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Asian Journal of Pharmaceutical Research and Development

(An International Peer-Reviewed Journal of Pharmaceutical Research and Development)

Open Access to Pharmaceutical and Medical Research

Open Access Research Article

ANALYSIS OF PATENT TRENDS BETWEEN 2000 AND 2017 IN THE AREAS OF MEDICAL, DENTAL AND TOILET PREPARATIONS INCLUDING OF PHARMACEUTICALS.

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ABSTRACT

Patent information is highly important for decision makers. Their demand for latest technology trend and competitor analysis poses new challenges with respect to the processing and visualization of large amount of patent data. The aim of present study is to map out research and development (R&D) activities landscape through patent analysis of these identified innovations and patent filing trend in the areas of medical, dental and toilet preparations including of pharmaceuticals. The scope of present work includes the patent search and analysis of relevant patents data from all countries across the world using paid patent database PatSeer. To achieve this, analysis and evaluation of available data have been carried out on patenting trends on following parameters: Priority Country, Current Legal Status, Patenting Trends, Major Current Owner of Technologies, Assignee Type, International Patent Classification (IPC) Group Data, Technology Topics.

Key words: Pharmaceutical Patent, Patent Trend, International Patent Classification, PatSeer .

Cite this article as:

Patel Amit kumar, Analysis of Patent Trends between 2000 and 2017 in the Areas of Medical, Dental and Toilet Preparations Including of Pharmaceuticals, Asian Journal of Pharmaceutical research and Development.2018;6 (2):47-59
DOI: http://dx.doi.org/10.22270/ajprd.v6.i2.352

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INTRODUCTION

Access to technology information has expanded rapidly in recent years, a result of the increasing availability of technical documents in digital format and the progressive development of electronic means of distribution and retrieval. As the quantities of technology information available to the public have grown, so too have the challenges of finding relevant information from which useful knowledge can be extracted. Patent documents represents a rich source of technical, legal and business information presented in a generally standardized format and often not reproduced anywhere else. (1)

A patent has two important functions: (1)

- Protection. A patent allows the patent holder to exclude others from commercially exploiting the invention covered by the patent in a certain country or region and for a specific period of time, generally not exceeding 20 years.
- Disclosure. A patent gives the public access to information regarding new technologies in order to stimulate innovation and contribute to economic growth.

Patent information is an important resource for researchers and inventors, entrepreneurs and commercial enterprises, and patent professionals. Patent information can assist users to: (2)

- Avoid duplicating research and development effort;
- Determine the patentability of their inventions;
- Avoid infringing other inventors' patents;
- Estimate the value of their or other inventors' patents;
- Exploit technology from patent applications that have never been granted, are not valid in certain countries, or from patents that are no longer in force;

- Gain intelligence on the innovative activities and future direction of business competitors;
- Improve planning for business decisions such as licensing, technology partnerships, and mergers and acquisitions;
- Identify key trends in specific technical fields of public interest such as those relating to health or to the environment and provide a foundation for policy planning.

Patent information comprises all information, which has either been published in a patent document or can be derived from analyzing patent filing statistics and includes: (3)

- Technical information from the description and drawings of the invention;
- Legal information from the patent claims defining the scope of the patent and from its legal status;
- Business-relevant information from reference data identifying the inventor, date of filing, country of origin, etc.;
- Public policy-relevant information from an analysis of filing trends to be used by policymakers, e.g., in national industrial policy strategy.

In particular, patent information refers to the following: (4)

- Applicant: Name of the individual or company applying to have a particular invention protected;
- Inventor: Name of the person or persons who invented the new technology and developed the invention;
- Description: Clear and concise explanation of known existing technologies related to the new invention and explanation of how this invention could be applied to solve problems not addressed by the existing technologies; specific embodiments of the new technology are also usually given;
- Claims: Legal definition of the subject matter which the applicant regards as his invention and for which protection is sought or granted; each claim is a single sentence in a legalistic form that defines an invention and its unique technical features; claims must be clear and concise and fully supported by the description;
- Priority filing: Original first filing on the basis of which further successive national, regional or international filings can be made within the priority period of one year;
- Patent family is referred as a group of applications based on a single application as described above. Identifying the members of a patent family will not only reveal in which countries or regions patent protection is being sought by an applicant, but may also uncover translations of the application in different languages.
- Priority date: Date of the first filing from which the innovation is protected if the application is successful and from which the one-year priority period for further applications starts;
- Filing date: Date of submitting an individual patent application at a particular patent office and, therefore, the date from which the innovation is protected if the application is successful;
- Designated states: If the application is regional or international, the countries to which the rights may be extended;
- Legal status: Indicates whether the patent has been granted or not; if granted, the countries or regions in which the patent has been granted; and whether it is still valid or has expired or been invalidated in a particular country or region;
- Citation and references: Certain patent documents also include references to related technology information uncovered by the applicant or by a patent examiner during the patent granting procedure; these references and citations include both patent and non-patent documents;
- Bibliographic data: Refers generally to the various data appearing on the front page of a patent document or the corresponding applications and may comprise document identification data, domestic filing data, priority data, publication data, classification data, and other concise data relating to the technical content of the document.

