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A SCIENTOMETRIC STUDY OF INDIAN JOURNAL OF CHEMICAL TECHNOLOGY

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Abstract

The present study examines the six hundred and forty six research paper published in the Indian Journal of Chemical Technology during the years from 2008 to 2017. The main objective of the paper is to examine the publication trends in the field of chemical engineering and technology. The result of study indicates that on an average of 64.6 papers published per year during the study periods. The majority of the contributions were made by multiple authors. More than seventy five percent of the contributors belong to India. An average number of references appended per research paper are 28.93.

Keywords: Scientometric, Bibliometric, Chemical Engineering and Technology

1. Introduction

Scientometrics studies have been applied mainly to scientific fields and empirical investigation of publications in specific scientific fields and subfields. It examines quantitative aspects of science, science of science, and scientific communication. This type of analysis provides useful indicators of scientific productivity and trends in the particular field. The term scientometric was coined in Russia by Nalimov. Since Nalimov's coinage of the Russian equivalent of the term 'Scientometrics' (naukometriya) in 1969, this term has grown in popularity and is used to describe the study of science: growth, structure, interrelationships and productivity (Hood & Wilson¹). According to Haiturn² "Scientometric" is a scientific discipline which performs reproducible measurement of scientific activity and reveals its objective quantitative regularities. Hence, scientometric studies aims to integrate the cognitive or intellectual structure of research with a view to appraise the relations among the authors,

institutions, journal articles and as a means of assisting the peer-review procedure. The main purpose of the scientometric studies is to determine the state and prospect of a subject and its future development. The present study aims to apply the scientometric technique to know the publication trends in the Indian Journal of Chemical Technology.

2. Review of Literature

Numbers of scientometric analysis studies have been conducted through the world. Out of them, two studies results are presented briefly. Padme and Vaishali³ conducted a bibliometric analysis of 'Indian Journal of Chemistry- Section A'. The Indian Journal of Chemistry-Section A published 482 research papers during the period of study i.e. from 2010 to 2014. The journal has published on an average of 96 research papers per year. The Double authors contributed the maximum numbers of papers 119(24.69%). The 653 contributors from 36 countries, India stands first place with the 66.76 percent of contributions and among Indian state wise distribution of the contributors, West Bengal stand first place with 71(16.28%) contributions. Nattur⁴ analysis of 829 articles published in the Indian Journal of Physics during the year from 2004 to 2008 reveals that maximum number of articles published in the year 2004. The important note of the study is that the majority of the articles are contributed by multiple authors and majority of the authors were affiliated to Universities. Ninety-two percent of the contributors were belonged to India and eight per cent belonged to other countries. Among the India, contributors belonged to Karnataka dominated the other states in India.

3. The Source Journal

National Communication and Information Resources (NISCAIR)⁵ came into existence on 30 September 2002 with the merger of National Institute of Science Communication (NISCOM) and Indian National Scientific Documentation Centre (INSDOC). Both NISCOM and INSDOC, the two premier institutes of the Council of Scientific and Industrial Research (CSIR), were devoted to dissemination and documentation of science and technology information. Now, with the formation of NISCAIR, an institute capable of serving the society using modern IT infrastructure in a more effective manner and taking up new ventures in the field of science communication, dissemination and science and technology information management systems and services. Broadly the core activity of NISCAIR will be to collect/store, publish and disseminate science and technology information through a mix of

traditional and modern means, which will benefit different segments of society. All publications of the Niscair publications are freely available in its web site and mobile app designed by Niscair. NISCAIR has been publishing 18 research journals in field of science and technology. The Indian Journal of Chemical Technology is one of the research publications in chemical technology. This bimonthly journal included novel and original research finding as well as reviews in the areas of Chemical Engineering, Catalysis, Leather Processing, Polymerization, Membrane Separation, Pharmaceuticals and Drugs, Agrochemicals, Reaction Engineering, Biochemical Engineering, Petroleum Technology, Corrosion and Metallurgy and Applied Chemistry. It's published in the month of January, March, May, July, September and November every year. Impact factor of IJCT is 0.348 (JCR 2017).

