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WORLDWIDE RESEARCH PRODUCTIVITY ON DRINKING WATER: A BIBLIOMETRIC ANALYSIS

K. Sivasami
Assistant Professor, Department of Library and Information Science, Annamalai University, Annamalai Nagar, Tamilnadu

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Abstract:

This paper discuss on Worldwide Research Productivity on Drinking Water; a Bibliometric Analysis, aim of this paper to analyze year wise drinking water research, find document types, sources types wise published drinking water research papers published, reveals that Source types wise, five source types were contributed more than eighty percent of papers were published in this research, among the 12865 papers MartÃ-nez-Romero, D. Serrano, M. and Valero, D. has contributed 13 papers each, country wise found that among the 145 countries United States has occupies first place with 2804 papers, China has second place with 1750 papers the remaining 143 countries were contributed less than 1000 papers, ten institutions were contributed more than 100 papers, Authorship pattern found that 98.14 percent of papers were collaborative publications, Among the sources, 'Water Research' has published more number of papers, and SJR value 2.629 and h- index value 233.

Key Words: Drinking Water, Water Contamination, Water Purification, Public Health.

Introduction:

Water intended for human consumption must be free from organisms and from concentrations of chemical substances that may be a hazard to health (World Health Organization, 1971). Getting enough water every day is important for our health. Healthy people meet their fluid needs by drinking when thirsty and drinking with meals. Most of our fluid needs are met through the water and beverages we drink. However, we can get some fluids through the foods that we eat. For example, broth soups and foods with high water content such as celery, tomatoes, or melons can contribute to fluid intake (U.S. Department of Health & Human Services, 2016). Drinking water comes from a variety of sources including public water systems, private wells, or bottled water. Clean drinking water is essential to human life, but water can become contaminated in many ways, including through naturally occurring chemicals and minerals, sewage overflows and spills and wildlife waste (The Fort Wayne – Allen County Department of Health, 2017).

Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhoea, dysentery, hepatitis A, typhoid, and polio. Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks. The safety and accessibility of drinking-water are major concerns throughout the world. Health risks may arise from consumption of water contaminated with infectious agents, toxic chemicals, and radiological hazards. Improving access to safe drinking-water can result in tangible improvements to health (World Health Organization, 2017). As drinking water research begins to develop further at worldwide, information about this should be collected before future research strategies can be formulated. The purpose of the present study was to bibliometrically analyze the water research publications at global level researchers from 2002 to 2016, in order to provide insights into the drinking water literature and identify patterns, tendencies, or irregularities that may exist in the publications. Moreover, this will provide a comprehensive evaluation of current drinking water research at global level.

Bibliometric:

The term "Bibliometric" was first coined by Prichard in 1969, and its usage and practice. Hulme (1923) used this idea and called it "statistical bibliography". Pritchard explained the term "Bibliometric" as an "application of mathematical and statistical methods to books and other media of communication". According to Sengupta (1991), he states that Campbell's (1896) statistical studies, in publications subject categories was conducted for the first time in Bibliometric studies up to Pritchard (1969) Bibliometric Studies was called statistical bibliography. The Bibliometrics is a well established part of library and information science research (Narin and Moll 1977; White and McCain 1989; Wilson 1999), and the use of it in libraries for e.g. collection development and management is also a well-known practice, not the least in relation to digital library development (Dikeman 1975; Jimenez-Contreras et al. 2006; Kishida 1995; Nicholson 2003). The bibliometric method is very useful to various library activities like; collection development and acquisition, organization, stacking, introducing new service, ranking of periodicals, and etc.

Materials and Methods:

The data have been collected from the Scopus database; the study period is during (2002-2016). The search string was used 'Drinking Water' in the Title search box, field were used, the time span field were select from 2002 to 2016. A total of 12862 records were retrieved, the data downloaded and analyzed using MS office

-Excel as per objectives of the present study. Moreover, the h-index (Hirsch 2005) was used to assess quantity and quality of research productivity by authors, countries and institutions. The journal Impact Factor (IF) obtained from the Journal Citation Report (JCR) and the *SCImago Journal Rank* (SJR) indicator (available at: http://www.scimagojr.com/journalrank.php) were used as a quality indicator for journal strength and reputation. The present study helps to find in drinking water research publications.