A search carried out in patent documents allows you to find information on recent developments in a range of technical areas. In fact, for some fields of technology, new developments are initially and sometimes exclusively recorded in patent documents. Nonetheless, it is critical to keep in mind the limitations of the data in which the search is being carried out. No single data source covers all available technology information, or even all available patent information. The information may be limited with respect to the range of dates or countries for which records are available or in terms of the search facilities offered. (2)

Innovation is the key for development and progress. Innovations in the areas of medical, dental, toilet preparations in general and broder scene, innovations in the areas of pharmaceuticals and aligned areas are driving the pharmaceutical and healthcare industry across the world, and are responsible for growth and new job creations. To understand the technological trends as well to predict the future of pharmaceutical and healthcare industry, it is very important to analyse the patent filing trends of innovations in the areas of medical, dental and toilet preparations.Present study includes the patent trend analysis of innovations in the areas of medical, dental and toilet preparations including of pharmaceuticals in the time period of 2000 to 2017 (1). The dataset for patent analysis includes the full text patent documents available from more than fifty major patent filing countries and bibliographic data available from more than hundred countries available on patseer database, which ensures for widest possible basic patent data set for further analysis (5).

Objectives

The key objective of present analysis of patent trends between the range of 2000 to 2017 in the area of medical, dental and toilet preparation including pharmaceuticals is to analyze large volume of data to extract information relevant to following points:

- Priority Country,
- Current Legal Status,

- Patenting Trends,
- Major Current Owner of Technologies,
- Assignee Type,
- International Patent Classification (IPC) Group Data,
- Technology Topics.

Methods

Effective searching of patent documentation and other sources of technology information often requires a solid knowledge of the technical field to which an invention belongs. An awareness of the terminology and issues related to this field are necessary if appropriate search criteria are to be identified.

To analyses the patent trends between 2000 and 2017 in the area of medical, dental and toilet preparations including of pharmaceuticals, the approach for selection of patent data and documents was made based on the International Patent Classification (IPC) Code of each patent document.

All patents are systematically classified according to their specific technical field. Though various national classification systems exist, the International Patent Classification (IPC) system is a common system shared by all patent offices. Further information on the IPC, including how to use keywords to find the right classification, is available at, http://www.wipo.int/classifications/ipc. (6)

The IPC Classification code with respect to medical, dental and toilet preparations including of pharmaceuticalsA61K. As per IPC the code A61K was exactly defined as: PREPARATIONS FOR MEDICAL, DENTAL, OR TOILET PURPOSES (devices or methods specially adapted for bringing pharmaceutical products into particular physical or administering forms A61J 3/00; chemical aspects of, or use of materials for deodorization of air, for disinfection or sterilization, or for bandages, dressings, absorbent pads or surgical articles A61L; soap compositions C11D). (7)

In order to get a quantitative estimation of such patent trend analysis, we have analyzed the patent data available on Patent research and collaboration platform PatSeer. PatSeer is a one-stop analysis and collaboration platform for Patent and Non-patent Literature search. PatSeer offers various search, analysis and visualization tools for effectively looking in to large volume of data. We found that most patents filed, published or granted are captured in to the database with very short period of time after their original release by various publishing authorities. PatSeer includes full tex patent data from 51 countries, it also Includes searchable english translations and bibliographic data from 104+ countries as part of INPADOC data. It includes approximately 74 million full-text records in a database of 115 million+ records. This allow completion of a patent trend analysis to the latest data.

Following methods were adopted to analyze the patent trendsin the area of medical, dental and toilet preparations including of pharmaceuticals.

- Analyze the countries, where in the major innovations are happening in these areas. This was achieved via analyzing the top priority country from where the innovations are first generated. This represent the key country where in maximum R&D was involved for development of new technology in said domains.
- Analyze the current legal status of large number of patent applications, which were filled across the world by various applicants. It wasanalyzed to check how many patents are in force, how many are expired, and expired for what reasons, How many are withdrawn etc.
- Analysis was made to check for the patent filing trend in these domains from time period of 1st January 2000 till 31st December 2017. To this we have analyzed the data for how many patent applications were filed and how many patents were granted in total, on yearly basis during said time period. Cumulative data for filing and grant of patents from all countries across the world, available on PatSeer database were been analyzed.
- From initial screening of records related to top priority countries, current legal status of filed patent applications, patent filing trend further analysis was made to identify the major current owner of technologies. It was analyzed to identify who holds the maximum number of patents in said areas of medical, dental and toilet preparations.
- To check the share of patents holding by various broad categories of assignees, a further analysis of patent data set was made based on the basis of assignee type. The patents were been grouped in to following groups of assignees: Firm, Individual, University, Government, Hospital, Institutes and Other
- Further to analyze the micro areas of innovations in these broad fields of innovation, the patent data were been analyzed based on the International Patent Classification (IPC) system. IPC analyses of the data set was performed on the IPC Group Data basis to define micro technical domains of each innovations protected by patents. And attempt was made to identify the total number of patent applications filed in particular technology domains.
- To see the macro areas of research, the patent documents data set was further been grouped into various groups of Technology Topics, the total area of records related to particular technology topics were been shown based on the total number of patent documents pertains to said domain in present study dataset.

Result and Discussion

To analyses the patent trends between 2000 and 2017 in the area of medical, dental and toilet preparations including of pharmaceuticals on PatSeer database we had carried out search using following search terms : APD:([2000-01-01 TO 2017-12-31]) AND IC:(A61K*) dated on 30th April 2018.

