Scientometric Analysis of Air Pollution Research Publications from SCOPUS Database During 2014-2018

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Abstract - *The present study analyzes the air pollution research publications are contributed in the SCOPUS online database during the period from 2014 to 2018 with 37394 research publications. This study analyzes the year wise growth of publications, top 10 authors contributions, document types, authorship pattern, authors contribution, degree of collaboration and top ten country wise distributions. During the study period, it is identified that maximum number of 8723 (23.33%) research publications are contributed in the year 2017, top ranking author is Koutrakis P with 129 (13.89%) research publications, maximum of 26997 (72.20 %) research publications are contributed by articles. Maximum of 6035 (16.14 %) publications are contributed by three authors, Average author per paper is 3.82 author's and average paper per author is 0.26 publications, average degree of collaboration is 0.91 and maximum of 9042 (29.39%) research publications are contributed by the United States.*

Key Words: Scientometric, Bibliometric, air pollution, authorship pattern and degree of collaboration

Introduction

Air pollution may be defined as "the presence of one or more contaminants like dust, smoke, vapor and smell in the atmosphere which are injurious to human beings, plants and animals". Rapid industrialization, fast urbanization, growth of population, drastic increase in vehicles on the roads and other activities of human beings has been disturbed the natural atmosphere[1]. In earlier days men started cooking with firewood, which leads to the origin of air pollution.

But the emergence of the utilization of coal started real air pollution. The beginning of 20th century adds fuel to the fire by means of transportation using petrol and diesel towards more air pollution. The petrochemical smoke emits from the combustion engines causes serious environmental issues worldwide.

Air pollution refers to the condition in which the existence of toxic substances in the atmosphere, generated by various human activities and natural phenomena such as volcanic eruptions, results in damaging effects on the welfare of human beings and the living environment[2]. More recently, there has been growing concern about various global changes, notably planetary warming due to elevated concentrations of greenhouse gases, such as carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons in the atmosphere.

Scientometrics

Scientometric is a study to measure the performance of researchers as well as the research publications. The research activities contain major changes over the last few decades and emerged as an established research in the discipline of "Library and Information Science". *The* study *of* scientific literature has *a* long history*d*ating back to the early decades of the past century. However, despite in the number of research literature in this area it was not until 1969, that the term bibliometrics first appeared in print (Pritchard, 1969)[3]. Definition of bibliometric was 'application of mathematical and statistical methods to books and other media of communication', particularly in North America, the term was quickly adopted and used (Wilson, 1999)[4]. At the same time, Nalimov and Mulchenko (1969)[5] coined the term scientometrics to refer to 'the application of quantitative methods which are dealing with the analysis of science viewed as an information process'. In contrast, this term was widely used in Europe (Wolfram, 2003)[6]. Initially, therefore, scientometrics was restricted to the measurement of science communication, whereasbibliometrics was designed to deal with more general information processes[7].

Review of Literature

Sivasami (2018)[8] analyzed the soil pollution research publications from 2002 to 2016with 1528 research publications. During the study period Maximum of 75% of soil pollution research papers were published in the form of articles. Nearly 80 percent of papers were published in English language and China has top ranking countries with 640 publications.
Sudhakar and Thanuskodi (2018)[9] analyzed the scientometric analysis of Marine Pollution Bulletin Journal research publications from 2008 to 2017 with 5416 publications. Maximum numbers of 905(16.71%) publications are contributed in the year 2017. This study identified RGR has been decreased from 0.63 to 0.18 and the same time doubling time has been increased from 1.10 to 3.85. The degree of collaboration was 0.94, which clearly indicates its dominance of multiple author's contributions. Liu J. was the top ranked authors with 49 articles. Maximumnumbers of 910 (12.06%) publications are contributed by United States.
Dhanya and Raja (2017)[10] analyzed the Indian research output of industrial pollutionindexed in the Web of Science database with 805 publicationsduring 2007-2016 which received 9699citations. Kumar A and Kumar R are the most productive authors with 13 (1.6%) publications. The most productive journal is Environmental Monitoring and Assessment with 103 (12.8%) publications and the maximum of articles are published in the year 2016 with 113(14%) publications.Relative Growth Rate is 0.16 in the year 2016 and Doubling Time is 4.58 in the year 2016.

Vivekanandhan, Sivasamy and Bathri Narayanan (2016)[11] analyzed the pollution control research output from the SCOPUS database during the period of 1985-2014. They analyzed his study growth of literature, number of citations and bibliographic distribution. Further they analyzed scientometric tools such as authorship pattern, Citation Index, Collaborative Coefficient, modified collaborative coefficient and block year wise publications. Maximum numbers of 13692 (25.43%) publications are contributed in the 6thblock of 2010 – 2014 and block year wise average degree of collaboration was 0.72.

