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Research Output of Greenhouse Effect in India: A Scientometric Analysis

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Abstract

The research Article presents a Scientometric analyst of research output in India in the field of Greenhouse Effect during the period of 2001 to 2017 as reflected in SCOPUS Database. Collected data for a total of 568 have been published in India in the field of Greenhouse effect and it's analyzed according to objectives. The research paper reveal that the year wise growth of literature in terms of year wise growth in the number of publications, subject areas leading to maximum publications, international affiliations, relative growth rate, doubling time and the individual contributions of authors to name a few and their publication reveals that Tiwari, G.N published highest number of papers 21 (3.70%), Document Wise Distribution show that the most number of documents are of the type article totaling to 395 (69.54%) publications. Foreign Countries Contribution in India shows that The United States of America (USA) has the top rate of involvement with 60 (31.91%).

Key Words: Scientometrics Analysis, Greenhouse Effect, Relative Growth Rate, India, Source Type, SCOPUS.

1. Introduction

This research aims to study and scrutinize the SCOPUS database on publications in India regarding Greenhouse Effect and work out statistics concerning the yearly growth in the number of publications, discerning the Ranking of Individual Authors, considerate the degree of Individual Contributions by Indian Universities / Institution and understanding the rate of reappearance of keywords.

2 Review of Literature

Vimlesh Patel (2018) studied Scientometrics analysis of papers published in Journal of Artificial Intelligence Research in the period of 2010 to 2016. His research reveals that highest number of papers published in 2014 with 68 (16.92%). In country wise publication studied that USA in the highest publication with 138 (34.33%) and followed by England 56 (13.93%). It has been found that highest contributed institutions was University Of Oxford with 17 Publications during the research period 2010 to 2016.

R.Senthilkumar and S. Abirami (2018) Analysed Bibliometric study that output of International Journal of paediatric Surgery. The data collected (Totally 28 years) from 1989 to 2016 retrieved from Web of Science (WOS). Based on this, the year 1998 has got the high level score of 273 (4.9 %) research output. In 1998 the rate of publication output in International Journal of paediatric Surgery was very high compared to other years. A majority of the researchers contributed their research output by the way of articles with the highest number of 4518 out of 5528 records.

3. The Main Objectives for this Analysis

- To study and analyze year wise research output in terms of total paper.
- To find out the individual contribution of the top ten authors.
- To Figure out the Subject Areas Contributing to the Highest Number of Publications
- To analysed the popularity of document wise distribution.
- To study and distinguish the top ten source type of the publications.
- To Classify the top ten Foreign Countries Contribution in India
- To Study the rate of recurrence of the top ten keywords.
- To find out the top ten Indian universities / Institution with the maximum number of publications.

4. Data Collections

This study is solely based on the source documents and research data of publications in India based on Greenhouse Effect compiled from the SCOPUS database over the period of 2001 to

2017. The entire data is fetched using the search key of Greenhouse Effect. The compiled data is extracted inside MS Office for study.

