

Bibliometric Analysis of Papers Published in Indian Journal of Chemistry-Section A and Section B during 2015-2020

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ABSTRACT:

An analysis of 456 papers published in IJCA and 548 papers in IJCB during 2015-2020 indicates that the average number of articles published per year was 76 in IJCA and 91.3 in IJCB. Academic institutions from India and abroad were the major contributors to both the journals, however, their share varied in the two journals. India and China were the major contributors to IJCA, while India and Iran were the major contributors to IJCB. The value of CPP for Indian and foreign authored papers was almost the same for both the journals. Among the prolific countries, highest value of CPP was for Bangladesh for papers published in IJCA and no significant difference was observed in the values of CPP for prolific countries in IJCB. Islamic Azad University (Iran) contributed the highest number of papers in IJCA, while CSIR-Indian Institute of Chemical Technology (CSIR-IICT) topped the list of institutions in IJCB. Among the prolific institutions, CSIR-CSMCRI (Bhavnagar) had the highest value of CPP for IJCA. In case of IJCB, Gujarat University and Maharaja Krishnakumarsinhji Bhavnagar University (MBKU) had the highest value of CPP. The Proportion of uncited papers was slightly more in IJCA as compared to IJCB. Of the 12 highly cited papers in IJCA five papers were written in domestic collaboration and one in international collaboration, while of the nine highly cited papers in IJCB four papers were written in domestic collaboration and none in international collaboration.

Keywords: Bibliometrics, Scientometrics, Citation Analysis, Indian Journal of Chemistry, Bibliometric indicators

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INTRODUCTION

Primary journals are the most important channel for communicating research and related scholarly activities. These have been used as a functional unit for analysis of a subject area in several bibliometric studies. Factors like journal productivity and the citation analysis of articles published in them may be used to rate the journals. Besides journal impact factor, several journal ranking indicators like SCImago Journal Rank (SJR) and Source-Normalized Impact per Paper (SNIP) have also been suggested as proxies for journal quality measurement.

CSIR-National Institute of Science Communication and Information Resources (CSIR-NISCAIR), New Delhi, now named as CSIR-National Institute of Science Communication and Policy Research (CSIR-NIScPR) publishes several journals in different disciplines of science and technology. It started publishing *Indian Journal of Chemistry* in 1963. It was bifurcated into two independent journals in 1976. These were "*Indian Journal of Chemistry - Section A*" (IJCA) and "*Indian Journal of Chemistry - Section B*" (IJCB). Both these journals publish original research articles belonging to different sub-disciplines of chemistry and are leading chemistry journals published from India. Both journals have been indexed in Web of Science (WoS) of the Clarivate Analytics (USA) and Scopus of the Elsevier (USA) since their publication. Besides these two citation databases, these are also abstracted/indexed in other international abstracting and indexing services like Analytical Abstract, Chemical Abstract, and Biosciences etc. Both the journals are published monthly and are available

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in open access since the start of their publication in January 1976. Details of sub-disciplines covered by each journal are available on the websites of the journals at <http://op.niscair.res.in/index.php/IJCA> and <http://op.niscair.res.in/index.php/IJCB> respectively. The impact factor of IJCA as listed in JCR 2020 is 0.491 and SCImago Journal Rank (SJR) is 0.133 and listed under Q4. The impact factor of IJCB as listed in JCR 2020 is 0.592 and the SCImago Journal Ranking (SJR) is 0.15 listed under Q3. The objectives of the present study have been described below in detail.