4. Objectives of the study

The main objective of the present paper is to examine the publication trends in the field of chemical engineering and technology. The other objectives are as follows:

- To find out the year wise distribution of papers
- To identify the authorship pattern
- To find out the collaborative pattern in the field of the chemical engineering and technology
- To determine the geographical wise distributions of papers
- To know the year wise distribution of references appended with the papers.

5. Methodology

The present scientometric study conducted for the purpose to know the publication trends in the field of chemical engineering and technology. The study analyses in detail, the bibliographic attributes of the papers and reference appended at the end of each papers in the Indian journal of chemical technology. Data collected from the journal's web site (<http://www.niscair.res.in/sciencecommunication/researchjournals/rejour/ijct/ijct0.asp>). Six hundred and forty six papers from ten volumes of the years from 2008 to 2017 have been taken for consideration of the present study. The information about the year wise distribution of research papers, single and multi author's contributions, and nativity pertains to authors and reference appended to papers were collected. The collected data are organized, tabulated and calculated by using simple statistical methods with the help of MS – Excel. Apart from the

general statistical analysis, some of the important bibliometric indicators like Degree of Collaboration (DC), Collaborative Index (CI), Collaborative Coefficient (CC), Relative Growth Rate (RGR) and Doubling Time (DT) are calculated and described in the following paragraphs.

6. Data Analysis and Interpretation

6.1. Year and Issue -Wise Distribution of the Papers

Table 1 indicates the number of papers published in the Indian Journal of Chemical Technology during the periods from 2008 to 2017. It is evident from the table-1 that publications of the source journal was irregular during the study period on three occasions, i.e., September and November 2014 issues, January and March 2015 issues and May and June 2015 issues. Five issues in 2014 and four issues in 2015 were brought out. However, before and after 2014 and 2015, the journal has been publishing regularly with all the six issues and with more number of papers. The result indicates that maximum 96 papers (14.86%) published in 2008 and minimum 46 papers (7.12 %) in 2015. The study journal published on an average of 64.6 papers per year during the study period.

Table 1: Year and Issue -Wise Distribution of Papers

S. No.	Month of Publications	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
1	January	16	13	10	10	10	10	10	12*	10	15	116
2	March	16	11	11	10	10	10	9		9	14	100
3	May	16	12	10	10	10	10	10	12*	12	12	114
4	July	16	12	10	9	10	10	10		11	13	101
5	September	16	12	10	10	10	9	10*	11	15	13	116
6	November	16	10	11	10	10	10		11	12	9	99
7	Total	96	70	62	59	60	59	49	46	69	76	646
8	%	14.86	10.84	9.60	9.13	9.29	9.13	7.59	7.12	10.68	11.76	100.00

* combined issues

6.2. Relative Growth Rate and Doubling Time

The research outcomes from the Indian Journal of Chemical Technology during the period from 2008 to 2017 were measure with the scientometric techniques Relative Growth Rate (RGR) and Doubling Time (DT)⁶. It is evidence from the Table 2 that the relative growth rate and doubling time of research outcomes have been fluctuating from 0.10 to 0.55 and from 1.27 to 7.20 respectively during the study period.

Table 2: Relative Growth Rate and Doubling Time of Papers

S. No.	Year	No. of Papers	Cumulative No. of Papers	W1	W2	RGR	Doubting Time (Dt)
1	2008	96	96		4.56		
2	2009	70	166	4.56	5.11	0.55	1.27
3	2010	62	228	5.11	5.43	0.32	2.18
4	2011	59	287	5.43	5.66	0.23	3.01
5	2012	60	347	5.66	5.85	0.19	3.65
6	2013	59	406	5.85	6.01	0.16	4.41
7	2014	49	455	6.01	6.12	0.11	6.08
8	2015	46	501	6.12	6.22	0.10	7.20
9	2016	69	570	6.22	6.35	0.13	5.37
10	2017	76	646	6.35	6.47	0.13	5.54

6.3. Authorship Pattern

Table 3 indicates the authorship pattern of research papers published in the Indian Journal of Chemical Technology during the period under study. It reveals that ninety six percent of the papers were written by multiple authors and on the other hand single author's contribution was 3.87 percent during the study period.