Relative Growth Rate (RGT) and Doubling Time (DT):

The Relative Growth Rate is the number of publications/pages per unit of time. Hence, one year is taken as the unit of time. The mean relative growth rate R (1-2) over a specified period of interval can be calculated from the following equation suggested by Mahapatra (1985).

$$R(1-2) = \frac{W2 - W1}{T2 - T1}$$

Where,

R = Mean relative growth rate over the specify period of interval
W1 = log W1 (Natural log of initial number of publications/ pages)
W2 = log W2 (Natural log of initial number of publications/ pages)
T2-T1 = Unit difference between the initial time and final time.

Therefore,

R (a) = relative growth rate per unit per of publication per unit of time (year)
R (p) = relative growth rate per unit per of pages per unit of time (year

The corresponding Doubling Time for publications and pages can be calculated by using the following formula:

$$\text{Doubling time (Dt)} \frac{0.693}{R}$$

Therefore,

$$\text{Doubling time for publications Dt (a)} \frac{0.693}{R(a)}$$

Objectives:

The following objectives of the present study are:

- ✓ To find drinking water research publications during 2002 to 2016
- ✓ To find authorship pattern in drinking water research publications
- ✓ To find out top twenty authors contributed in drinking water research
- ✓ To identify top twenty countries contributed in drinking water research
- ✓ To find out top twenty institutions contributed in drinking water research
- ✓ To top twenty drinking water research paper published source's h index and Impact Factor value

Analysis and Interpretation:

Table 1: Year wise drinking water research publications

S.No	Year	No. of Papers	Percentages
1	2002	522	4.06
2	2003	523	4.07
3	2004	576	4.48
4	2005	599	4.66
5	2006	710	5.52
6	2007	862	6.70
7	2008	820	6.38
8	2009	908	7.06
9	2010	1013	7.88
10	2011	1019	7.92
11	2012	1008	7.84
12	2013	1027	7.98
13	2014	1051	8.17
14	2015	1071	8.33
15	2016	1153	8.96
	Total	12862	100.00

Table 1 shows that year wise drinking water research publications during 2002 – 2016; during the study period 12862 papers were published. Among the fifteen year 2016 have occupies first place with 1153 papers were published, 2015 has second place with 1071 papers, 2014 has third place with 1051 papers, followed by 2013 has 1027 papers, 2011 has 1019 papers in drinking water research, 2010 has 1013 papers,

2012 has 1008 papers, 2009 has 908 papers, 2007 has 862 papers, 2008 has 820 papers, 2006 has 710 papers, 2005 has 599 papers, 2004 has 576 papers, 2003 has 523 papers, 2002 have 522 papers published in drinking water research which is starting year was published least number of publications.

Table 2: Relative Growth Rate and Doubling Time of drinking water research

S.No	Year	No. of Papers	Cumulative total	W1	W2	W2-W1 R(a)	Mean (a) 1-2	Doubling Time	Mean Dt (a) 1-2
1	2002	522			6.25				
2	2003	523	1045	6.25	6.25	0.00		0.00	
3	2004	576	1621	6.25	6.35	0.10		6.93	
4	2005	599	2220	6.35	6.39	0.04		17.33	4.07
5	2006	710	2930	6.39	6.56	0.17	0.08	4.08	
6	2007	862	3792	6.56	6.75	0.19		3.65	
7	2008	820	4612	6.75	6.7	-0.05		-13.86	
8	2009	908	5520	6.7	6.81	0.11		6.30	
9	2010	1013	6533	6.81	6.92	0.11		6.30	
10	2011	1019	7552	6.92	6.93	0.01		115.50	
11	2012	1008	8560	6.92	6.91	-0.01		-69.30	
12	2013	1027	9587	6.91	6.93	0.02	0.03	34.65	8.27
13	2014	1051	10638	6.93	6.95	0.02		34.65	
14	2015	1071	11709	6.95	6.97	0.02		34.65	
15	2016	1153	12862	6.97	7.05	0.08		8.66	
	Total	12862					0.055		6.17

Table 2 shows that, Relative Growth Rate and Doubling Time of drinking water research publications, during the study period publications of Doubling Time mean value are 6.17. In 2002, the drinking water research publication was 522; gradually the research publications were rise to 1153 in the year 2016, the relative growth rate mean is 0.055. The Growth Rate of publications is raise two times means of from 522 to 1153 publications in drinking water research during the study period.