Review of literature

During the past two decades, several authors have developed a scientometric profile of several individual international journals in the discipline of chemistry. For instance, Schubert^[1] developed a scientometric profile of papers published during 1990–1994 in *Inorganica Chimica Acta being published by Elsevier since 1967*. Based on the study authors suggested some measures as how to improve the visibility and prestige of the journal in future. Marx^[2] examined the citations obtained by papers published in *Angewandte Chemie*. The journal is being published in two different editions as *Angewandte Chemie and Angewandte Chemie International Edition* by John Wiley and Sons, the USA. Marx identified errors resulting from the publication of two different editions of the journal. Buznik, Zibareva, Piottukh-Peletsii^[3] *et al.* made a bibliometric analysis of the *Journal of Structural Chemistry* published by the Siberian Branch of the Russian Academy of Sciences since 1960. The study identified authors, their affiliations and topics covered in the journal during 1960–2002. The study also identified publications with the highest number of citations. In a study Téllez and Vadillo^[4] made a bibliometric study of papers published during 2000–2007 in five journals related to analytical chemistry using data from the Web of Science database. The study considered only journals that mostly published full research articles. The study found that Germany and the UK contributed most to the top journal in analytical chemistry. Another clear conclusion of this study is that the contribution of China has increased greatly and it now has one of the highest publication rates of any other country. Beside these, some studies related to national journals including India have also been published. For instance, Padme and Khaparde^[5] made a bibliometric analysis of papers published during 2010–2014 in *Indian Journal of Chemistry Section A*. Authors found that India and China were the main contributors to the journal. In another study, Nishy, Parvatharajan and Prathap^[6] examined the pattern of growth of the research papers published during 2005–2009, citations received by these papers, number of contributing authors, and papers contributed by Indian and foreign authors in *Indian Journal of Chemistry Section B*. The study found that contributions of Indian universities were more as compared

to government, private, public and CSIR laboratories. Das,^[7] made a bibliometric study of papers published during 1987–1996 in the *Journal of Chemical Sciences*. The study revealed that the maximum number of articles were published in the year 1993 (127) and minimum in the year 1994 (21) articles. Authorship patterns of papers published indicate that 599 (83.5 %) papers were jointly authored and 16.5 % were single authored papers. Most of the works were done on physical and theoretical chemistry with 291 articles followed by inorganic and analytical chemistry with 208 articles. Hassan, Jafar and Hassan^[8] *et al.* made a bibliometric analysis of 2134 records published in *Arabian Journal of Chemistry* during 2009–2019. The study found that of the total published records, 94% were research articles and the remaining were reviews. The study identified top 10 countries, institutions and authors and their citation impact. Visualization map, using VOSviewer was developed for co-words, co-authorship and co-citations patterns. Few studies related to bibliometric study of organic chemistry have been published in literature. For instance, Nagpaul and Pant^[9] found organic chemistry as a strong area of research in the chemical sciences in India. Scientometric assessment of Indian organic chemistry research during 1970s and 1980s by Karki and Garg^[10] also showed that its impact has improved during the 80s compared to the 70s. In another study, Karki and Garg^[11] found that alkaloid chemistry research performed in India was well connected to the mainstream science based on the communication pattern of publications and their citations in international literature. Kumari^[12] analysed research output and citation impact in synthetic organic chemistry (SOC) research for a group of countries and found that China out-performed India in terms of the absolute citations as well as relative citation impact. Dwivedi, Kumar and Garg^[13] analysed 17,344 papers published by Indian scientists and indexed by Web of Science in the discipline of organic chemistry and its sub-disciplines during 2004–2013 found that the Indian output has increased significantly in the later period. Academic institutions were the major contributors followed by the Council of Scientific and Industrial Research (CSIR). Indian researchers in the discipline of organic chemistry published their papers in international journals with impact factor more than one and about 11% of the papers published by Indian scientists in the discipline of organic chemistry during 2004–2013 remained uncited. The above review of literature indicates that no bibliometric study has been reported in literature which compared *Indian Journal of Chemistry Section A and Section B* simultaneously. The present study is an attempt in that direction and fills this gap.

Objectives of the Study

The basic aim of the study is to evaluate the journals, IJCA and IJCB in terms of the following bibliometric parameters:

- To compare the pattern of growth of articles published in IJCA and IJCB during the six years period of 2015 – 2020;
- To identify most prolific contributing countries and institutions and their citation impact in terms of Citation per Paper (CPP) and papers not cited (PnC). Details of these indicators have been described under methodology and bibliometrics indicators used.
- To examine the pattern of citations and to identify highly cited papers;
- To examine the pattern of authorship in both IJCA and IJCB.
- To examine the pattern of domestic and international collaboration of papers published.

