LITERATURE ON OZONE (2000-2015): A BIBLIOMETRIC ANALYSIS

Debabrata Maity

Librarian, Khejuri College, Baratala, Khejuri, Purba Medinipur, India

ABSTRACT

This study is based on 1831 articles on ozone literature published during the years 2000-2015 and archived in Directory of Open Access Journals (DOAJ). Articles have been analysed to observe year wise growth pattern, authorship pattern, degree of collaboration, identification of core journals, subject wise average number of references and objects used per article etc. From the study it is found that there is positive growth on ozone literature and most of the articles are in engineering and technology discipline. Most of the articles are published by 1-5 author(s). Atmospheric Chemistry and Physics is the leading journal for publishing articles on ozone literature.

Key words: Bibliometrics, Ozone Literature, DOAJ

Cite this Article: Debabrata Maity, Literature on Ozone (2000-2015): A Bibliometric Analysis. *International Journal of Library & Information Science*, 7(2), 2018, pp. 71–79.

<http://iaeme.com/Home/issue/IJLIS?Volume=7&Issue=2>

1. INTRODUCTION

Bibliometrics is a major sub-discipline of quantitative research in LIS field. This is a tool traditionally used by the library and information science professionals for studying the communication process, information flows and others for better understanding and effective management and dissemination of information (Rajendiran & Parihar, 2007). Harrod's Librarians' Glossary and Reference Book defines Bibliometrics as "The application of mathematical and statistical methods to the study of the use made of books and other media within and between library systems" (Prytherch, 2005, p. 67). In this paper a bibliometrics study has been done to depict the open access publication pattern in the field of ozone literature.

2. OBJECTIVES OF THE STUDY

The objectives of this study are:

- To see year wise growth rate of ozone literature.
- To analyse authorship from various angles like year wise authorship pattern, single versus multiple authorship, degree of collaboration etc.

- To know language wise distribution of ozone literature.
- To identify core journals publishing ozone literature.
- To observe subject wise distribution of ozone literature.
- To access subject wise references and objects use pattern in ozone literature.

3. METHODOLOGY

For this study, data has been collected from Directory of Open Access Journals (DOAJ) database. 'Ozone' was the search term and has been searched against two criteria i.e. 'title' and 'abstract'. Necessary data related to all the retrieved articles have been collected in Excel Sheet and duplicate record has been removed. Total 1831 articles have been found during the preferred time span. Then data has been tabulated and analysed to fulfil objectives of the study.

4. SCOPE AND LIMITATION

Articles published only in the period of 2000 to 2015 and available only in DOAJ database have been considered for the study. The searched term used was 'ozone'; if any synonymous or related term of 'ozone' has been used in some articles then those are missing from the study.

5. LITERATURE REVIEW

Study of literature in any subject area is an integral part of LIS research. A good number of research articles are available on literature study. Bibliometrics study of laser literature was carried out by Rajendiran and Parihar (2007) to see growth pattern, authorship pattern, subject wise distribution of article etc. Macias-Chapula (2000) studied literature on Acquired Immune Deficiency Syndrome to find types of published documents, authorship pattern and subject content. A study was also carried out by Arunachalam and Gunasekaran (2002) on tuberculosis research in India and China and they identified institutions and cities active in research, core journals, and author collaboration. A study executed on literature on hepatitis (1984-2003) by Ramakrishnan and Babu (2007). They collected data from MEDLINE, CINAHL and IPA databases. Kannappanavar & Vijayakumar (2001) worked on authorship trend and solo versus team research in international monetary fund literature. Clarke (1964) studied on multiple authorship trends in scientific papers. Authorship trend and solo research in bibliometrics was also carried out by Kabir (1994). A work entitled "Bibliometric analysis of 'fiber optics' literature" was carried out by Rajendran, Babu and Gopalakrishnan (2005).

6. OZONE

"An allotropic form of oxygen, a bluish toxic gas, O₃, with a characteristic odour, produced from molecular oxygen by electrical discharge and in the upper atmosphere by ultraviolet light, and formerly supposed to have a tonic effect" ("Ozone," 2007, p. 2065).