- With no criteria for removal of duplicative records, we found total number of results with above mentioned search term as 2869394 Records.
- For removal of duplicate results based on application number, we found total number of results reducing to a number of 2552069 Records.

This basic dataset of mentioned number of patent documents was further analyzed on various parameters and results were been found as following:

Priority Country:

Based on the patent data screened on the basis of IPC class code, to select patents relevant to the areas of medical, dental and toilet preparations including of pharmaceuticals, top fifteen countries were been sorted, from where maximum number of innovations had been developed and filed for first patent application for said invention. Country where the patent is first filed before being (possibly) extended to other countriesis known as Priority Country. The priority date is the first date of filing of a patent application, anywhere in the world (normally in the applicant's domestic patent office), to protect an invention. In Table 1 data for top fifteen priority country is been provided, in descending order of filled patent applications. In Figure 1 graph for top fifteen priority countries is represented. In Figure 2 data for top priorities countries is been provided in gradient color effect, darker color reflects more patent filing from said country.

Table 1: Priority Country

Sr. No.	Priority Country	Priority Country Code	Total
1	USA	US	1039770
2	China	CN	406178
3	Europe	EP	210787
4	Japan	JP	208488
5	United Kingdom	GB	122996
6	Germany	DE	103583
7	France	FR	88342
8	Korea	KR	74029
9	India	IN	35506
10	Russia	RU	26121
11	Australia	AU	24941
12	Italy	IT	23958
13	Sweden	SE	20833
14	Denmark	DK	18984
15	Spain	ES	12706