5. Results and Discussions

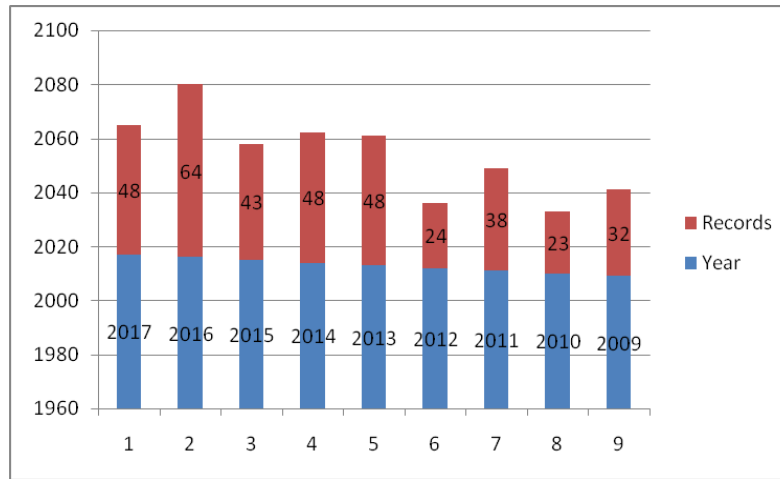
5.1. Year Wise Growth in Publications

Table 1 show that the top 17 years and start with the highest number of publications. This study analyses the publications published for a time frame of 17 years starting from 2001 to 2017. This duration resulted in the publication of 568 publications. This analysis showed that the most number of publications where published in the year 2016 with 79 (11.27%) and followed by 2013, 2014, 2017 with 48 (8.45%) publications being published. (Table 1 and Figure 1 show 17 years publications).

Table 1: Year Wise Growth in Publications

Year	Records	Percentage	Cum.	Cum. %
2017	48	8.45	48	8.45
2016	64	11.27	112	19.72
2015	43	7.57	155	27.29
2014	48	8.45	203	35.74
2013	48	8.45	251	44.19
2012	24	4.23	275	48.42
2011	38	6.69	313	55.11
2010	23	4.05	336	59.15
2009	32	5.63	368	64.79
2008	25	4.40	393	69.19
2007	28	4.93	421	74.12
2006	31	5.46	452	79.58
2005	22	3.87	474	83.45
2004	28	4.93	502	88.38
2003	28	4.93	530	93.31
2002	19	3.35	549	96.65
2001	19	3.35	568	100
Total	568	100		

Figure 1: Year Wise Growth in Publications



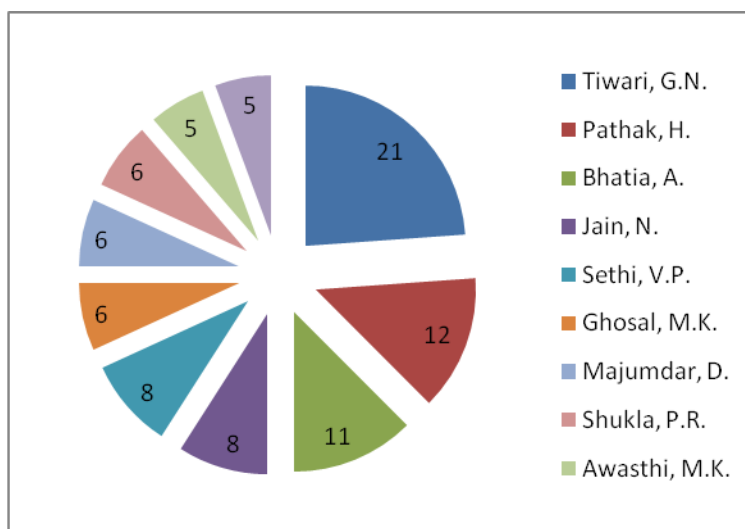
5.2 Ranking of Individual Authors

Table 2 shows the top ten authors who have contributed the most publications. Totally 160 are responsible for the papers published in the field of Greenhouse effect in India, with Tiwari, G.N. making the highest number of contributions with 21 (3.70%) followed by Pathak, H with 12 (2.11%) publications. (Table 2 and Figure 2 show the Ranking of Individual Authors).

Table 2: Ranking of Individual Authors

Sl. No.	Author	Records	%
1	Tiwari, G.N.	21	3.70
2	Pathak, H.	12	2.11
3	Bhatia, A.	11	1.94
4	Jain, N.	8	1.41
5	Sethi, V.P.	8	1.41
6	Ghosal, M.K.	6	1.06
7	Majumdar, D.	6	1.06
8	Shukla, P.R.	6	1.06
9	Awasthi, M.K.	5	0.88
10	Garg, A.	5	0.88