Table 3: Document types wise drinking water research

S.No	**Document Types**	**No. of Papers**	**Percentages**
1	Article	9749	75.80
2	Conference Paper	1788	13.90
3	Review	600	4.66
4	Book Chapter	226	1.76
5	Note	150	1.17
6	Letter	113	0.88
7	Short Survey	89	0.69
8	Erratum	63	0.49
9	Editorial	60	0.47
10	Book	23	0.18
11	Business Article	1	0.01
	Total	12862	100.00

Table 3 shows that document type wise drinking water research publications during the study period, article occupies first place with 9749, Conference Paper has second place with 1788, Review has third place with 600, followed by Book Chapter has 226, Note has 150, Letter has 113, Short Survey has 89, Erratum has 63, Editorial has 60, Business article has eleventh place with single pape

Table 4: Source types in drinking water research

S.No	**Source types**	**No. of Papers**	**Percentages**
1	Journals	10540	81.95
2	Conference Proceedings	1317	10.24
3	Book Series	605	4.70
4	Books	251	1.95
5	Trade Publications	149	1.16
	Total	12862	100.00

Table 4 shows that source types in drinking water research publications, only five source types were contributed 12862 papers in drinking water research, among the five sources Journals has first place with 81.95 percent of papers, Conference Proceedings has 10.24 percentages, Book Series has 4.70 percent of papers, Books has 1.95 percent of papers, Trade Publications has last place with 1.16 percent of papers in drinking water research during the study period.

Table 5: Top twenty languages contributed drinking water research

S.No	Language	No. of Papers	Percentages
1	English	10956	85.181
2	Chinese	634	4.929
3	German	491	3.817
4	French	244	1.897
5	Russian	146	1.135
6	Spanish	129	1.003
7	Portuguese	62	0.482
8	Polish	36	0.280
9	Italian	30	0.233
10	Czech	26	0.202
11	Persian	21	0.163
12	Turkish	18	0.140
13	Japanese	16	0.124
14	Slovenian	8	0.062
15	Croatian	6	0.047
16	Hungarian	6	0.047
17	Dutch	5	0.039
18	Korean	4	0.031
19	Ukrainian	4	0.031
20	Bosnian	3	0.023

Table 5 shows that drinking water research papers published in top twenty languages, among the 12862 papers were published in 31 languages among those languages, English language occupies first place with 10956 papers, Chinese language has second place with 634 papers, German has third place with 491 papers, followed by French fourth place with 244 papers, Russian has fifth palce146 papers, Spanish has sixth place with 129 papers, Portuguese has seventh place with 62 papers, Polish has eighth place with 36 papers, Italian has ninth place 30 papers, Czech has tenth place with 26 papers, Persian has eleventh place with 21 papers, Turkish has twelfth place with18 papers, Japanese has thirteenth place with 16 papers, Slovenian has fourteenth place with 8 papers, Croatian and Hungarian has fifteenth and sixteenth place with 6 papers respectively, Dutch has seventeenth place with 5 papers, Korean and Ukrainian has eighteenth and nineteenth place with papers respectively, and Bosnian has occupies twentieth place with 3 papers, moreover the remaining 17 papers were published in eleven languages.

Table 6: Top twenty authors contributed in drinking water research

S.No	**Author Name**	**No. of Papers**	**% of 12865**
1	MartÃnez-Romero, D.	13	0.101
2	Serrano, M.	13	0.101
3	Valero, D.	13	0.101
4	Castillo, S.	12	0.093
5	GuillÃ©n, F.	12	0.093
6	Tanaka, M.	12	0.093
7	Vega-GÃ¡lvez, A.	11	0.086
8	Miranda, M.	10	0.078
9	Akev, N.	9	0.070
10	Misawa, E.	9	0.070
11	Zapata, P.J.	9	0.070
12	Boudreau, M.D.	8	0.062
13	Maensiri, S.	8	0.062
14	Yamada, M.	8	0.062
15	Can, A.	7	0.054
16	PÃ©rez-Won, M.	7	0.054
17	Rao, P.S.	7	0.054
18	Subramanian, S.	7	0.054
19	Tabilo-Munizaga, G.	7	0.054
20	Goyal, P.K.	6	0.047

Table 6 indicates that top twenty authors contributed in drinking water research publications, among the 12865 papers MartÃnez-Romero, D. Serrano, M. and Valero, D. has contributed 13 papers respectively, Castillo, S. GuillÃ©n, F. and Tanaka, M. has contributed 12 papers respectively, Vega-GÃ¡lvez, A. has

contributed 11 papers, Miranda, M has 10 papers contributed, Akev, N. Misawa, E. and Zapata, P.J. has 9 papers contributed respectively, Boudreau, M.D. Maensiri, S. and Yamada, M. has 8 paper contributed respectively, Can, A. PÃ©rez-Won, M. Rao, P.S. Subramanian, S. and Tabilo-Munizaga, G. has contributed 7 papers respectively, and Goyal, P.K. has occupies twentieth place with 6 paper contributed.