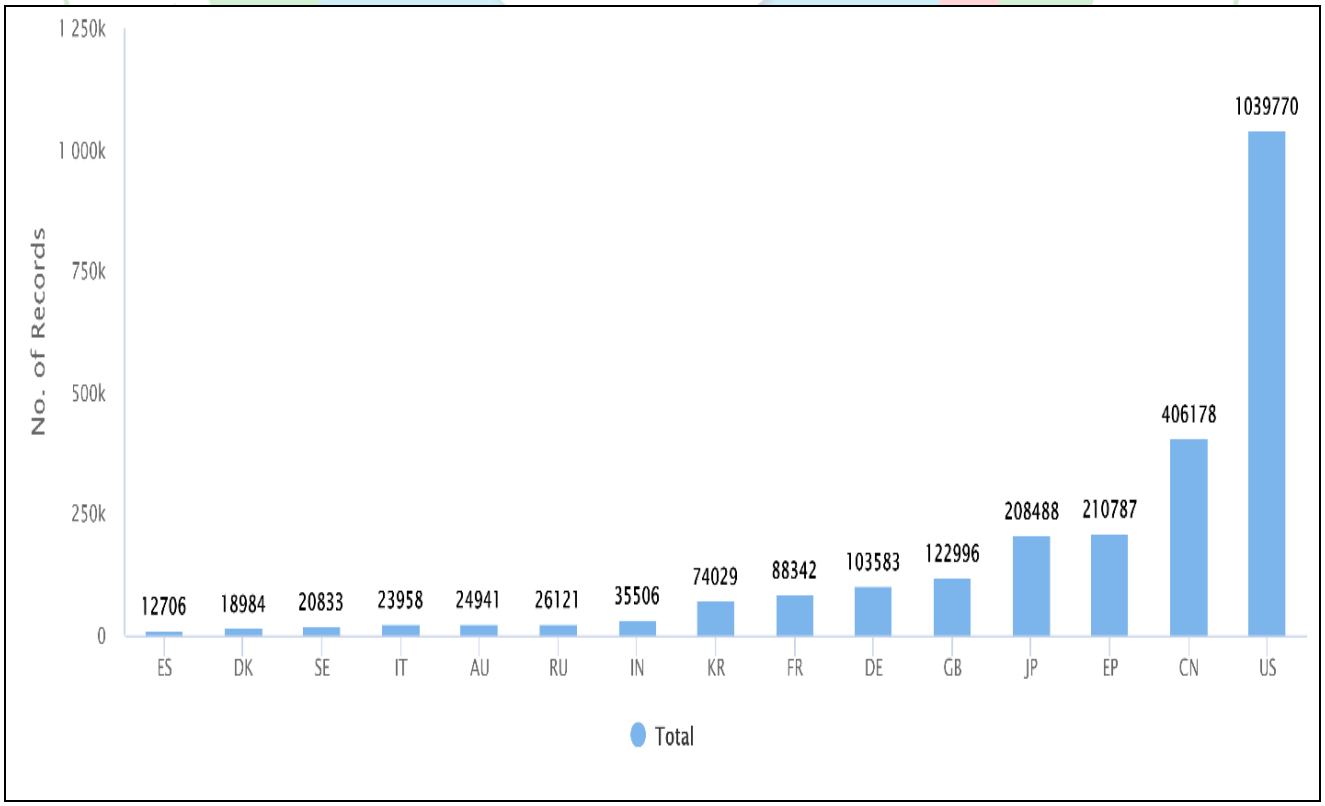

Fig. 1: Graph for Priority Country

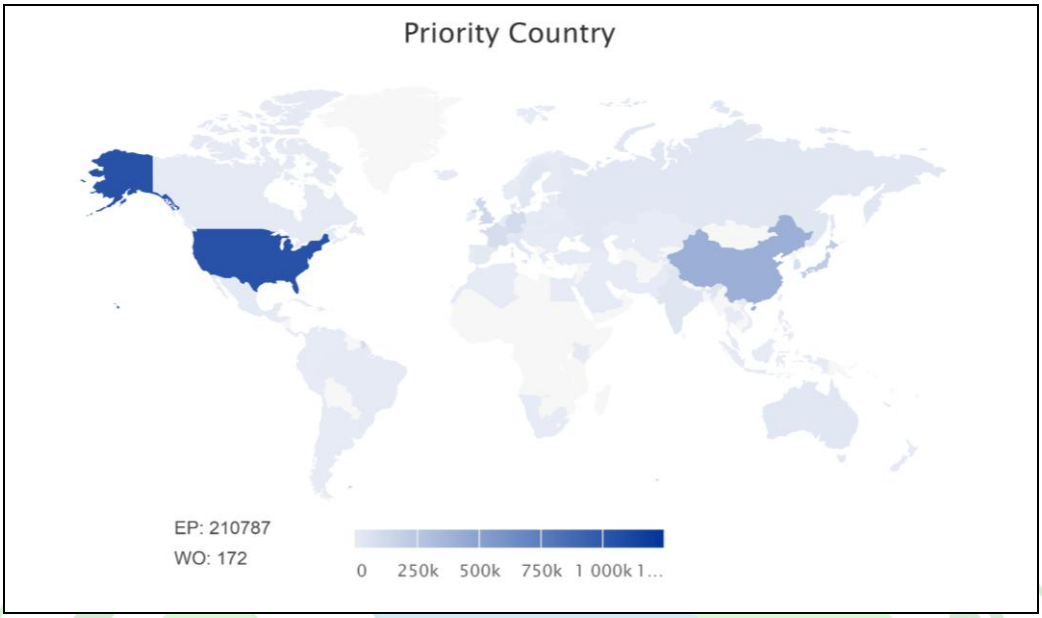

Fig. 2: Priority Countries for medical, dental and toilet preparationsincluding of pharmaceuticals.

Current Legal Status:

The patent data set was further analyzed to obtain details related to current legal of said patent applications in all jurisdictions where ever they had been filed. All patents were been grouped based on their status of applied, active, inactive, expired, withdrawn, surrendered, granted, revoked, refused etc. Here SPC is to be considered as patent term extension.Table 2 below represent the statistics for Current Legal Status of all relevant patents data set. Figure 2 below represent the graphical representation for Current Legal Status of all relevant patents data set.

Table 2: Current Legal Statusof all relevant patents data set

Sr. No.	Current legal status	Total
1	Active – Applied	750404
2	Active – Granted	724472
3	Inactive - Withdrawn / Surrendered	400530
4	Inactive – Expired	316655
5	Inactive – Nonpayment	197644
6	Inactive - Rejected / Refused / Suspended	155851
7	Inactive - Opposition / Revoked	1563
8	SPC Active - Granted / Applied	323
9	SPC Inactive - Expired / Rejected	9

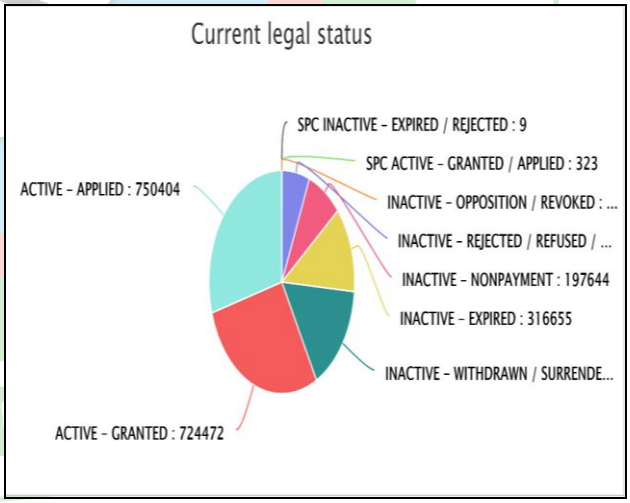

Fig. 2: Graphical representation for Current Legal Status of all relevant patents data set

Patenting Trends:

Further the data set is analyzed to check for the total number of patent applications were been filed in all jurisdiction in a defined period of time, and total number of relevant patents granted by all jurisdiction in to same amount of time period. The data were been analyzed on yearly basis starting from start of 2000 to end of 2017.Table 3 below represents the patenting trend, data for total number of patent applications filed and total patents granted on yearly basis by all jurisdictions in cumulative manner. Figure 3 represents the graphical

representation of patenting trend, data for total number of patent applications filed and total patents granted for same data.