Figure 2: Ranking of Individual Authors



5.3 Subject Areas Contributing to the Highest Number of Publications

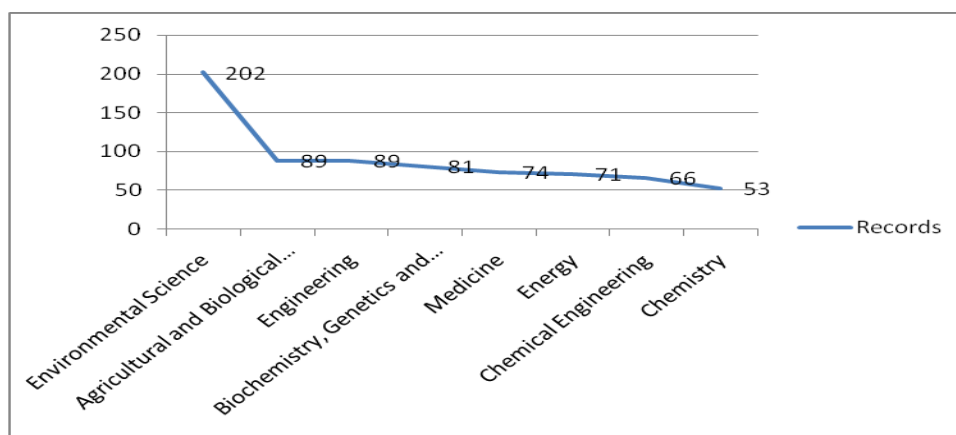
Table 3 shows the top most popular subject areas in the published papers with Environmental Science taking the first position with 202 (20.9%) publications, Agricultural and Biological Sciences, Engineering coming in second with 89 (9.2%) publications. Arts and Humanities occupy the last position along with total of 24 publications. (Table 3 and Figure 3 show the Subject Areas Contribution)

Table 3: Subject Areas Contribution

Subject Area	Records	%
Environmental Science	202	20.9
Agricultural and Biological Sciences	89	9.2
Engineering	89	9.2
Biochemistry, Genetics and Molecular Biology	81	8.4
Medicine	74	7.6
Energy	71	7.3
Chemical Engineering	66	6.8
Chemistry	53	5.5
Earth and Planetary Sciences	51	5.3
Multidisciplinary	34	3.5
Immunology and Microbiology	31	3.2
Pharmacology, Toxicology and Pharmaceuticals	31	3.2
Materials Science	26	2.7
Computer Science	20	2.1

Physics and Astronomy	12	1.2
Social Sciences	12	1.2
Mathematics	7	0.7
Business, Management and Accounting	6	0.6
Economics, Econometrics and Finance	3	0.3
Nursing	3	0.3
Health Professions	2	0.2
Neuroscience	2	0.2
Veterinary	2	0.2
Arts and Humanities	1	0.1
Total	968	100

Figure 3: Subject Areas Contribution



5.4. Document Wise Distribution

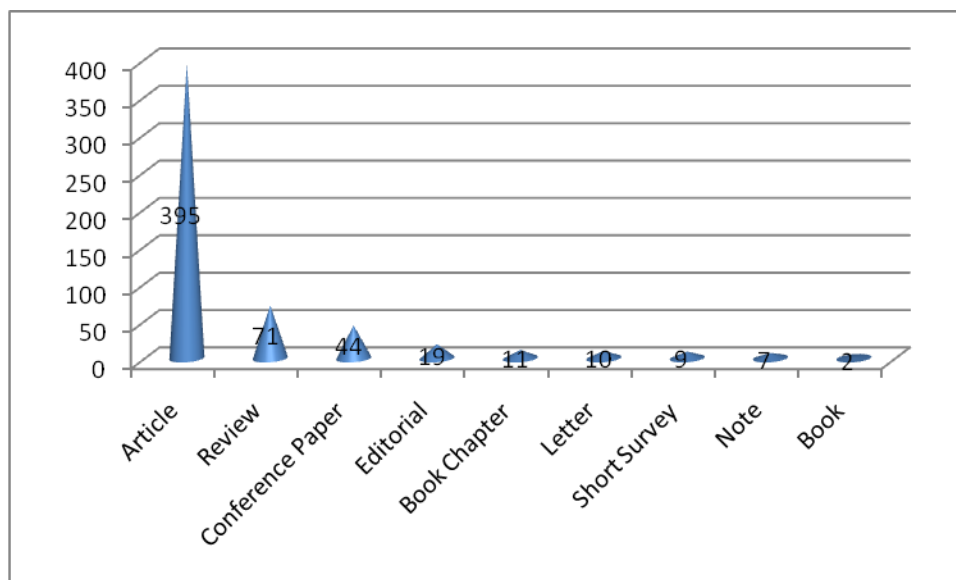
Table 4 shows the different document types published in India on the topic of Greenhouse Effect. The investigation points out that the most number of documents are of the type article totaling to 395 (69.54%) publications with Review occupying the second position with 71 (12.50%) publications. Book the least number of documents with 2 (0.35%) publications. (Table 4 and Figure 4 show that Document Wise Distribution)