Table 7: Top twenty countries contributed in drinking water research

S.No	Countries	No. of Papers	% of 12862
1	United States	2804	21.80
2	China	1750	13.61
3	Germany	814	6.33
4	India	779	6.06
5	Canada	747	5.81
6	United Kingdom	516	4.01
7	France	498	3.87
8	Spain	405	3.15
9	Australia	373	2.90
10	Netherlands	311	2.42
11	Japan	284	2.21
12	Italy	271	2.11
13	Iran	253	1.97
14	Turkey	239	1.86
15	Brazil	231	1.80
16	Pakistan	218	1.69
17	Switzerland	186	1.45
18	Poland	179	1.39
19	South Korea	178	1.38
20	Sweden	169	1.31

Totally 145 counties were contributed in drinking water research, in the table 7 listed only top twenty countries contributed in research during the study period, among the top twenty countries United States has occupies first place with 2804 papers, China has second place with 1750 papers, Germany has third place with 814 papers, India has fourth place with 779 papers, Canada has fifth place with 747 papers, United Kingdom has sixth place with 516 papers, France has seventh place with 498 papers, Spain has eighth place with 405 papers, Australia has ninth place 373 papers, Netherlands has tenth place with 311 papers, Japan has eleventh place with 284 papers, Italy has twelfth place with 271 papers, Iran has thirteenth place with 253 papers, Turkey has fourteenth place with 239 papers, Brazil has fifteenth place with 231 papers, Pakistan has sixteenth place with 218 papers, Switzerland has seventeenth place with 186 papers, South Korea nineteenth place with 178 papers, and Sweden has occupies twentieth place with 169 papers, moreover the remaining 125 papers were published less than 169 papers contributed.

Table 8: Top twenty drinking water research institutions

S.No	Institutions name	No. of Records	% of 12862
1	United States Environmental Protection Agency	409	3.18
2	Chinese Academy of Sciences	230	1.79
3	Harbin Institute of Technology	168	1.31
4	Tsinghua University	150	1.17
5	Ministry of Education China	139	1.08
6	Research Center for Eco-Environmental Sciences Chinese Academy of Sciences	117	0.91
7	KWR Watercycle Research Institute	115	0.89
8	Delft University of Technology	113	0.88
9	Tongji University	111	0.86
10	The University of North Carolina at Chapel Hill	109	0.85
11	Swiss Federal Institute of Aquatic Science and Technology	97	0.75
12	Virginia Polytechnic Institute and State University	93	0.72
13	University of Alberta	87	0.68
14	University of Waterloo	83	0.65
15	Centers for Disease Control and Prevention	81	0.63
16	Universite Laval	75	0.58
17	Nanjing University	74	0.58

18	Universidade de Sao Paulo - USP	68	0.53
19	University of Cincinnati	67	0.52
20	UC Berkeley	66	0.51

Table 8 shows that top twenty drinking water research institutions, among the12862 articles 'United States Environmental Protection Agency' has occupies first place with 409 papers published, 'Chinese Academy of Sciences' has second place with 230 papers, 'Harbin Institute of Technology' has third place with 168 papers, followed by 'Tsinghua University' has fourth place with 150 papers, 'Ministry of Education China' has fifth place with 139 papers, 'Research Center for Eco-Environmental Sciences Chinese Academy of Sciences' has sixth place, 'KWR Watercycle Research Institute' has seventh place, 'Delft University of Technology' has eight place, Tongji University' has ninth place, 'The University of North Carolina at Chapel Hill' has tenth place, 'Swiss Federal Institute of Aquatic Science and Technology' has eleventh place, 'Virginia Polytechnic Institute and State University' has twelfth place, 'University of Alberta' has thirteenth place, 'University of Waterloo' has fourteenth place, 'Centers for Disease Control and Prevention' has fifteenth place, 'Universite Laval' has sixteenth place with, 'Nanjing University' has seventeenth place, 'Universidade de Sao Paulo – USP' has eighteenth place, 'University of Cincinnati' has nineteenth place, and 'UC Berkeley' has twenty place with 66 papers.