Methodology and Bibliometric Indicators used

Data for the study was downloaded from the Web of Science core collection using the journal title in the tag “publication name” for the year 2015 to 2020. Data was downloaded in plain text form which was converted into a dbase relational database. The data contained the name of the authors, their institutional affiliations, type of documents and citations obtained by each article. Data was analysed to meet the objectives mentioned above. Authors have used four different bibliometric indicators. These are TNP: total number of publications published during 2015–2020, TNC: total number of citations received by these papers during 2015–2021 (January 5, 2022). CPP: citation per Paper, and PnC (%). These have been used for comparison of output and impact of countries, institutions and authors. CPP is the ratio of citations to publications or the average number of citations per paper. The value of PnC was obtained by making the citation analysis of papers provided in Table 5 in the text below. In the present study, authors have used the method of complete count or whole count. This method inflates the total count of publications and citations, because each country or institution or authors in multi-authored papers are given unit credit for their contributions, unlike first author count where only the first author gets the credit.

RESULTS AND DISCUSSION

In the following paragraphs authors discuss the results of the analysis on different parameters mentioned under the objectives.

Type of Documents

During 2015–2020, IJCA published 456 records. Of these 98.9% were articles including articles-proceedings and the rest one percent were other types of documents. Of the 548 records published by IJCB 99 % were articles and the

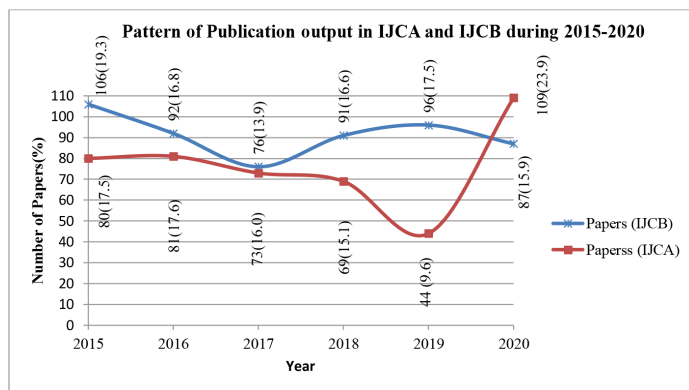


Figure 1: Pattern of output in IJCA and IJCB during 2015-2020.

remaining one percent were other types of documents. Thus, both the journals published almost equal number of articles. In the present study authors have made a detailed bibliometric analysis of all types of documents as the proportion of other type of documents (letters, corrections and editorials) is only about one per cent in both the journals and their inclusion in the analysis will not affect the citation impact of countries, institutions and authors.

Chronological Distribution of Articles during 2015-2020

The pattern of output for papers published in IJCA and IJCB has been depicted graphically in Figure 1. The pattern of output as depicted in the Figure 1 for IJCA indicates a declining trend of output with the lowest number of papers in 2019 and a steep increase in output in 2020. Authors explored the reason for a steep increase in the number of papers published in 2020. It was found that the journal published a special issue containing 17 articles presented at “International Conference on Advances in Chemistry with Specific Reference to Catalysis, Sensors, Drug Delivery and Energy Materials (ICACSEM-2020)” with Dr E. Murugan as the Guest Editor, resulting in more number of articles in 2020. Further analysis of output for IJCA indicates that the average number of articles published per year was 76. The journal published less than average number of articles during 2017, 2018 and 2019. The pattern of output for IJCB indicates an inconsistent trend of output unlike IJCA during the study period. The output started increasing after reaching at the lowest level in the year 2017. IJCB on average published about 91.3 articles per volume. This indicates that IJCB published a much higher number of articles per volume as compared to IJCA. Except for 2017 and 2020, the number of articles published in IJCB was either more or close to the average number of articles published per year in the journal.

Distribution of Output and Impact of Prolific Countries

This section has been divided into two sub-sections. These are: (i) Contribution and impact of India versus foreign countries for IJCA and IJCB and (ii) Distribution of output

Table 1: Distribution of output and impact of India versus foreign countries

Journal	Countries	TNP (%)	TNC	CPP	PnC (%)
IJCA	India	503 (62.0)	951	1.9	211 (41.9)
	Foreign countries (29)	308 (38.0)	550	1.8	124 (40.3)
	Total	811 (100)	1501	1.8	335 (41.3)
IJCB	India	815 (79.8)	1502	1.8	290 (35.6)
	Foreign countries (33)	206 (20.2)	356	1.7	94 (26.4)
	Total	1021 (100)	1858	1.8	384 (37.6)

and its citation impact for prolific countries contributing one or more per cent of output for IJCA and IJCB respectively.