Table 3: Patenting Trend

Year	Applications Filed	Grant
2000	111470	1305
2001	149761	4551
2002	138273	11344
2003	146286	22644
2004	137149	32515
2005	141463	38562
2006	144580	47420
2007	140626	52730
2008	135215	56448
2009	126530	58242
2010	124478	61730
2011	123573	69482
2012	130246	71800
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2014	147476	78656
2015	147546	78137
2016	115826	83208
2017	65642	83937

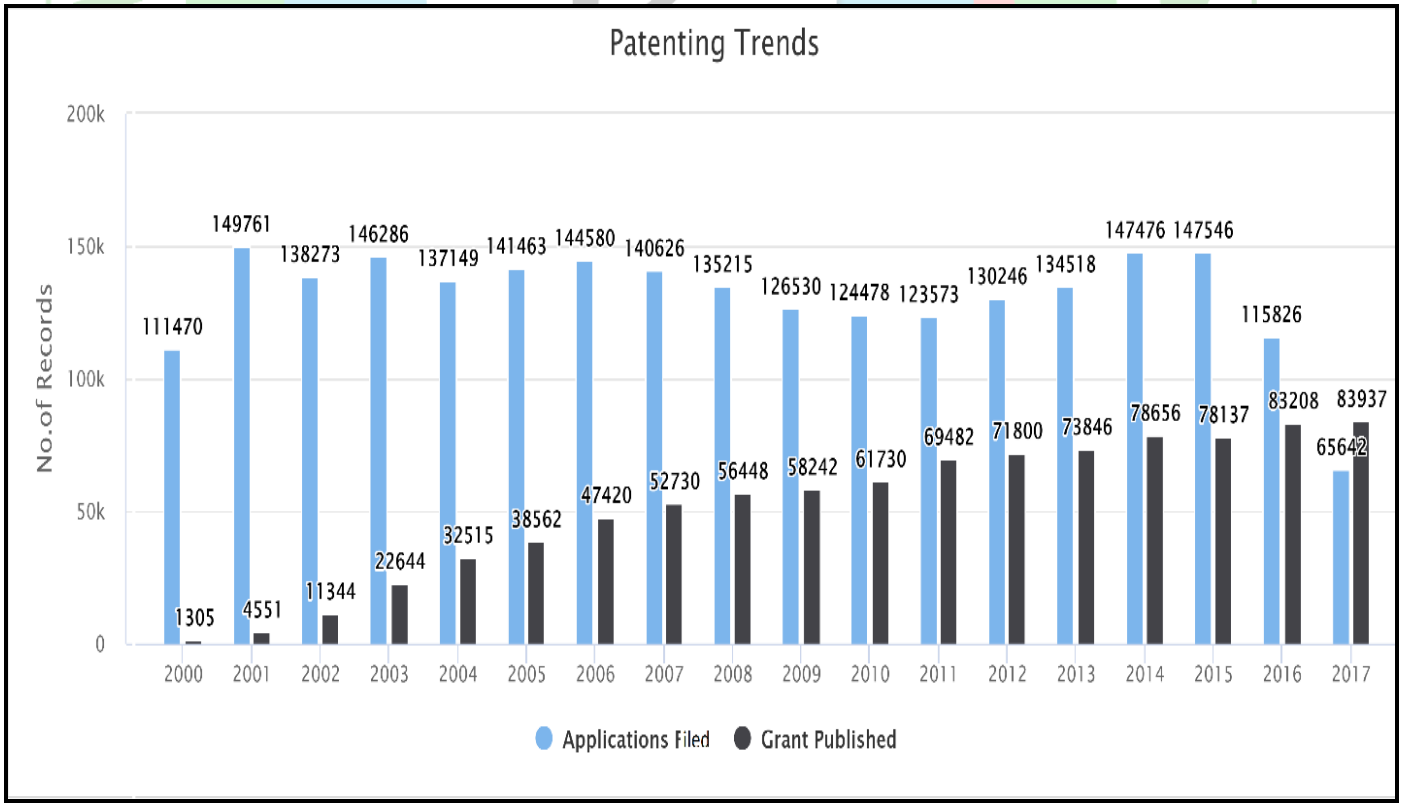

Fig. 3: Graphical representation for Patenting Trend

Current Owner (Assignee):

Patent data set was analyzed further to check for the top assignee/current owner of maximum patents in this area. The top assignees had been find out based on the maximum number of patent applications filed, granted holds by any assignees from all relevant patents data set. From the whole patents data set attempt was made to identify top fifty assignees, who holds maximum number of patents in the area of medical, dental and

toilet preparations including of pharmaceuticals. Table 4 below represents the patenting trend, data for top fifty assignees worldwide who holds maximum number of patents in this domain. Figure 4 is a graphical representation to show the top fifty current owners of patents with number of patents hold by each owner.

Table 4: Top Fifty Current Owners

Sr. No	Current Owner	Total
1	Pfizer Inc	62171
2	Novartis Ag	49851
3	Glaxosmithkline Plc	41995
4	Sanofi Sa	41302
5	Roche Holding Ag	40351
6	Astrazeneca Plc	32274
7	Johnson & Johnson	32243
8	Bayer Ag	28479
9	Merck Sharp & Dohme Corp	26875
10	Loreal Sa	26740
11	Ch Boehringer Sohn Ag & Co Kg	23645
12	Procter & Gamble Co	19572
13	Bristol Myers Squibb Co	19050
14	Takeda Pharma Co Ltd	17400
15	Merck Group	17177
16	Abbott Lab	16805
17	Lilly Co	14623
18	Genentech Inc	12672
19	Unilever Nv	11850
20	Amgen Inc	11189
21	Mitsubishi Group	10626
22	Allergan Plc	9968
23	Univ California	9725
24	Colgate Palmolive Co	9017
25	Kao Corp	8675
26	Daiichi Sankyo Co Ltd	8459
27	Gilead Science Inc	8119
28	Henkel Ag & Co Kgaa	7817
29	Astellas Pharma Inc	7560
30	Teva Pharma Industry	7252
31	Centre Nat Rech Scient	7233
32	Vertex Pharma Inc	7146
33	Otsuka Holding Co Ltd	6871
34	Nestle Sa	6870
35	Baxter International Inc	6617
36	Novo Nordisk As	6447
37	Teva Pharma Ind Ltd	6321
38	Shiseido Co Ltd	5947
39	H Lundbeck As	5423
40	Basf Ag	5350
41	Celgene Corp	5289
42	Abbvie Inc	4985
43	Bristolmyers Squibb Company	4953
44	Dow Chem Co	4941
45	Maxingvest Ag	4612
46	Merck & Co Inc	4610
47	Dsm Nv	4442
48	Amorepacific Corp	4419
49	3m Co	4373
50	Schering Ag	4342