"Allotrope of oxygen, m.p.-193° C, b.p.-112° C, blue in colour, present in upper atmosphere and absorbs u.v. radiation and hence protects earth's surface from excess u.v. radiation. Holes can be caused in the ozone layers because of the radiation of ozone with species formed by, e.g. CFCs. Ozone is formed at ground level by interaction of nitrogen oxides, NOX, with hydrocarbons (from auto emissions). It is a respiratory irritant and can cause crop damage. Prepared by action of electric discharge on O₂ and can be separated from O₂ by fractionation. Has bent molecule, used for oxidation, sterilization and purification" (Sharpe, 2003, p. 293).

“A powerfully oxidizing allotropic form of the element oxygen. The ozone molecule contains three atoms (O_3), while the more common oxygen molecule has two atoms (O_2).

Ordinary oxygen is a colorless gas and condenses to a very pale blue liquid, whereas ozone gas is decidedly blue, and both liquid and solid ozone are an opaque blue-black color, similar to that of ink. Even at concentrations as low as 4%, the blue color of ozone gas mixed with air or other colorless gas in a tube in 1 in. (2.5 cm) or more in diameter and 4 ft (1.2m) or more long can be seen by looking length wise through the tube” (“Ozone,” 1987, p. 609).

7. BRIEF INFORMATION ABOUT DOAJ

DOAJ was launched in 2003 at Lund University, Sweden, with 300 open access journals. At present, it contains more than 10000 open access journals covering all areas of science, technology, medicine, social science and humanities. DOAJ is a membership organisation and membership is available in 3 main categories: Publisher, Ordinary Member and Sponsor. A DOAJ Membership is a clear statement of intent and proves a commitment to quality, peer-reviewed open access. DOAJ is a community-curated list of open access journals and aims to be the starting point for all information searches for quality, peer reviewed open access material. The main mission of DOAJ is to increase the visibility, accessibility, reputation, usage and impact of quality, peer-reviewed, open access scholarly research journals globally, regardless of discipline, geography or language. It will work with editors, publishers and journal owners to help them understand the value of best practice publishing and standards and apply those to their own operations. DOAJ also committed to being 100% independent and maintaining all of its services and metadata as free to use or reuse for everyone (“DOAJ,” 2018).

8. ANALYSES AND INTERPRETATIONS

8.1. Year Wise Distribution of Ozone Literature

Year wise distribution of ozone literature is presented in Table 1 that reveals that 13.43% of total literature is produced in the year 2015 followed by 12.73% and 10.05% are in the year 2014 and in 2012 respectively. Before the year 2007 the growth rate is less than 5% per year in respect of total literature. There is a positive growth rate from the year 2003 to 2015, but 2011 and 2013 – these two years are exceptional with in this thirteen years time span.

Table 1 Year wise distribution of Ozone literature

S.No.	Years	No of Articles	Percentage
1	2000	41	2.24
2	2001	21	1.15
3	2002	20	1.09
4	2003	33	1.80
5	2004	58	3.17
6	2005	60	3.28
7	2006	72	3.93
8	2007	88	4.81
9	2008	113	6.17
10	2009	154	8.41
11	2010	172	9.39
12	2011	171	9.34
13	2012	184	10.05
14	2013	165	9.01
15	2014	233	12.73
16	2015	246	13.43
Total		1831	100.00

8.2. Authorship Pattern

The literature in any subject reflects the basic publishing pattern as well as characteristics of the authors themselves. In Table 2, number of authors has been categorized into seven classes in respect of concerned years. Out of 1831 articles 60.13% articles are contributed by 1-5 author(s) following 27.85% article by 6-10 authors. Article contributed by more than 30 authors are noticeable from the year 2007.