Contribution and Impact of India Versus Foreign Countries

In the following paragraphs we describe the contribution and impact of India and for all foreign countries taken together. Table 1 depicts the output and citation impact in terms of CPP and PnC for India vis-à-vis all foreign countries for IJCA and IJCB respectively. Data presented in Table 1 indicates that the publication share of all foreign countries taken together for IJCA was more (38 %) as compared to IJCB (20.2 %). Citation impact per paper for India and all foreign countries taken together is almost equal for both IJCA and IJCB. However, the percentage of papers not cited (PnC %) for India is higher than foreign countries taken together for both IJCA and IJCB. Details for different prolific countries publishing one percent or more papers and the value for CPP and PnC have been depicted in Table 2A for IJCA and Table 2B for IJCB below.

Prolific Countries and Impact of their Output

IJCA: Raw analysis of data indicates that 30 countries including India contributed the total output in IJCA. Regional distribution of countries indicates that the highest number of countries including India were from Asia (18) followed by Europe (7), Africa (2), North and South America one each and trans-continental country one. Table 2A depicts data on the distribution of output and its impact in terms of citations per paper (CPP) and papers not cited (PnC). Nine countries which produced one per cent or more of the output listed in Table 2A contributed about 94.3% of the total output. Of this, 62% papers were contributed by India followed by China (17.8 %) and Iran (5.2 %) output. Thus, these three countries together contributed more than two-third (85%) of the total output. These findings are similar to the findings of Padme and Khaparde who did a bibliometric study of papers published in IJCA during 2010–2014. The pattern of output indicates a highly skewed distribution of research output as the remaining 21 non prolific countries not listed in Table 2A published only 5.7 % papers. Of these 21 countries, eight

Table 2A: Distribution of output and impact of prolific countries for IJCA.

#	Publishing countries (IJCA)	TNP (%)	TNC	CPP	PnC (%)
1	India	503 (62.0)	951	1.9	211 (41.9)
2	China	145 (17.8)	192	1.3	68 (46.9)
3	Iran	42 (5.2)	85	2.0	11 (26.2)
4	Turkey	32 (3.9)	47	1.5	18 (56.3)
5	Egypt	10 (1.2)	15	1.5	5 (50.0)
6	USA	9 (1.1)	12	1.3	2 (22.2)
7	South Korea	8 (1.0)	18	2.3	1 (12.5)
8	Bangladesh	8 (1.0)	29	3.6	3 (37.5)
9	Malaysia	8 (1.0)	9	1.1	5 (62.5)
	Sub-total	765 (94.3)	1358	1.8	324 (42.4)
	Other 21 countries	46 (5.7)	143	*3.1	11 (23.9)
	Total	811	1501	1.8	335 (41.3)

*CPP for other countries is more because CPP for Italy is more than 11.

countries contributed one paper each and five contributed two papers each. Thus, these 13 countries contributed 18 papers only. The number of papers of the remaining eight countries varied between three to seven papers, indicating a highly skewed distribution of output.

The impact of the publication output of the nine prolific countries has been examined by using CPP and PnC %. The value of CPP for the entire output is 1.8. Of the nine countries listed in Table 2A, CPP is highest (3.6) for Bangladesh. For five countries, namely China, Turkey, Egypt, USA and Malaysia, it is less than the overall value of CPP. The overall value of PnC (%) was 41.3. The value of PnC (%) was much less than 41.3 for the USA and Iran. Lowest PnC % was for the USA. For China, Turkey, Egypt and Malaysia, the value of PnC % was more than the overall value of PnC % resulting in a low value of CPP for these countries. The value of PnC (%) was highest for Malaysia followed by Turkey and Egypt. The value of CPP for 21 countries not listed in Table 2A is more than the overall value of CPP, because among these countries CPP for Italy is more than 11 with a very low value (28.6 %) of PnC %.

IJCB: Table 2B depicts data on the distribution of output and its impact in terms of citations per paper (CPP) and papers not cited PnC (%) for countries publishing one or more than one per cent of papers. Data presented in Table 2B indicates that 34 countries including India contributed the total output in IJCB. Like IJCA, India contributed the highest number of papers. This is similar to the finding of Nishy, Parvatharajan and Prathap. The share of papers contributed by India was much more than its contribution in IJCA. India contributed more than 79% of the total output. Share of China and Iran in IJCB was less in comparison to their share in IJCA. Like the number of countries contributing to the total output from different regions of the globe also changed. The number of

Table 2B: Distribution of output and impact of prolific countries for IJCB.