Table 4: Document Wise Distribution

Sl. No	Document Type	Records	%
1	Article	395	69.54
2	Review	71	12.50
3	Conference Paper	44	7.75
4	Editorial	19	3.35

5	Book Chapter	11	1.94
6	Letter	10	1.76
7	Short Survey	9	1.58
8	Note	7	1.23
9	Book	2	0.35
Total		568	100

Figure 4: Document Wise Distribution



5.5. Top Ten Source Titles

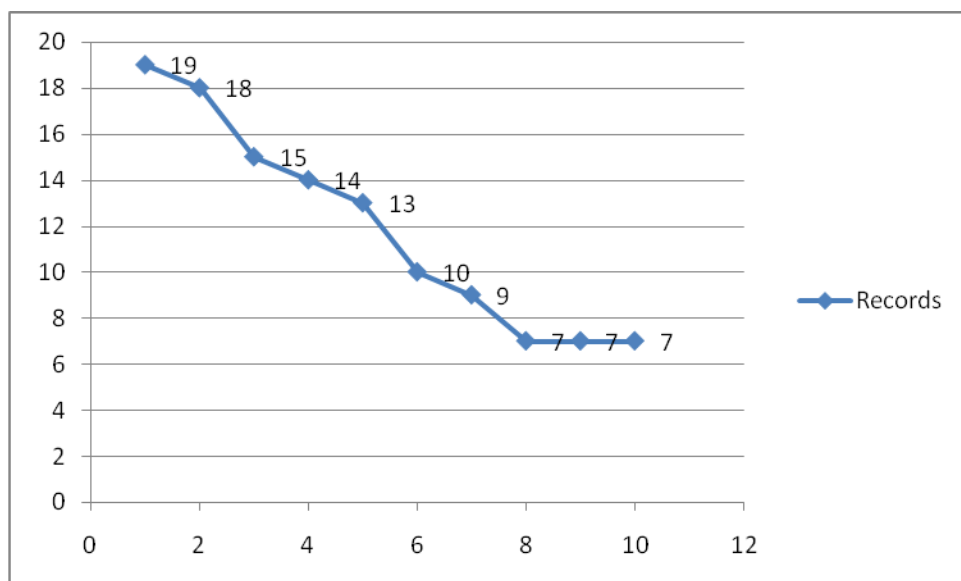
Table 5 shows the show the top 10 source titles of publications published in India based on Greenhouse Effect. The mentioned topic provided to 160 source titles of publications. The maximum number of publications where provided to the Environmental Monitoring And Assessment 91 (15.97%) with publications and Atmospheric Environment coming in second position with 18 (15.13%) publications. (Table 5 and Figure 5 show that Top Ten Source Titles)

Table 5: Top 10 Source Titles

Sl. No	Source Title	Records	%
1	Environmental Monitoring And Assessment	19	15.97
2	Atmospheric Environment	18	15.13
3	International Journal Of Chemtech Research	15	12.61
4	Science Of The Total Environment	14	11.76

5	Bioresource Technology	13	10.92
6	Energy Conversion And Management	10	8.40
7	Journal Of Chemical And Pharmaceutical Sciences	9	7.56
8	Chemosphere	7	5.88
9	Indian Journal Of Occupational And Environmental Medicine	7	5.88
10	Science	7	5.88
Total		119	100