Table 3: Authorship Pattern

S. No.	Year	Type of Authors					Total
		Single	Double	Three	Four	More than four authors	
1	2008	1	33	30	19	13	96
2	2009	4	26	20	14	6	70
3	2010	7	22	15	10	8	62
4	2011	2	20	20	11	6	59
5	2012	1	18	22	11	8	60
6	2013	3	11	25	14	6	59
7	2014	1	15	11	15	7	49
8	2015	0	15	12	10	9	46
9	2016	3	18	14	19	15	69
10	2017	3	21	21	18	13	76
	Total	25	199	190	141	91	646
	%	3.87	30.80	29.41	21.83	14.09	100.00

6.4. Collaboration Measures

The collaborative authorship is a well recognized feature of modern science. The study on “Authorship trend and collaborative research in Genetics and plant breeding” conducted by Mallinath Kumbar and N.G.Kumar⁷ found that intellectual sharing took place by two or more scientists. Multiple authors’ researches are very familiar in the present days. To evaluate the Lawani’s Collaborative Index and Subramanian’s Degree of Collaboration, Isola Ajiferuk⁸ and others introduce the new collaboration measure

Collaboration Coefficient. The above mentioned three collaboration measures are calculated and presented in the table 4. Subramanian⁹'s Degree of Collaboration follows between 0.89 and 1.00 , Collaboration Index between 2.84 and 3.36 and Collaboration Coefficient between 0.56 and 0.66, the present study's result proved the previous studies statement and collaborative authorship pattern exist in field of Chemical Engineering and Technology during the study period.

Table 4: Collaboration Measures

S. No.	Year	Single Author	Multiple Authors	Total	DC*	CI**	CC***
1	2008	1	95	96	0.99	3.10	0.64
2	2009	4	66	70	0.94	2.89	0.59
3	2010	7	55	62	0.89	2.84	0.56
4	2011	2	57	59	0.97	2.98	0.62
5	2012	1	59	60	0.98	3.12	0.64
6	2013	3	56	59	0.95	3.15	0.64
7	2014	1	48	49	0.98	3.24	0.65
8	2015	0	46	46	1.00	3.28	0.66
9	2016	3	66	69	0.96	3.36	0.65
10	2017	3	73	76	0.96	3.22	0.64
Total		25	621	646	0.96	3.11	0.63

*Degree of Collaboration **Collaborate Index ***Collaborate Coefficient

6.5. Country Wise Distribution of Contributors

The country wise distributions of the contributors are presented in the table 5. During the period of study, totally 646 research papers were contributed by 2074 contributors from 37 countries. Among the 37 countries, nearly 74.25 percent of the contributors are belonged to India and remaining 25.75 percent of the contributors are belongs to the foreign countries. India (74.25%) stands first place followed by China on second place (6.03 %) and Iran on third place with (5.79%).

Table 5: Country Wise Distribution of Contributors

S. No.	Country	No. of Contributors	%	S. No.	Country	No. of Contributors	%
1	India	1540	74.25	20	Russia	4	0.19
2	China	125	6.03	21	Ethiopia	4	0.19
3	Iran	120	5.79	22	South Korea	4	0.19
4	Turkey	56	2.70	23	Venezuela	4	0.19
5	Croatia	35	1.69	24	Pakistan	3	0.14
6	Bangladesh	33	1.59	25	Serbia	2	0.10
7	Malaysia	27	1.30	26	Singapore	2	0.10
8	Egypt	22	1.06	27	Canada	2	0.10
9	Mexico	11	0.53	28	Zimbabwe	1	0.05
10	Thailand	11	0.53	29	USA	1	0.05
11	Vietnam	8	0.39	30	Norway	1	0.05
12	Iraq	8	0.39	31	UK	1	0.05
13	Saudi Arabia	8	0.39	32	Kuwait	1	0.05
14	South Africa	7	0.34	33	Korea	1	0.05
15	Morocco	7	0.34	34	France	1	0.05
16	Algeria	6	0.29	35	Indonesia	1	0.05
17	Nigeria	6	0.29	36	Germany	1	0.05
18	Sri Lanka	5	0.24	37	Czech Republic	1	0.05
19	Spain	4	0.19		Total	2074	100.00