#	Publishing countries (IJCB)	TNP (%)	TNC	CPP	PnC (%)
1	India	815 (79.8)	1502	1.8	290 (35.6)
2	Iran	36 (3.5)	79	2.2	17 (47.2)
3	China	28 (2.7)	38	1.4	17 (60.7)
4	Turkey	26 (2.5)	59	2.3	8 (30.8)
5	Japan	15 (1.7)	10	0.7	9 (60.0)
6	Spain	12 (1.2)	20	1.7	0 (00.0)
7	South Africa	10 (1.0)	13	1.3	4 (40.0)
	Sub-total	942 (92.3)	1721	1.8	345 (36.6)
	Others (27 countries)	79 (7.7)	137	1.7	39 (49.4)
	Total	1021	1858	1.8	384 (37.6)

countries from Asian region decreased from 18 in IJCA to 12 in IJCB and the number of countries from Europe increased to 12 from six in IJCA. Number of countries from the African region also increased from two in IJCA to four in IJCB. The pattern of output in IJCB also indicates a highly skewed distribution of research output like IJCA.

Of the 27 countries not listed in Table 2B, 14 countries contributed one paper each and eight countries contributed two papers each. Thus, these 22 countries contributed 30 papers again indicating a highly skewed distribution of output like IJCA. Of seven countries, only Iran and Turkey had a higher value than the overall value of CPP. Value of CPP for India was equal to the overall CPP. The value of CPP for the remaining four countries namely China, South Africa, Saudi Arabia and Japan was lower than the overall value of CPP. The value of CPP was lowest for Japan. Proportion of papers not cited was lowest for Turkey followed by India. For the remaining five countries, it was more than the overall value of PnC (%). Proportion of uncited papers (PnC %) was highest for China and Japan. None of the papers published by Spain remain uncited.

Distribution of Output and Impact of Prolific Institutions

IJCA: Analyses of data for institutional productivity indicate that 435 institutions from India and abroad produced the total output. Thus, the average number of institutions per paper is 1.8. Table 3A depicts 12 prolific institutions which produced one percent or more of the output. The output of these 12 prolific institutions was about 16.6 % of the total output and the proportion of citations received by these institutions was about 17.6% of all the citations. The remaining 423 institutions produced more than two-third (83.4 %) of the total output and received about 82.4% of all citations. Of the 12 prolific institutions depicted in Table 3A, one each was from Iran and Egypt and the remaining 10 were from India. All institutions were academic except CSIR-CSMCRI, an institution funded by the Council of Scientific and Industrial Research (CSIR).

Table 3A: Distribution of output and impact of most prolific institutions for IJCA.

#	Institute	Country	TNP	TNC	CPP	PnC (%)
1	Islamic Azad University	Iran	16	35	2.2	2 (12.5)
2	University of Delhi (Delhi)	India	15	27	1.8	5 (33.3)
3	*UST (Meghalaya)	India	15	18	1.2	7 (46.7)
4	Goa University (Goa)	India	13	29	2.2	4 (30.8)
5	Osmania University (Hyderabad)	India	12	37	3.1	2 (16.7)
6	Jadavpur University (Jadavpur)	India	12	14	1.2	6 (50.0)
7	Shivaji University (Kolhapur)	India	11	8	0.7	8 (72.7)
8	IIT (Madras)	India	10	31	3.1	5 (50.0)
9	**CSIR-CSMCRI (Bhavnagar)	India	9	32	3.6	0 (00.0)
10	University of Madras (Chennai)	India	9	2	0.2	7 (77.8)
11	Bharathiar University (Coimbatore)	India	8	20	2.5	4 (50.0)
12	Cairo University (Giza, Egypt)	Egypt	8	15	1.9	3 (37.5)
	Sub-total		138	268	1.9	53 (38.4)
	Other 423 institutions		695	1256	1.8	293 (42.2)
	Total institutions = 435		833	1524	1.8	346 (41.5)

*UST: University of Science and Technology **CSIR-Central Salt and Marine Chemical Research Institute