Figure 5: Top 10 Source Titles



5.6. Recurrences of Keywords

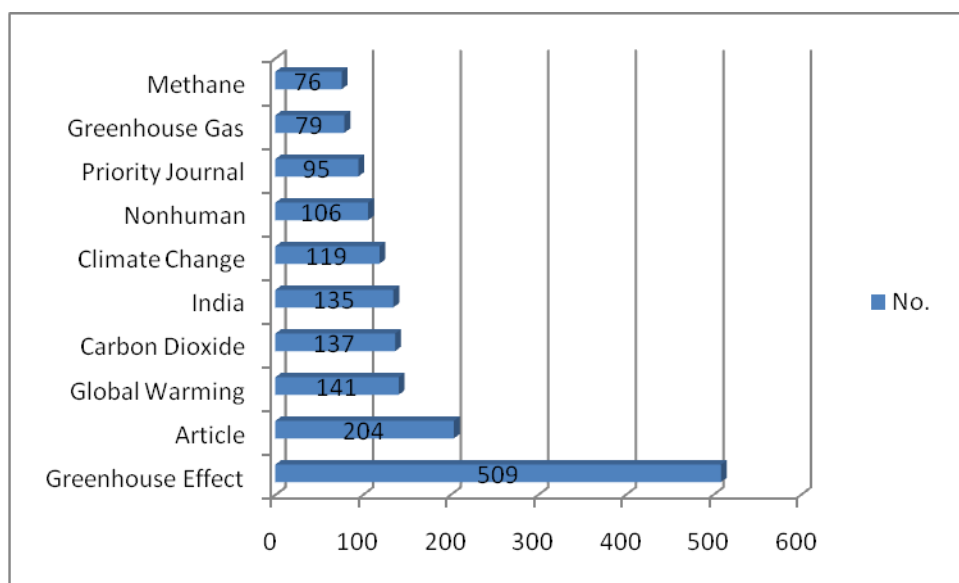
Table 6 shows the top 10 most frequently persistent keywords in publications related to Greenhouse Effect. The study shows that the most commonly occurring keywords are Greenhouse Effect, Article and Global Warming with a recurrence percentage of 31.79%, 12.74% and 8.81% respectively. Methane takes the end position in the top ten with a recurrence percentage of 4.75%. Table 6 and Figure 6 show that Recurrence of Keywords)

Table 6: Recurrences of Keywords

Sl. No.	Keyword	No.	%
1	Greenhouse Effect	509	31.79
2	Article	204	12.74
3	Global Warming	141	8.81
4	Carbon Dioxide	137	8.56
5	India	135	8.43

6	Climate Change	119	7.43
7	Nonhuman	106	6.62
8	Priority Journal	95	5.93
9	Greenhouse Gas	79	4.93
10	Methane	76	4.75
Total		1601	100