Table 2 Year wise distribution of authorship pattern

S.No.	Years	1-5 Authors	6-10 Authors	11-15 Authors	16-20 Authors	20-25 Authors	26-30 Authors	>30 Authors	Total
1	2000	33	8	0	0	0	0	0	41
2	2001	21	0	0	0	0	0	0	21
3	2002	20	0	0	0	0	0	0	20
4	2003	27	5	1	0	0	0	0	33
5	2004	37	15	2	2	1	1	0	58
6	2005	39	14	2	2	1	2	0	60
7	2006	52	20	0	0	0	0	0	72
8	2007	53	25	7	0	0	2	1	88
9	2008	65	37	5	3	3	0	0	113
10	2009	85	51	9	2	5	1	1	154
11	2010	101	46	9	9	2	1	4	172
12	2011	106	45	11	4	3	2	0	171
13	2012	106	40	25	6	4	2	1	184
14	2013	85	60	11	2	2	2	3	165
15	2014	137	69	17	7	0	1	2	233
16	2015	134	75	22	7	3	1	4	246
Total		1101	510	121	44	24	15	16	1831
Percentage		60.13	27.85	6.61	2.41	1.31	0.82	0.87	100.00

8.3. Single Authored Versus Multiple Authored Articles

Table 3 Year wise distribution of single authored versus multiple authored articles

S.No.	Year	No of article	No of Article contributed by Single Author	Percentage	No of Article contributed by Multiple Authors	Percentage
1	2000	41	5	12.20	36	87.80
2	2001	21	2	9.52	19	90.48
3	2002	20	5	25.00	15	75.00
4	2003	33	4	12.12	29	87.88
5	2004	58	6	10.34	52	89.66
6	2005	60	4	6.67	56	93.33
7	2006	72	13	18.06	59	81.94
8	2007	88	5	5.68	83	94.32
9	2008	113	2	1.77	111	98.23
10	2009	154	12	7.79	142	92.21
11	2010	172	5	2.91	167	97.09
12	2011	171	9	5.26	162	94.74
13	2012	184	6	3.26	178	96.74
14	2013	165	1	0.61	164	99.39
15	2014	233	9	3.86	224	96.14
16	2015	246	7	2.85	239	97.15
Total		1831	95	5.19	1736	94.81

In Table 3, single versus multiple authors' contribution pattern has been presented. It is clear from the study that rate of multiple authors' contribution is very high than single author's contribution. From the year 2007 over 90% articles are from multiple authors and in 2013 single author's contribution is very less (0.61%). Over all 94.81% article has been contributed by multiple authors.

8.4. Degree of Collaboration

K. Subramanyam (as cited in Kannappanavar & Vijayakumar, 2001) suggested a formula to measure the degree of collaboration in quantitative terms, that formula has been used here to find out the degree of collaboration and result has been given in Table 4. The formula is given below:

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

Where,

C = Degree of collaboration in a discipline

Nm = Number of multiple authored papers

Ns = Number of single authored papers

From Table 4 it is found that in the year 2002 the value of degree of collaboration is less (0.75) and in 2013 the value is very high (0.99) than any other concerned years. A positive trend of collaboration has been found here and the average value of degree of collaboration is 0.95 which indicate a higher degree of collaborative research in ozone.

Table 4 Year wise distribution of degree of collaboration

S.No.	Year	No of Article contributed by Single Author	No of Article contributed by Multiple Authors	Degree of Collaboration
1	2000	5	36	0.88
2	2001	2	19	0.90
3	2002	5	15	0.75
4	2003	4	29	0.88
5	2004	6	52	0.90
6	2005	4	56	0.93
7	2006	13	59	0.82
8	2007	5	83	0.94
9	2008	2	111	0.98
10	2009	12	142	0.92
11	2010	5	167	0.97
12	2011	9	162	0.95
13	2012	6	178	0.97
14	2013	1	164	0.99
15	2014	9	224	0.96
16	2015	7	239	0.97
Average		95	1736	0.95

8.5. Distribution of Articles According to Country Wise Authors' Contribution

In Table 5, total authors contributed for 1736 articles have been categorized into two categories that are author(s) from a single country and authors form more than one country responsible for an article. It is found from the table that 8.12% articles have been written by the collaboration of authors from multiple countries. It also found from the table that within the parameter of author(s) from a single country Brazil is the leading country producing

13.16% articles followed by Russian Federation (9.86%), Cuba (7.85%), Italy (6.01%) and India (5.79%) respectively.