Objectives of the study

- To identify the year wise growth of publications
- To identified the top ten authors contributions
- To find out the document types of publications
- To identified the authorship pattern and authors contributions.
- To analyze the degree of collaborations
- To identified the top 10 countries contributions

Methodology

Data has been download in the field of Air Pollution research publications from SCOPUS online database during the period of 2014-2018, and the following search strategy has been used in the combined field of Title, Abstract & Keywords. The search query is: (TITLE-ABS-KEY("Air Pollution") AND PUBYEAR > 2014 AND PUBYEAR < 2018. This study used a total number of 37394 research publications in global level. The collected data has been analyzed using MS Excel.

Year-wise distribution of publications

Table -1 Year-wise growth of publications

S.No	Year	Publications	%	Commutative	%
1	2014	6556	17.53	6556	17.53
2	2015	6479	17.33	13035	34.86
3	2016	6945	18.57	19980	53.43
4	2017	8723	23.33	28703	76.76
5	2018	8691	23.24	37394	100
Total		**37394**	**100**		

Table -1 show that year wise growth of publications from 2014 to 2018 with a total number of 37394 research publications. Among the study period it is identified that, the year 2017 has contributed maximum number of 8723 (23.33%) research publications. Followed by, the year 2018 with 8691(23.24%) research publications and 2016 has third place with 6945(18.57%) research publications.The average research publication per year is 7479 in the field of air pollution research.

Top 10 Author's Contributions

Table -2 Top ten author's contributions

S. No	Authors	Publications	%
1	Koutrakis, P.	129	13.89
2	Hoek, G.	111	11.95
3	Kan, H.	108	11.63
4	Brunekreef, B.	92	9.90
5	Sunyer, J.	84	9.04
6	Querol, X.	83	8.93
7	Kloog, I.	82	8.83
8	Hao, J.	81	8.72
9	Cao, J.	80	8.61
10	Morawska, L.	79	8.50
Total		**929**	**100**

Table-2 shows that, top 10 author's contributions in the field of air pollution research publications for the selected five years study period. It is identified from the table-2, the highest number of top-ranking author is Koutrakis, P with 129 (13.89%) research publications, followed by 2nd rank author is Hoek G.with 111 (11.95 %) publications and third ranking author is Kan H.with 108 (11.63%) publications. The top ten authors are contributed with 929 research publications.

Document Types

Table-3 Document Types

S. No	Document Type	Publications	%
1	Article	26997	72.20
2	Conference Paper	5202	13.91
3	Review	2138	5.72
4	Book Chapter	863	2.31
5	Note	732	1.96
6	Editorial	545	1.46
7	Letter	441	1.18
8	Short Survey	136	0.36
9	Book	118	0.32
10	Conference Review	77	0.21
11	Erratum	62	0.17
12	Data Paper	17	0.05
13	Business Article	7	0.02
14	Retracted	4	0.01
15	Abstract Report	2	0.01
16	Undefined	53	0.14
Total		**37394**	**100**

Table-3 shows that the document type of air pollution research publications during the five years study period. From the study it is identified that, maximum of 26997 (72.20%) research publications are contributed by article, followed by 5202 (13.91%) publications are conference paper and 2138 (5.72%) publications are review. From the study, it is identified

that top three documents like article, conference paper and review are contributed more than 90% of total publications.

Authorship Pattern

Table - 4 Authorship Pattern

Year	Anon.	1	2	3	4	5	6	7	8	9	>9	Total
2014	111	601	966	1154	1043	788	564	392	273	179	485	6556
2015	101	587	892	1075	947	806	582	432	321	211	525	6479
2016	53	598	955	1082	1018	868	659	467	312	280	653	6945
2017	147	1062	1293	1346	1231	927	710	510	400	229	868	8723
2018	60	725	1217	1378	1248	1075	757	597	451	319	864	8691
Total	472	3573	5323	6035	5487	4464	3272	2398	1757	1218	3395	37394
%	1.26	9.56	14.23	16.14	14.67	11.94	8.75	6.41	4.70	3.26	9.08	100.00

Table-4 shows that the authorship patternin the field of air pollution research publications during the selected five years study period. From the study it is identified that, maximum of 6035(16.14%) publications are contributed by three authors. Followed by, four authors with 5487(14.67%) publications, 5323(14.23%) publications are contributed by two author contributions with third place. During the study it is identified that more than nine authors are contributed 3395 (9.08) research publications and anonymous authors are contributed 472(1.26%) research publications.