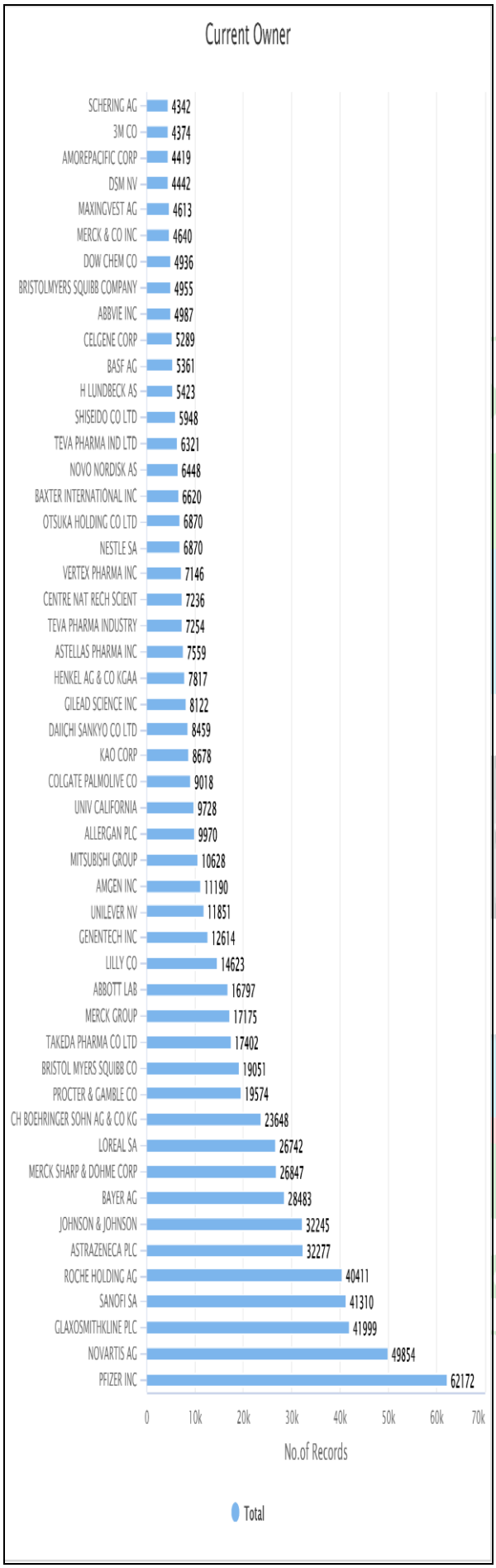

Fig. 4: Top Fifty Current Owners

Assignee Type:

After analyzing the patent data set for top current owners of patents, an attempt was made in this study to analyze the patent holdings by the kind of various assignees. For this purpose the assignees were been classified into following sub categories: Firm, Individual, University,

Government, Hospital, Institutes and Other. Table 5 below represents a number of patents hold by each type of the assignee. Figure 5 below represents a graphical representation to show the a number of patents hold by each type of the assignee.

Table 5: Assignee Type

Sr.	Assignee Type	Number of Patent
1	Firm	1616826
2	Individual	343942
3	University	267145
4	Government	32612
5	Hospital	22346
6	Institutes	722
7	Other	318400

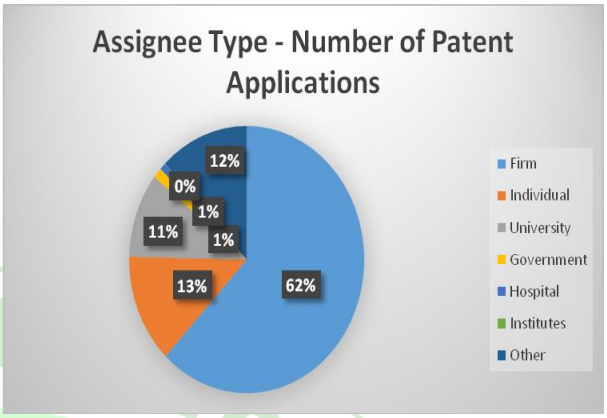

Fig. 5: Assignee Type

IPC Group Data:

All patents are systematically classified according to their specific technical field. Though various national classification systems exist, the International Patent Classification (IPC) system is a common system shared by all patent offices. Further information on the IPC, including how to use keywords to find the right classification, is at, http://www.wipo.int/classifications/ipc. To this research study further attempt was made to analyze the micro areas of technologies, based on the IPC group code assigned to each patent by respective authorities. A definition for each of those IPC groups is provided in below mentioned Table 6. Attempt was made to identify top fifty such IPC groups which have maximum of patents classified with said code. Based on the aspect and scope of each patent application, respective authorities may assign one or more IPC to patents.