Table 5 Country wise distribution of authors

Authors' contribution for an article	Country	No of article	Percentage
Author(s) from single country	Brazil	241	13.16
	Russian Federation	175	9.86
	Cuba	146	7.85
	Italy	110	6.01
	India	106	5.79
	China	79	4.29
	USA	64	3.47
	Chile	57	3.11
	Poland	41	2.24
	Mexico	35	1.91
	Japan	32	1.74
	Others	596	32.45
Authors from more than one country		149	8.12
Total		1831	100.00

8.6. Language Wise Distribution of Articles

Language wise distribution of articles has been depicted in Table 6. It is seen from the Table that 63.24% articles published in English language where as 11.80%, 5.84% and 5.41% articles published in Portuguese, Spanish and Russian language respectively.

Table 6 Language wise distribution of articles

S.No.	Language	No of article	Percentage
1	English	1158	63.24
2	Portuguese	216	11.80
3	Spanish	107	5.84
4	Russian	99	5.41
5	Italian	55	3.00
6	Chinese	32	1.75
7	Persian	27	1.47
8	Serbian	24	1.32
9	Thai	22	1.20
10	Turkish	18	0.98
11	Others	73	3.99
Total		1831	100.00

8.7. Ranking of Core Journals

There are total 1831 number of articles has been taken for the study and they are scattered in different journals. Only top 12 ranking journals have been highlighted in Table 7 and as shown from the table that 611 articles (33.37%) published in 'Atmospheric Chemistry and Physics', 339 articles (21.79%) in 'Atmospheric Measurement Technique', 179 articles (9.78%) in 'Annals of Geophysics' and so on.

Table 7 Ranking of journals

S.No.	Journal	No of article	Percentage	Rank
1	Atmospheric Chemistry and Physics	611	33.37	1
2	Atmospheric Measurement Technique	399	21.79	2
3	Annals of Geophysics	179	9.78	3
4	The scientific World Journal	73	3.99	4
5	International Journal of Environmental Research and Public Health	42	2.29	5
6	Polythematic Online Scientific Journal of Kuban State Agrarian University	34	1.86	6
7	Atmosphere	26	1.42	7
8	Biogeosciences	23	1.26	8
9	Quimica Nova	16	0.87	9
10	Geoscientific Model Development	15	0.82	10
11	Advances in Meteorology	14	0.76	11
12	iForest : Biogeosciences and Forestry	13	0.71	12
13	Others	386	21.08	-
Total		1831	100.00	-

8.8. Subject Wise Distribution of Articles

Though there is an increasing trend of research articles from its single disciplinary area to multi disciplinary area, an attempt has been made to categorise articles into seven broad disciplines. The highest, 31.08% of articles have been found under the discipline engineering and technology, followed by 24.19% in chemistry, 12.78% in physics and 10.48% in earth and environment sciences and so on.

Table 8 Subject wise distribution of articles

S.No.	Subject	No of article	Percentage
1	Engineering and Technology	569	31.08
2	Chemistry	343	24.19
3	Physics	294	12.78
4	Earth and Environmental Sciences	232	10.48
5	Medicine	147	8.03
6	Biosciences	129	7.05
7	Agriculture	84	4.59
8	Others	33	1.80
Total		1831	100.00

8.9. Subject Wise Reference Distribution

Table 9 Subject wise number of references used in articles

S.No.	Subject	Average no of references used per article (in round figure)	Rank
1	Chemistry	51	1
2	Agriculture	37	2
3	Earth and Environmental Sciences	36	3
4	Biosciences	31	4
5	Medicine	30	5
6	Physics	27	6
7	Engineering and Technology	25	7
8	Others	28	-

It reveals from Table 9 that in chemistry 51 numbers of references have been used per article. Average number of references used per article in agriculture, earth and environmental

sciences, bioscience, medicine, physics and engineering and technology are 37, 36, 31, 30, 27, and 25 respectively.