Among all the prolific institutions, Islamic Azad University (Iran) topped the list with 16 papers, closely followed by University of Delhi and Goa University from India. Among all the 12 prolific institutions, the value of CPP is highest (3.6) for CSIR-CSMCRI followed by Osmania University (Hyderabad) and Indian Institute of Technology (IIT) Madras. Lowest value of CPP was for University of Madras followed by Shivaji University, because these two institutions had the highest proportion of uncited papers. Among all the prolific institutions no paper remained uncited published by CSIR-CSMCRI, resulting in highest value of CPP for this institute. Among the non-prolific institutions, Bharathidasan University had the highest CPP followed by Devi Ahilya University, (Indore, India) and Jahangirnagar University (Bangladesh). The value of CPP for these institutions was 6.3, 4.7 and 4.2 respectively.

IJCB: Top 13 prolific institutions which produced one percent or more papers have been depicted in Table 3B. Of the 13 prolific institutions, all were academic institutions including institutes of technology except CSIR-Indian Institute of Chemical Technology, which was funded by CSIR. Like IJCA, all prolific institutions were Indian except one which was from Iran. Among all the prolific institutions, CSIR-

Table 3B: Distribution of output and impact of most prolific institutions for IJCB.

Sl. No.	Institute	Country	TNP	TNC	CPP	PnC (%)
1	CSIR Indian Institute of Chemical Technology	India	62	111	1.8	26 (41.9)
2	Kakatiya University	India	21	36	1.7	5 (23.8)
3	Jawaharlal Nehru Technology University	India	17	29	1.7	6 (35.3)
4	University of Delhi	India	15	27	1.8	8 (53.3)
5	Sri Venkateswara University	India	15	21	1.4	4 (26.7)
6	Gujarat University	India	14	39	2.8	1 (7.1)
7	*MBKU	India	13	36	2.8	3 (23.1)
8	Islamic Azad University	Iran	12	17	1.4	3 (25.0)
9	Indian Institute of Technology (Bombay)	India	12	27	2.2	3 (25.0)
10	University of Rajasthan	India	11	27	2.5	4 (36.4)
11	University of Allahabad	India	11	16	1.5	2 (18.2)
12	HPT Arts and RYK Science College	India	10	22	2.2	1 (10.0)
13	University of Bombay	India	10	13	1.3	3 (30.0)
	Sub-total	India	223	421	1.9	69 (30.9)
	Others		812	1481	1.8	316 (38.9)
	Total		1035	1902	1.8	385 (37.2)

*MBKU: Maharaja Krishnakumarsinhji Bhavnagar University

Indian Institute of Chemical Technology (India) topped the list with 62 papers. Among the prolific institutions, the value of CPP is highest (2.8) for Gujarat University and Maharaja Krishnakumarsinhji Bhavnagar University (MBKU) followed by University of Rajasthan. Of the 13 institutions listed in Table 3B, six institutions had a low value of CPP than the overall value of CPP. The lowest CPP was for the University of Bombay. Among all the institutions, the highest proportion of uncited papers was for University of Delhi followed by CSIR-Indian Institute Chemical Technology. Gujarat University had the lowest value of PnC % resulting in the highest value of CPP for this institute.

Pattern of Citations and Highly Cited Papers

Citation counts are a measure of the impact and influence made by each article published in the journals. These are obtained by making a count of the number of times these are cited by other articles. High number of citations to a publication is considered as an indication of its influence, visibility and impact. An author's influence and visibility can be measured by determining how often his/her articles have been cited in other articles. Table 4 depicts the pattern of citations of papers published in the two journals during 2015–2020. Citations of papers were examined in the first week of January 2022. During the period of 2015–2021, 456 papers published in IJCA received 847 citations, while 548 articles published in IJCB obtained 910 citations. Of the total papers published in the two journals 190 (41.7%) articles in IJCA and 217 (39.6%) articles in IJCB remained uncited. Of the total cited papers,

50.7 % in IJCA and 52.4 % in IJCB were cited between 1–5 times respectively. The number of papers cited more than 10 times were almost equal in both the journals.

