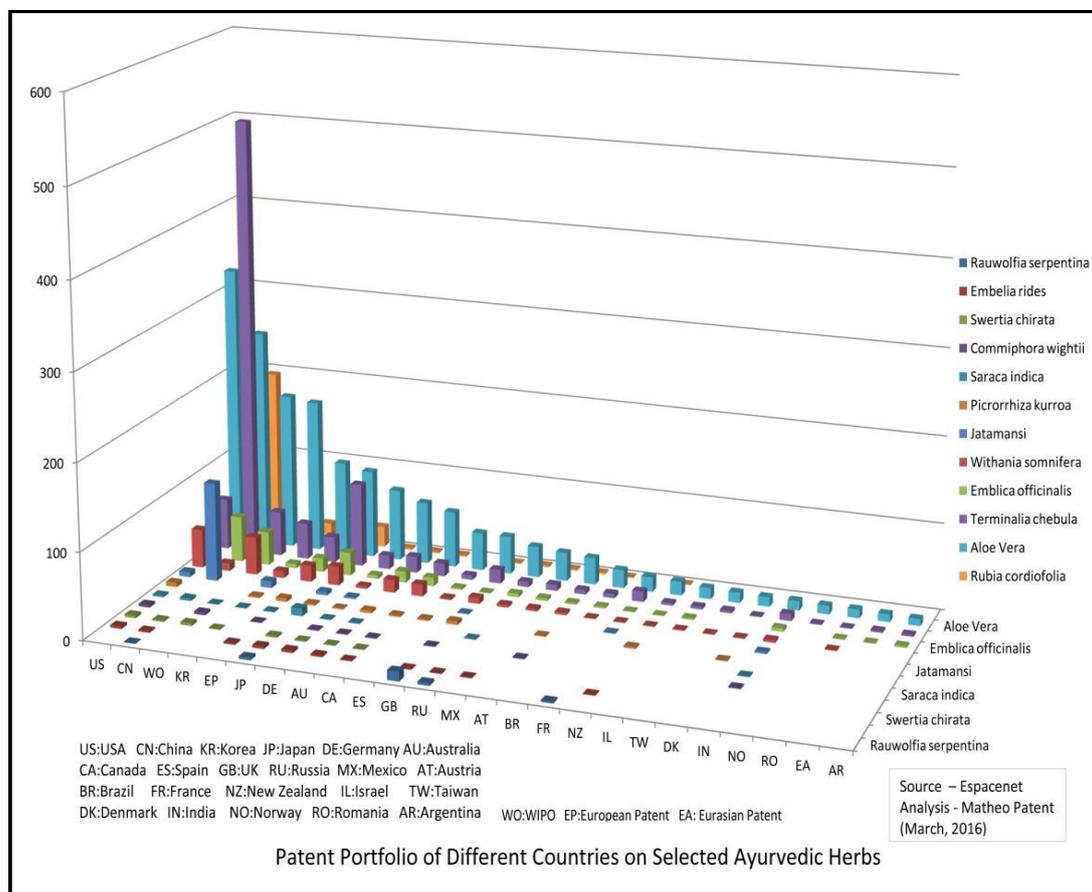


Figure 3: Patent Portfolio of Different Countries in Some Ayurvedic Herbs

It can be seen that for most of the Ayurvedic herbs which are actively traded in the Indian sub-continent and can be regarded as the backbone of Indian Ayurvedic industry, much of the research is taking place in US, China, Korea, Japan and Europe only.

It is reported that screening of almost 2000 plants for biological efficacy by India's Central Drug Research Institute did not yield any new drug. On the other hand, screening of about 35,000 plant species for anticancer activity by National Cancer Institute of USA resulted in only two new drugs, 'paclitaxel' and 'camptothecin'^[24].

While the global patent data puts India in a dismal picture, it must be remembered that plant-based drug discovery is both expensive and full of uncertain outcomes, with the screening of randomly selected plants for selected bioassays being less successful than the focused screening.