Table 6: Top IPC Group with Definition of Groups.

Sr. No.	IPC Group	Group Definition	Total
1	A61K31/00	Medicinal preparations containing organic active ingredients	1261187
2	A61K9/00	Medicinal preparations characterised by special physical form	459475
3	A61P35/00	Antineoplastic agents	385571
4	A61K38/00	Medicinal preparations containing peptides	370702
5	A61P25/00	Drugs for disorders of the nervous system	323895
6	A61K36/00	Medicinal preparations of undetermined constitution containing material from algae; lichens; fungi or plants; or derivatives thereof	315321
7	A61K47/00	Medicinal preparations characterised by the non active ingredients used	291066
8	A61K8/00	Cosmetics or similar toilet preparations	287541
9	A61P31/00	Antiinfectives	276111
10	A61P43/00	Drugs for specific purposes	273346
11	A61K39/00	Medicinal preparations containing antigens or antibodies	269200
12	A61P9/00	Drugs for disorders of the cardiovascular system	261140
13	A61P3/00	Drugs for disorders of the metabolism	236061
14	A61P1/00	Drugs for disorders of the alimentary tract or the digestive system	228776
15	A61P29/00	Non central analgesic; antipyretic or antiinflammatory agents; e.g antirheumatic agents ; Non steroidal antiinflammatory drugs	226012
16	C12N15/00	Mutation or genetic engineering ; Dna or rna concerning genetic engineering; vectors	225498
17	A61K45/00	Medicinal preparations containing active ingredients	214707

Sr. No.	IPC Group	Group Definition	Total
18	C07K14/00	Peptides having more than 20 amino acids ; Gastrins ; Somatostatins ; Melanotropins ; Derivatives thereof	203639
19	A61P17/00	Drugs for dermatological disorders	202024
20	A61K35/00	Medicinal preparations containing material or reaction products thereof with undetermined constitution	198189
21	A61P37/00	Drugs for immunological or allergic disorders	194517
22	A61P11/00	Drugs for disorders of the respiratory system	162701
23	A61P19/00	Drugs for skeletal disorders	158552
24	C07D401/00	Heterocyclic compounds containing two or more hetero rings; having nitrogen atoms as the only ring hetero atoms; at least one ring being a six membered ring with only one nitrogen atom	154391
25	C07K16/00	Immunoglobulins	152001
26	A61Q19/00	Preparations for care of the skin	138505
27	G01N33/00	Investigating or analysing materials by specific methods	130134
28	C12N5/00	Undifferentiated human; animal or plant cells	126967
29	A61P7/00	Drugs for disorders of the blood or the extracellular fluid	109407
30	A61P13/00	Drugs for disorders of the urinary system	109154
31	A61K48/00	Medicinal preparations containing genetic material which is inserted into cells of the living body to treat genetic diseases ; Gene therapy	105488
32	A61P27/00	Drugs for disorders of the senses	104837
33	C12Q1/00	Measuring or testing processes involving enzymes or micro organisms	98424
34	C07D413/00	Heterocyclic compounds containing two or more hetero rings; at least one ring having nitrogen and oxygen atoms as the only ring hetero atoms	97638
35	C07D471/00	Heterocyclic compounds containing nitrogen atoms as the only ring hetero atoms in the condensed system; at least one ring being a six membered ring with one nitrogen atom	96795
36	A61P15/00	Drugs for genital or sexual disorders	96633
37	C07D403/00	Heterocyclic compounds containing two or more hetero rings; having nitrogen atoms as the only ring hetero atoms	91121
38	C07D405/00	Heterocyclic compounds containing both one or more hetero rings having oxygen atoms as the only ring hetero atoms; and one or more rings having nitrogen as the only ring hetero atom	90609
39	C07D417/00	Heterocyclic compounds containing two or more hetero rings; at least one ring having nitrogen and sulfur atoms as the only ring hetero atoms	89501
40	A61K33/00	Medicinal preparations containing inorganic active ingredients	87157
41	C07D487/00	Heterocyclic compounds containing nitrogen atoms as the only ring hetero atoms in the condensed system	79894
42	A61Q5/00	Preparations for care of the hair	75407
43	C12N1/00	Micro organisms	72363
44	C12P21/00	Preparation of peptides or proteins	70088
45	C07D409/00	Heterocyclic compounds containing two or more hetero rings; at least one ring having sulfur atoms as the only ring hetero atoms	67297

Sr. No.	IPC Group	Group Definition	Total
46	C07D213/00	Heterocyclic compounds containing six membered rings; not condensed with other rings; with one nitrogen atom as the only ring hetero atom and three or more double bonds between ring members or between ring members and non ring members	58355
47	A61P5/00	Drugs for disorders of the endocrine system	57773
48	A23L1/00	Foods or foodstuffs ; Their preparation or treatment	56979
49	C12N9/00	Enzymes	54366
50	A61P21/00	Drugs for disorders of the muscular or neuromuscular system	53022

Technology Topics:

After analyzing the full patent data set to find out top fifty IPC groups to identify the micro areas of research, and attempt was made to define a macro level areas of all these patent documents. To see the macro areas of research, the patent documents data set was further been grouped into various groups of Technology Topics, the total area of records related to particular technology topics were been shown in below Figure 6, the size of particular technology topics in below figure is related and based as the total number of patent documents pertains to said domain in present study dataset.