Figure 6: Recurrences of Keywords

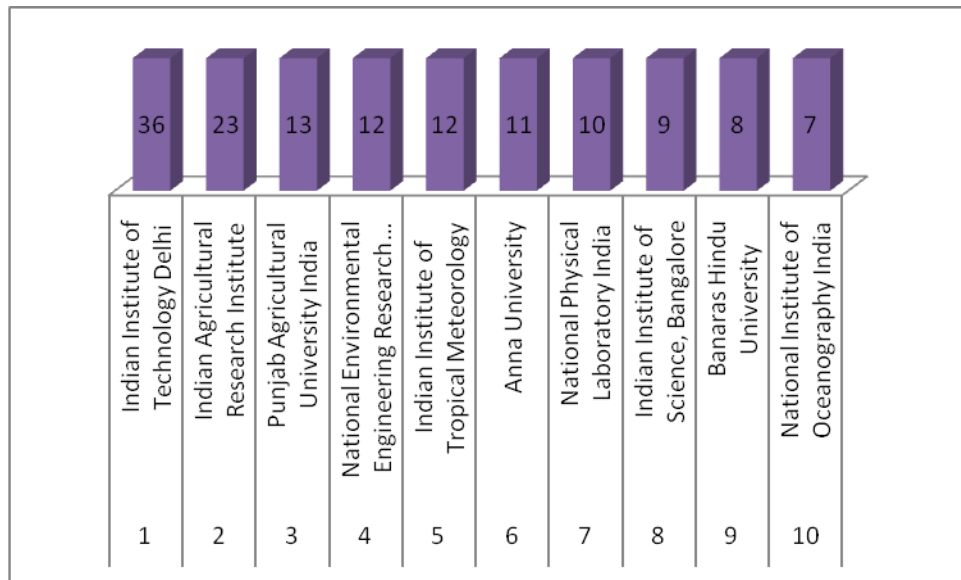


5.7. Individual Contributions by Indian Universities / Institution

Entirely 160 Universities in the India level have contributes publications on the term of Greenhouse Effect. Table 7 shows the top 10 Universities with the highest number of contributions. The Indian Institute of Technology Delhi has made the maximum number of publications at 36 (25.53%) publications, followed by Indian Agricultural Research Institute with 23 (16.31%) publications. Punjab Agricultural University India is the 3rd Position with 13 (9.22%) publications. National Environmental Engineering Research Institute India and Indian Institute of Tropical Meteorology come in a joint 4th position with 10 publications each.

Table 7: Individual Contributions by Indian Universities

Sl. No	University / Institution	Records	%
1	Indian Institute of Technology Delhi	36	25.53
2	Indian Agricultural Research Institute	23	16.31
3	Punjab Agricultural University India	13	9.22
4	National Environmental Engineering Research Institute India	12	8.51
5	Indian Institute of Tropical Meteorology	12	8.51
6	Anna University	11	7.80
7	National Physical Laboratory India	10	7.09
8	Indian Institute of Science, Bangalore	9	6.38
9	Banaras Hindu University	8	5.67
10	National Institute of Oceanography India	7	4.96
Total		141	100

Figure 7: Individual Contributions by Indian Universities

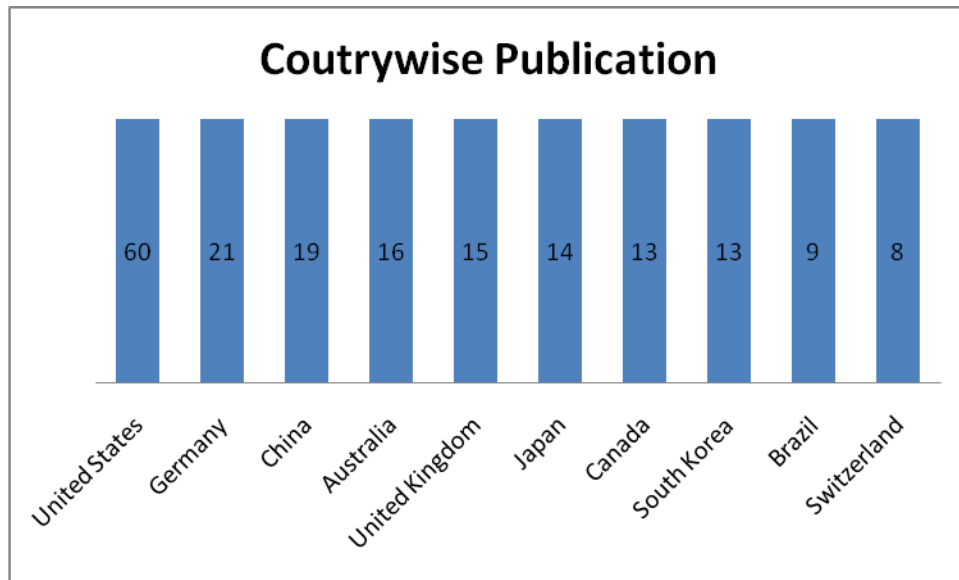
5.8. Foreign Countries Contribution in India

Table 8 shows the top ten foreign countries with the highest involvement in India on the subject of Greenhouse Effect (188 Publication). The analysis of the data shows that The United States of America has the top rate of involvement with 60 (31.91%). Germany comes in the second position with 21 (11.17%) publications followed by China in 3rd Position with 19 (1.11%) and So on. Switzerland comes in 10th position with 8 (4.26) publications on the referred subject of Greenhouse Effect.