Authors Contributions

Table-5 Authors Contributions

Year	Anon	1	2	3	4	5	6	7	>7	Total Authors	%	AAPP	APPA
2014	111	601	1932	3462	4172	3940	3384	2744	11287	31522	16.77	4.21	0.24
2015	101	587	1784	3225	3788	4030	3492	3024	12443	32373	17.23	4.06	0.25
2016	53	598	1910	3246	4072	4340	3954	3269	14168	35557	18.92	3.89	0.26
2017	147	1062	2586	4038	4924	4635	4260	3570	17861	42936	22.85	3.41	0.29
2018	60	725	2434	4134	4992	5375	4542	4179	19167	45548	24.24	3.59	0.28
Total	472	3573	10646	18105	21948	22320	19632	16786	74926	187936	100	3.77	0.27
%	0.25	1.9	5.66	9.63	11.68	11.88	10.45	8.93	39.87	100		3.82	0.26

Table- 5 shows that authors contribution in the field of air pollution research publications during the selected five years study period a total number of 37394 research publications are contributed by 187936 authors. From the study it is identified that more than seven authors are contributed with 74926(39.87%) authors. Followed by five authors are contributed with 22320(11.88%) authors, four authors are contributed with 21948(11.68%) authors, six authors are contributed with 19632(10.45%) authors. This study identified that AAPPis 3.82 authors and APPA is 0.26 publications.

Degree of collaboration

Table- 6 shows that, degree of collaboration between single-authored publications with multi authored publications on air pollution research during the five year study period. Subramanyan (1983)[12] formula has been adopted to examine the extent of research collaboration in the study, and the same where as used by Sivasamy K (2015)[13]

$$DC = Nm/ (Ns + Nm)$$

Whereas DC=Degree of Collaboration in a subject field Nm=Number of multiple authored papers, Ns = Number of single-authored papers.

Table-6 Degree of Collaboration

Year	Anon.	%	Single Author Publications (Ns)	%	Multi Author Publications (Nm)	%	Degree of Collaboration (DC) =Nm/(Nm+Ns)
2014	111	0.297	601	1.61	5844	15.6	0.91
2015	101	0.27	587	1.57	5791	15.5	0.91
2016	53	0.142	598	1.6	6294	16.8	0.91
2017	147	0.393	1062	2.84	7514	20.1	0.88
2018	60	0.16	725	1.94	7906	21.1	0.92
Total	**472**	**1.262**	**3573**	**9.56**	**33349**	**89.2**	**0.90**

The degree of collaborations is calculated for the five years study period from 2014 to 2018. During the study period, it is identified from the table- 6, the degree of collaboration is 0.88 in the year 2017 and 0.92 in the year 2018. The average degree of collaboration is 0.90 and it is confirmed that the degree of collaboration is fluctuation trend.

Top 10 Country-wise Research Publications

Table-7 Top 10 Country-wise growth of air pollution research publications

S.No	Country	Publications	%
1	United States	9042	29.39
2	China	8594	27.93
3	United Kingdom	2515	8.17
4	Italy	1898	6.17
5	India	1769	5.75
6	Canada	1604	5.21
7	Germany	1601	5.20
8	France	1345	4.37
9	Spain	1248	4.06
10	Japan	1150	3.74
Total		30766	100

Table- 7 shows that, top 10 country wise growth of air pollution research publications during the 5 year study period. It is identified that, maximum number of 9042(29.39%) research publications are contributed by the United States, followed by China with 8594(27.93%) research publications, United Kingdom with 2515(8.17%) publications, Italy with 1898(6.17%), India has fifth place with 1769(5.75%) research publications.

Major Findings

- During the five year study period a total number of 37394 research publications are contributed in the field of Air Pollution research and maximum of 8723(23.33%) research publications are identified in the year 2017.
- Top-ranking author is Koutrakis, P with 129 (13.89%) research publications and maximum number of 26997 (72.20%) research publications are contributed by articles.

- Maximum of 6035(16.14%) publications are contributed by three authors and anonymous author contribution is 472 (1.26%) publications.
- Total number of 37394 research publications is contributed by 187936 authors and maximum of 74926(39.87%) authors are contributed by more than seven authors publications.
- Degree of collaboration is 0.88 in the year 2017 and 0.92 in the year 2018 and the average degree of collaboration is 0.90. Out of 37394 publications, United States contributed maximum number of 9042 (29.39%) research publications.

Conclusion

Around the world, air is very important to each and every living organism. Environments are mainly polluted by the air such as human activities, industries, natural hazards and transports. Recent days technologies are increased enormously and the other hand pollutions are increased day by day due to the fast growing technology. During the past two decades developed countries are doing many more researches activities in the field of air pollution research. United States contributed maximum number of 9042 (29.39%) research publications. So that, Ministry of human resource development (MHRD) will be allot many more funds, doing the many more research in the field of air pollution research and save the life of living being.

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