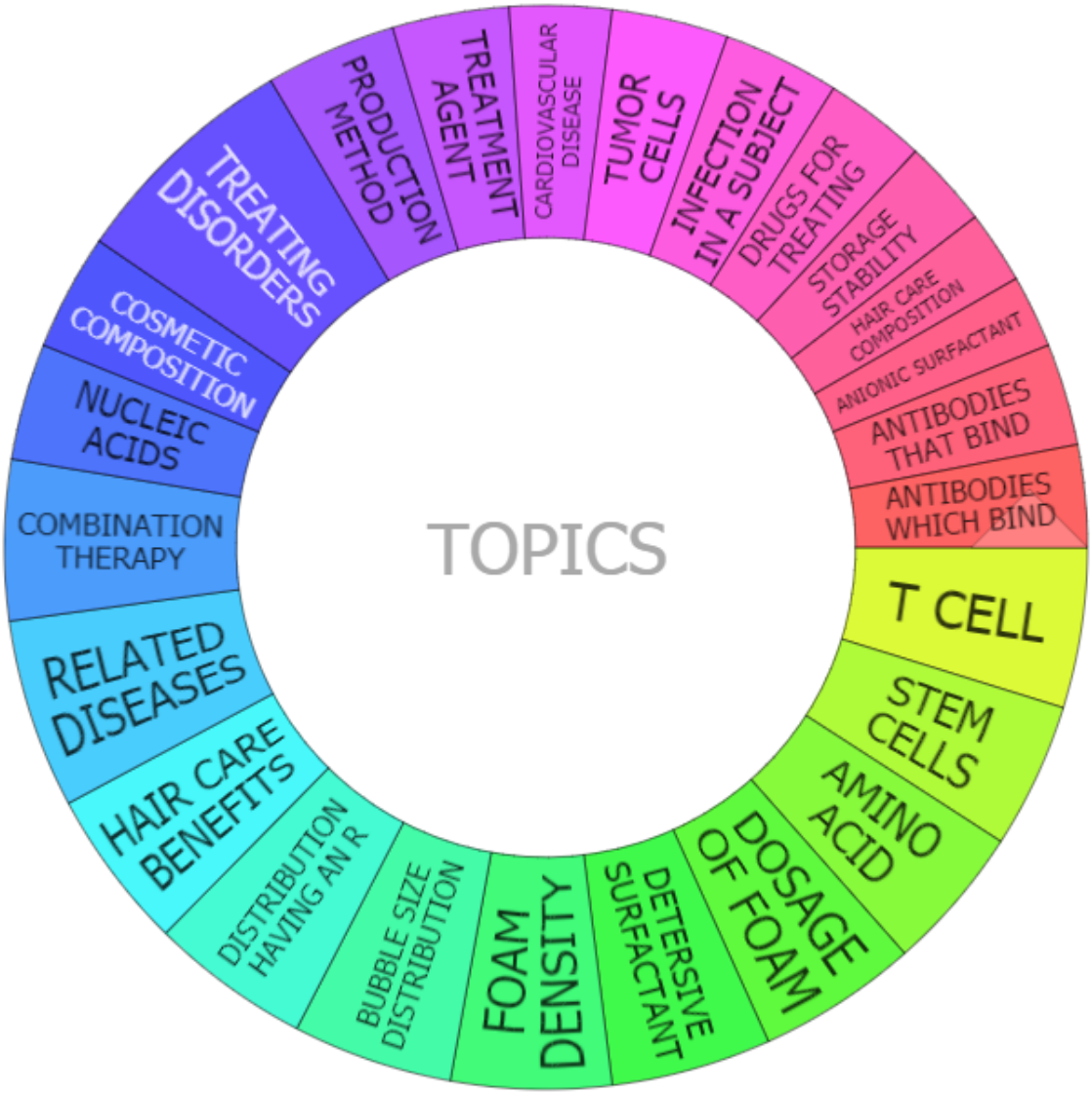

Fig. 6: Technology Topics

CONCLUSION

This analysis of patent trends between 2000 and 2017 in the area of medical, dental and toilet preparations including of pharmaceuticals, provided the patent

situation (globally) in the said areas by means of patent information analysis. Based on IPC classifications assigned to patents/application, the study categorizes the inventions in the domains of medical, dental and toilet preparations including of pharmaceuticals in to various groups. It was found that most of the research in this area was carried out in US followed by china. It was also concluded that apart from patent applications and granted patents in this domain, large number of patents are in inactive phase due to the reason either of withdrawal, surrender, expired, nonpayment of fees, rejected, refused or suspended. From patenting trend it was been evident that, there was no such reportable increase in filing of patent applications in this domain, but it is been observed that total number of grant for patent in this domain was increased in consistent manner, year on year basis. Analysis was made to identify major current owners of technologies, and top 50 assignees had been identified with total number of patents they are holding. Further analysis was made to categorize the patent applications and patents, based on the type of assignee. From this it was evident that, majority of patents were hold by firms, followed by individual and university as assignees. Further the innovations were grouped and analyzed based on micro level in various technical fields, based on various IPC group codes. In current study top IPC groups were been identified, to which area a maximum of patent applications are been filed. Patent data was also grouped in various broad technology topics, to identify topic area of research on macro level.

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