Table 8: Foreign Countries Contribution in India

Sl. No	Countries	Records	%
1	United States	60	31.91
2	Germany	21	11.17
3	China	19	10.11
4	Australia	16	8.51
5	United Kingdom	15	7.98
6	Japan	14	7.45
7	Canada	13	6.91
8	South Korea	13	6.91
9	Brazil	9	4.79
10	Switzerland	8	4.26
Total		188	100

Figure 8: Foreign Countries Contribution in India



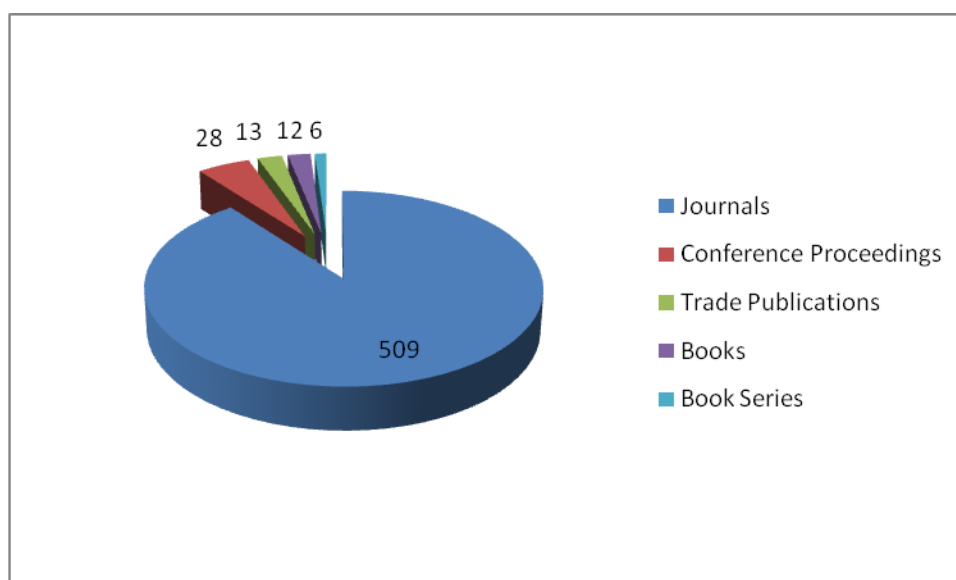
5.9. Source Types of Publications

Table 9 shows the source type of publications in India on the subject of Greenhouse Effect. The analysis shows that the most number of publications were made to journals with 509 (89.61%) publications followed by conference proceedings with 28 (4.93%) publications, Trade Publication with 13 (2.29%). Books Series are the least common source type with 6 (1.06%) publications.

Table 9: Source Type of Publications

Sl. No	Source Type	Records	%
1	Journals	509	89.61
2	Conference Proceedings	28	4.93
3	Trade Publications	13	2.29
4	Books	12	2.11
5	Book Series	6	1.06
Total		568	100

Figure 9: Source Type of Publications



6. Conclusions

This analysis was conducted on the publications published in India on the subject of Greenhouse Effect within the time duration of 17 years starting from 2001 to 2017. During this time a total of 64 papers were published with 2014 being the year which resulted in the maximum number of publications. Tiwari, G.N was determined as the author to make the highest number of contributions with 21 (3.70%) publications. The United States of America has the top rate of involvement with 60 (31.91%) publication in India. The Indian Institute of Technology Delhi has made the maximum number of publications at 36 (25.53%) publications, followed by Indian Agricultural Research Institute with 23 (16.31%) publications.

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