Table 1: Patent Portfolio of Selected Ayurvedic Herbs Across Various countries

Herbs Country	(Patents-Families)	US	CN	WO	KR	EP	JP	DE	AU	CA	ES	GB	RU	MX	AT	BR	FR	NZ	IL	TW	DK
Rauwolfia serpentina	(29-24)		1				3					11	3				2				
Embelia rides	(31-10)	3	2			2	3	3	2	1		1	1	1				1			
Swertia chirata	(29-11)	3	2	3	1		2	1	1	1											
Commiphora wightii	(20-5)	3		3		1		1	1	1		1			1						
Saraca indica	(34-13)	2	3	1	1	1	9	1	1				1								
Picrorrhiza kurroa	(55-8)	5			2	4	2	1	3	2	2	4			1			2			1
Jatamansi	(192-146)	6	115		8		4	2				1					1				
Withania somnifera	(338-88)	45	9	44	8	19	22	3	15	14	2	7	3	3	3	1	1	1	1	1	1
Emblca officinalis	(367-130)	39	53	39	5	16	27	4	13	10	2	1	4	3	2	2	1	1	2		
Terminalia chebula	(1259-721)	59	510	52	42	30	97	16	19	15	5	16	6	7	5	5	12	3	3	3	1
Aloe Vera	(2490-1015)	325	253	181	177	108	102	83	72	65	44	44	36	33	31	21	17	16	13	12	11
Rubia cordifolia	(355-244)	8	195	12	20	4	24	2	2	2		1	2	2	2	1		1			

Herbs Country	(Patents-Families)	IN	NO	RO	EA	AR	BG	PL	PT	UA	CZ	HK	IT	CO	HU	NL	AP	CH	EE	SG	SK
Rauwolfia serpentina	(29-24)									1											
Embelia rides	(31-10)														1						1
Swertia chirata	(29-11)																				
Commiphora wightii	(20-5)	1																			
Saraca indica	(34-13)	1											1		1	1					
Picrorrhiza kurroa	(55-8)								1												
Jatamansi	(192-146)	2																			
Withania somnifera	(338-88)	3		1								1							1		1
Emblca officinalis	(367-130)	4		1	1	2					2		1		1	1	1				1
Terminalia chebula	(1259-721)	8	1	1	2	2		1	1	1	1	2	2	1	2	1	1	1		3	1
Aloe Vera	(2490-1015)	11	10	10	9	8	8	8	8	8	6	6	6	4	4	4	3	3	3	3	3
Rubia cordifolia	(355-244)									1				1							1

Herbs Country	(Patents-Families)	TR	GR	HR	MA	OA	PE	RS	YU	BE	DO	EC	GT	HN	IE	IS	LV	MY	PA	SI	
Rauwolfia serpentina	(29-24)																				
Embelia rides	(31-10)																				
Swertia chirata	(29-11)																				
Commiphora wightii	(20-5)																				
Saraca indica	(34-13)																				
Picrorrhiza kurroa	(55-8)																				1
Jatamansi	(192-146)																				
Withania somnifera	(338-88)																				
Emblca officinalis	(367-130)						1					1									
Terminalia chebula	(1259-721)																		1		1
Aloe Vera	(2490-1015)	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
Rubia cordifolia	(355-244)																		1		

Source - Espacenet Analysis - Mattheo Patent (2016)

Legend:

AR:Argentina AT:Austria AU:Australia BE:Belgium BR:Brazil BG:Bulgaria CA:Canada CH:Switzerland CN:China CO:colombia CZ:Czech DE:Germany DK:Denmark DO: Dominican Republic EC: Ecuador EE:Estonia ES:Spain FR:France GB:UK GR: Greece GT:Guatemala HK:Hong Kong HN:Honduras HR: Croatia HU:Hungary IE:Ireland IL:Israel IN:India IS:Iceland IT:Italy KR:Korea LV:Latvia MA: Morocco MX:Mexico MY:Malaysia NL:Netherlands NO:Norway NZ:NewZealnd PA:Panama PE:Peru PL:Poland PT:Portugal RO:Romania RS:Serbia RU:Russia SG:Singapore SI:Slovenia SK:Slovak TR:Turkey YU:Yugoslavia TW:Taiwan UA:Ukraine US:USA
 AP:African Regional Industrial Property Organization EA:Eurasian Patent Organization
 OA:African Intellectual Property Organization WO:WIPO EP: European Patent Office

Patent Portfolio of Selected Ayurvedic Herbs Across Various Countries

Technology-Patent.Com

Indian Ayurvedic Industry and Global Market

The global market for the herbal industry is reportedly soaring high and is expected to reach US\$115 billion by 2020; the global sales of Chinese herbal medicine has already reached US\$83 billion in 2012 up more than 20 per cent from the previous year^[31]. Against this, the current size of Indian Ayurvedic industry is not authoritatively known; the total market size of the Indian Ayurveda projected in a government report dated as far back as 2000 was worth US\$1 billion against the global herbal market of US\$62 billion^[32]. A bird's eye view of Ayurvedic industry presents a complex picture of various units manufacturing i) pharmaceuticals, ii) cosmetics and dietary supplements and iii) processing herbal extracts, distillates and oils as a basic raw material or essential ingredient for use by other units within the country or abroad.