Table 9: Top twenty drinking water research sources

S.No	Source titles	No. of Records	% of 12862
1	Water Research	440	3.42
2	Water Science and Technology Water Supply	262	2.04
3	Environmental Science and Technology	239	1.86
4	GWF Wasser Abwasser	219	1.70
5	Journal of Water and Health	202	1.57
6	Science of The Total Environment	200	1.55
7	Desalination and Water Treatment	145	1.13
8	Journal American Water Works Association	134	1.04
9	Desalination	130	1.01
10	Environmental Monitoring and Assessment	130	1.01
11	Journal of Water Supply Research and Technology Aqua	127	0.99
12	Water Science and Technology	127	0.99
13	Environmental Health Perspectives	108	0.84
14	Chemosphere	106	0.82
15	Chinese Journal of Endemiology	103	0.80
16	Journal of Hazardous Materials	97	0.75
17	Applied And Environmental Microbiology	93	0.72
18	Huanjing Kexue Environmental Science	85	0.66
19	Gigiena I Sanitariia	81	0.63
20	Environmental Science and Pollution Research	79	0.61

Table 9 shows that top twenty drinking water research sources, among the 12862 papers 'Water Research' has occupies first place with 440 papers, 'Water Science and Technology Water Supply' has second place with 262 papers, 'Environmental Science and Technology' has third place with 239 papers, followed by 'GWF Wasser Abwasser' have published 219 papers, 'Journal of Water and Health' have published 202 papers, 'Science of The Total Environment' have published 200 papers, 'Desalination and Water Treatment' have published 145 papers, 'Journal American Water Works Association' have published 143 papers, 'Desalination' and 'Environmental Monitoring and Assessment' each have published 130 papers, 'Journal of Water Supply Research and Technology Aqua' and 'Water Science and Technology' each has published 127 papers, 'Environmental Health Perspectives' have published 108 papers with thirteenth place, 'Chemosphere' have published 106 papers, 'Chinese Journal of Endemiology' have published 103 papers, 'Journal of Hazardous Materials' have published 97 papers, 'Applied And Environmental Microbiology' have published 93 papers, 'Huanjing Kexue Environmental Science' have published 85 papers, 'Gigiena I Sanitariia' have published 81 papers, and Environmental Science and Pollution Research' has occupies twentieth place with 79 papers in this research during the study period, moreover less than 79 papers.

Table 10: Authorship pattern in drinking water research

S.No	Authorship pattern	No. of Records	Percentages
1	Single	239	1.86
2	Double	503	3.91
3	Three	879	6.83
4	Four	914	7.11
5	Five	1783	13.86

6	Six and above	8544	66.43
	Total	12862	100.00

Table 10 shows that authorship pattern in drinking water research during 2002 to 2016, among the 12862, 239 authors were contributed single authorship pattern; 503 papers ware contributed two authors' collaboration, 879 papers were three authors collaboration, four author collaboration papers are 914, five authors collaboration papers are 1783, Six and above authors were collaborations are 8544 papers, moreover 98.14 percent of papers were collaborative publications.

Table 11: Top twenty drinking water source's h-index and Impact Factor value

S.No	Sources title	No. of outputs	SJR	Impact Factor	h -index	Cites / Doc. Last (2years)
1	Water Research	440	2.629	0.78	233	7.21
2	Water Science and Technology: Water Supply	262	0.26	0.573	30	0.61
3	Environmental Science & Technology	239	2.538	6.198	301	6.25
4	Gas Wasserfach Wasser Abwasser	219	0.12	10	10	0.03
5	Journal of Water and Health	202	0.443	1.35	48	1.15
6	Science of the Total Environment	200	1.621	4.42	182	5.04
7	Desalination and Water Treatment	145	0.343	34	34	1.3
8	Journal of the American Water Works Association	134	0.298	0.96	61	0.51
9	Desalination	130	1.808	5.527	128	5.68
10	Environmental Monitoring and Assessment	130	0.545	1.687	77	1.49
11	Journal of Water Supply: Research and Technology - AQUA	127	0.352	0.824	39	0.86
12	Water Science and Technology	127	0.394	1.197	111	1.2
13	Environmental Health Perspectives	108	3.067	5.44	227	7.93
14	Chemosphere	106	1.417	4.208	187	4.27
15	Chinese Journal of Endemiology	103	0.191	Not Available	7	0.06
16	Journal of Hazardous Materials	97	1.727	6.065	198	6.27
17	Applied and Environmental Microbiology	93	1.691	3.807	270	3.83
18	Huanjing Kexue/Environmental Science	85	0.18	0.21	23	0.44
19	Gigiena i sanitariia	81	0.116	0.463	4	0.08
20	Environmental Science and Pollution Research	79	0.813	2.97	69	2.45