6.6. Indian States and Union Territories Wise Distribution of Contributors

Table 6 depicts the Indian states and union territories wise distribution of the contributors. The result shows that among 1540 Indian contributors, more than two hundred contributors are belonged to Tamil Nadu and the contributors, between 100 and 200, belonged to Maharashtra (191); Karnataka (162); Uttarpradesh (132) and Gujarat (100). The remaining 723 contributors are belonged to remaining 17 Indian States and Union Territories.

Table 6: Indian States and Union Territories Wise Distribution of Contributors

S. No.	States / Union Territories	No. of Contributors	%	S. No.	States / Union Territories	No. of Contributors	%
1	Tamil Nadu	232	15.06	13	Jharkhand	48	3.12
2	Maharashtra	191	12.40	14	Telangana	43	2.79
3	Karnataka	162	10.52	15	Haryana	41	2.66
4	Uttarpradesh	132	8.57	16	Andhrapadesh	39	2.53
5	Gujarat	100	6.49	17	Punjab	37	2.40
6	West Bengal	82	5.32	18	Jammu & Kashmir	18	1.17
7	Madhyapadesh	75	4.87	19	Chhattisgarh	17	1.10
8	Odisha	70	4.55	20	Uttarakhand	15	0.97
9	Kerala	64	4.16	21	Himachalpradesh	9	0.58
10	Rajasthan	59	3.83	22	Goa	2	0.13
11	Delhi	52	3.38	Total		1540	100.00
12	Assam	52	3.38				

6.7. Year wise Distribution of References

Table 7 displays the number of references cited by the authors in their papers. Out of the 646 papers, 226 papers (34.98%) have 21 – 30 references, followed by 213 papers (32.97%) with more than 30 references, 117 papers (27.40%) with 11 – 20 references and 30 papers (4.64%) with 1 -10 references. Table also indicates the year –wise distribution of number of references.

Table 7: Year wise Distribution of References

Year	No. of Reference				Total
	1-10	11-20	21-30	More than 30	
2008	8	32	38	18	96
2009	2	24	27	17	70
2010	3	23	19	17	62
2011	1	12	21	25	59
2012	3	21	23	13	60
2013	3	14	25	17	59
2014	1	11	15	22	49
2015	2	10	13	21	46
2016	7	18	22	22	69
2017	0	12	23	41	76
Total	30	177	226	213	646
%	4.64	27.40	34.98	32.97	100.00

6.8. Average Number of References per Year

Table 8 focuses the average number of references appended to the papers during the study period. The totals of 17,862 references were cited in 646 papers during the study period in the source journal. Out of the 17862 reference, more than two thousand references were cited in the papers published in the years 2008, 2009 and 2017 and the minimum 1304 references were contained in the papers published in 2015. The averages of 27.65 references were cited per paper in the journal during the study periods.

Table 8: Average No. of References per Year

Particulars	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
No. of Papers	96	70	62	59	60	59	49	46	69	76	646
Total No. of References	2188	2203	1558	1718	1544	1549	1480	1304	1753	2565	17862
Average Number of References per Paper	22.79	31.47	25.13	29.12	25.73	26.25	30.20	28.35	25.41	33.75	27.65

8. Conclusions

The study deals with the scientometric analysis of the five years (2013-2017) research publications of Indian Journal of Chemical Technology. An average number of paper published during the study periods are 64. The study of authorship pattern shows dominance of two authored, three authored and four authored research papers. Mallinath Kumbar and N.G.Kumar found that intellectual sharing took place by two or more scientists. Multiple authors' researches is very familiar in the present days. The present day also proved this statement. Seventy four percent of contributors were belonged to India and twenty six percent belonged to other countries. Among the Indian contributors, more than hundred contributors are belonged to Tamilnadu, Maharashtra, Karnataka, Uttarpradesh and Gujarat.

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