There is a predominance of a very large number of small manufacturing units in this industry with only handful large units which together process about 35% of the raw material of basic herbs and medicinal plants produced within the country. While the larger companies are a set of well known names in the country and abroad such as Dabur, Himalaya, Patanjali, Zandu, Baidaynath etc. who run on professional lines taking care of quality control and quality assurance of their produce as well as adhering to the norms of GMP and GLP and also have reasonably good R&D set up, the same, for many smaller units may always be suspect. There is a growing awareness in the industry to move to modernisation of manufacturing processes of extraction, removal of heavy metal content of lead, arsenic, mercury, cadmium etc. by leaching as well the preservation of raw material and adopting proper agro-technologies. Of all the Ayurvedic products available within the country, nearly 1500 items are sold as unbranded preparations alongside more than 30,000 branded items. On a volume basis, crude herbs constitute nearly 60% of all exports^[32].

Emerging Issues and Recommendations

Having reviewed the current status of Ayurveda in all its manifestations both within the country and outside, we may now recount key issues of concern that are important for Ayurveda to reach its pinnacle of global recognition and success.

Integration of Ayurvedic practice with modern medicine

The integration of Ayurvedic practice with modern medicine is most desirable in the Indian context and the Government seems to be quite keen to address this issue. To establish Ayurvedic departments in allopathic hospitals, as is being already done in some measure is the step in the right direction. Also, further integration of AYUSH sector in national health programs such as mental health, AIDS control, cancer control, tobacco control, oral health, cardiovascular diseases, fluorosis, tuberculosis, malaria, diabetes, non-communicable diseases (NCDs) etc. by utilising its impressive infrastructure of about 785,000 registered AYUSH practitioners, 3277 hospitals, 24,289 dispensaries and bed strength of 62,649 in the government aided sector. It is equally important that the mainstream health system integrates its health delivery strategies with AYUSH in a meaningful way^[17]. Clearly, more innovative approaches are required to integrate Ayurved and modern medicine both in teaching as well as in practice.

Safety & Clinical Trials

To make a dent in the global herbal market with Ayurvedic products produced in India, it is important that this area receives the highest priority. The country may adopt policies and programmes that are in line with the global herbal medicine strategies. It is necessary to conduct pre-clinical and clinical research to obtain scientific evidence to support efficacy, safety, and quality of traditional and herbal medicines and therapies based on them. It is also important to put in

place an effective vigilance system to check malpractices of adulteration in the supply-chain of medicinal plants trade^[33-35].

Agro technologies

Agri Export Zones (AEZs) for medicinal and aromatic plants set up in the states of Kerala and Uttarakhand by APEDA need to be replicated in all states where cultivation of medicinal and aromatic plants is being promoted in clusters.

Marketing Support and Promotion

To support a large number of small players, an umbrella institution may be created by the Govt for marketing support and a common brand or banner. This can be done by the Government by creating a brand or a 'geographical indication' of its own for Indian Ayurvedic products and offer the franchise to small companies producing standard products of assured quality.

New Drug Discovery Programmes

New drug discovery programmes based on leads from Ayurved may be launched at a big enough scale with involvement of research institutes, universities and private sector institutions and industry. India possesses more than six thousand medicinal plants found in the Himalayan region, around its coastline, the deserts and the rain forest eco-systems of which only about one fourth species are reported in Ayurveda. In addition, around 4000 species are used in local health care and tribal traditions. There are immense possibilities of developing new improved Ayurvedic formulations that can be duly protected by patents and find easy market throughout the globe.

Ayurved and Eco-tourism

India has today a complete eco-system and infrastructure to emerge as an ultimate destination for Ayurvedic education and health resorts with rich content of Ayurvedic therapies and massages and also emerge as the main source of high quality Ayurvedic medicines both offline and online. The Government may quickly develop and implement a road map for eco-tourism based on Ayurveda.

CONCLUSION

There is a huge opportunity for Indian herbal industry in global exports despite numerous challenges for the industry, regulatory authorities and research institutions to overcome problems of quality, efficacy, safety and standardization to successfully compete in international market. There also are many opportunities for promoting Ayurvedic education and eco-tourism based on Ayurveda in India for international community. India already has adequate infrastructure and innovation eco-system in place to make big strides in these directions.

Meanwhile, the challenges of integrating Ayurveda in all its manifestations with modern medicine and education will continue to exist.

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