\\ Sources: http://www.scimagojr.com/journalrank.php (accessed on 01/01/2018)

Table 11indicates that top twenty drinking water source's h index and Impact Factor value**,** among the twenty sources h index value 'Environmental Science & Technology' source' h index value are high means of 301, and 'Gigiena i sanitariia' sources has h index value are 4, followed by among the sources high Impact Factor value (6.198) has 'Environmental Science & Technology', and 'Huanjing Kexue/Environmental Science' has least impact factor value (0.21), followed by 'Chinese Journal of Endemiology' have not impact factor value, the value search date on 01/01/2018. Moreover among the sources, 'Water Research' has published more number of papers, and it has highest Scimago Journal Rank value 2.629 and h-index also.

Conclusion:

Conclude from this study, the drinking water research publications found increasing trend from 522 to 1153. Among the 12862 papers 75.80 papers are article, remaining 24.20 percent of papers are Conference Paper, Review, Book Chapter and etc., Journals sources were published majority of publications in drinking water research. Language wise publications in drinking water research, 85.181 percent of papers were published in English language, 14.819 percent of papers were published other than English languages. Among the 12865 papers, only eight authors were contributed 10 and above papers in drinking water research publications during 2002 to 2016. Totally 145 countries were contributed in drinking water research during the study period, amongst 28 countries were contributed more than 100 papers, remaining 117 countries were contributed less than 100 papers in this research. Among the sources, 'Water Research' has published more number of papers, and it has highest SJR value 2.629 and h-index value 233.

References:

1. Dikeman, R. K. (1975), Use of Bibliometric Techniques in Serials Management for Libraries. Proceedings of the American Society for Information Science, 12: 55-56.
2. Hirsch, J. E. (2005), An index to quantify an individual's scientific research output. Proc Natl Acad Sci USA 102(46):16569–16572
3. Hulme, E.W. (1923), Statistical Bibliography in Relation to the Growth of Modern Civilization, Grafton, London. P 9.
4. Jimenez-Contreras, E. et al., (2006), A Bibliometric Model for Journal Discarding Policy at Academic Libraries. Journal of the American Society for Information Science and Technology, 57(2): 198-207.
5. Kishida, K. (1995), Quantitative Approaches to Library Management: A Critical Review. Library and Information Science, (33): 39-69.
6. Mahapatra. M. "On the Validity of the theory of Exponential Growth of Scientific Literature", Proceeding of the 15th IASLIC Conference, Bangalore, 1985, pp.61-70.
7. Narin, F. and Moll, J. K. (1977), Bibliometrics. Annual Review of Information Science and Technology, 12: 35-58.
8. Nicholson, S. (2003), The Bibliomining process: Data Warehousing and Data Mining for Library Decision Making. Information Technology and Libraries,. 22 (4): 146-151.
9. Pritchard, A (1969). Statistical Bibliography or Bibliometric, Journal of Documentation, Vol.25 (4): 348-349.
10. Sengupta I.W and Lalita Kumari (1991), Bibliometric Analysis of Aids Literature: Scientometric, Vol.20 (1): pp 297-315.
11. The Fort Wayne - Allen County Department of Health, Drinking water, available at http://www.allencountyhealth.com/get-informed/environmental-health-hazards/water-quality/drinking-water/ accessed on 27/12/2017
12. U.S. Department of Health & Human Services, CDC, Water & Nutrition, 2016, available at https://www.cdc.gov/healthywater/drinking/nutrition/index.html accessed on 27/12/2017
13. White, H.D & Griffith, B.C (1981), Author Co-Citation: A Literature Measure of Intellectual Structure. Journal of the American Society for Information Science, 32(3): 163-171.
14. Wilson, C.S (1999), Informetrics. Annual Review of Information Science and Technology, 34: 107-247.
15. World Health Organization, Drinking-water, 2017 aviailable at http://www.who.int/topics/drinking_water/en/ accessed on 27/12/2017
16. World Health Organization, International Standards for Drinking-Water, Third Edition, Geneva, 1971