8.10. Subject Wise Objects Distribution

Generally the content of any scholarly communication, particularly in science may be broadly categorising in five groups according to its nature i.e. elements for bibliographic information, textual content, objects, numerical contents and references. Objects include tables, maps, figures, diagrams, photographs etc. In Table 10 subject wise average number of objects used per article has been presented. Here rank 1 position goes to chemistry (9 objects per article) and rank 7 position for medicine having 4 objects per article.

Table 10 Subject wise number of objects used in articles

S.No.	Subject	Average no of objects used (in round figure)	Rank
1	Chemistry	9	1
2	Engineering and Technology	8	2
3	Physics	7	3
4	Earth and Environmental Sciences	7	3
5	Agriculture	5	5
6	Biosciences	5	5
7	Medicine	4	7
8	Others	3	-

9. FINDINGS

The major findings of this study are given below:

- There is a positive growth trend of ozone literature.
- 60.13% articles are contributed by the collaboration of 1-5 author(s).
- Only 5.19% articles from single authorship.
- Average degree of author collaboration is also very high 0.95.
- 8.12% articles are written by the collaboration of authors from more than single country.
- The journal entitled 'Atmospheric Chemistry and Physics' is the top most leading journal for publishing ozone literature.
- Most of the articles (31.08%) are related to the discipline engineering and technology.
- In Chemistry, average number of references (51) and average number of objects (9) used per article is higher than any other disciplines.

REFERENCES

- [1] Arunachalam, S., & Gunasekaran, S. (2002). Tuberculosis research in India and China: From bibliometrics to research policy. *Current Science*, 82(8), 933-946.
- [2] Clarke, B. L. (1964). Multiple authorship trends in scientific papers. *Science*, 143, 882-884.
- [3] DOAJ: About. (2018). Retrieved April 24, 2018, from <https://doaj.org/about>
- [4] Kabir, S. H. (1994). Authorship trend and solo research in bibliometrics: A bibliometrics study. *Library Science with a Slant to Documentaion*, 31(1), 87-90.
- [5] Kannappanavar, B. U., & Vijayakumar, M. (2001). Authorship trend and solo v/s team research in international monetary fund literature: A bibliometric study. *Annals of Library and Information Studies*, 48(3), 117-120.

- [6] Macias-Chapula, C. A. (2000). AIDS in Haiti: A bibliometric analysis. *Bulletin of the Medical Library Association*, 88(1), 56-61.
- [7] Ozone. (1987). In *Mc GRAW-HILL encyclopedia of science & technology* (6th ed., Vol. 12, p. 609). New York: Mc GRAW-HILL Book Company.
- [8] Ozone. (2007). In *Shorter oxford english dictionary on historical principle* (6th ed., Vol. 2, p. 2065). New York: Oxford University Press.
- [9] Prytherch, R. (2005). *Harrod's Librarians' Glossary and Reference Book* (10th ed., p. 67). Aldershot: Ashgate.
- [10] Rajendiran, P., & Parihar, Y.S. (2007). A bibliometric study of laser literature in India, 1995-2005. *Annals of Library and Information Studies*, 54(2), 112-118.
- [11] Rajendran, P., Babu, B. R., & Gopalakrishnan, S. (2005). Bibliometric analysis of 'fiber optics' literature. *Annals of Library and Information Studies*, 52(3), 82-85.
- [12] Ramakrishnan, J., & Babu, B. R. (2007). Literature on haptics (1984-2003): A bibliometric analysis. *Annals of Library and Information Studies*, 54(4), 195-200.
- [13] Sharpe, D.W.A. (2003). Ozone. In *The Penguin dictionary of chemistry* (3rd ed., p. 293). New Delhi: Penguin Books.