Highly Cited Papers

IJCA: Table 5A lists papers those were cited 10 or more times during 2015–2021 in IJCA. Of the 12 papers cited 10 or more times in IJCA, one was published by authors from Bangladesh which ranked third and one each by authors from China and South Africa. These ranked sixth and eight respectively. Remaining nine were contributed by Indian authors. Of the 12 papers one was published in international collaboration between India and Italy and it received the highest number of citations. Five papers were published in domestic collaboration.

IJCB: Table 5B lists nine papers those received 10 or citations during 2015–2021 in IJCB. Of the nine papers cited 10 or more times in IJCB, only one paper was contributed by authors from Iran and it ranked first among the list of highly cited papers. Remaining eight papers were contributed by Indian authors. Of the nine highly cited papers four were published in domestic collaboration and none in international collaboration.

Pattern of Authorship

To study the pattern of authorship, the data on the number of authors has been divided into four categories. These were single, two, multi and mega-authored papers for the

Table 5A: Papers cited 10 or more times in IJCA.

SI No.	Papers with 10 or more citations	Citations
*1	Raizada, Pankaj., Priya, Bhanu., Thakur, Pankaj., <i>et al.</i> , Shoolini University, Solan, Himachal Pradesh, India, and IstItaliano Technology, Naples, Italy. IJCA 55 (7) 2016, 803 - 809	41
**2	Dey, Dhananjay., De, Abhranil., Pal, Sukanta., <i>et al.</i> , Raghunathpur College, Purulia (WB), India, Indian Association for Cultivation of Science, Kolkata, India, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India, Urumu Dhanalakshmi College, Tiruchirappalli, Tamil Nadu, India. IJCA 54 (2) 2015, 170 - 178	17
3	Hoque, Md. Anamul., Mitu, Attikunahar., Patoary, Mohammad Omar Faruk, <i>et al.</i> , Jahangirnagar University, Dhaka, Bangladesh. IJCA 55 (7) 2016, 793 - 802	16
**4	Thirumalai, Kupplingam., Shanthi, Manohar., Swaminathan, Meenakshisundaram Annamalai University, Annamalaiagar, Tamil Nadu, India. Kalasalingam University, Krishnankoil, India. IJCA 56 (1) 2017, 50 - 56	13
5	Khare, Savita., Chokhare, Rajendra., Shrivastava, P., <i>et al.</i> , Devi Ahilya University, Indore, Madhya Pradesh, India IJCA 54 (8) 2015, 1032 - 1038	13
6	Tang, Youxia., Wang, Yanming., Liu, Gen., <i>et al.</i> , Huaibei Normal University, Huaibei, PRC. IJCA 55 (3) 2016, 298 - 303	12
7	Ravi, Gundeboina., Mansouri, Saleh., Palla, Suresh., <i>et al.</i> , Osmania University, Hyderabad, Andhra Pradesh, India IJCA 54 (1) 2015, 20 - 26	12
**8	Venkatesh, G., Govindaraju, M., Vennila, P., Bharathiar University, Coimbatore, Tamil Nadu, India, Arignar Anna Government Arts College, Namakkal, India, Thiruvalluvar Government Arts College, Rasipuram, India. IJCA 55 (4) 2016, 413 - 422	11
9	Chokkareddy, Rajasekar., Bhajanthri, Natesh Kumar., Redhi, Gan G., Durban University of Technology, Durban, South Africa. IJCA 57 (7) 2018, 887 - 895.	10
**10	Narayanan, Hariprasad., Nair, M. V., Harindranathan, Viswanathan, Balasubramanian, Indian Institute of Technology Madras, Tamil Nadu, India, Cochin University of Science and Technology, Cochin, Kerala, India. IJCA 56 (3) 2017, 251 - 269	10
11	Mitra, Merry., Ghosh, Rajarshi, University of Burdwan, Burdwan, WB, India. IJCA 55 (6) 2016, 681 - 685	10
**12	Muthuvinnayagam, A., Viswanathan, Balasubramanian., National Institute of Technology, Calicut, Kerala, India, Indian Institute of Technology, Madras, Tamil Nadu, India. IJCA 54 (2) 2015, 155 - 160	10

Table 5B: Papers cited 10 or more times in IJCB.

SI No.	Papers with 10 or more citations	Citations
**1	Maghsoodlou, MalekTaher., Heydari, Reza., Lashkari, Mojtaba., and Mohamadpour, Farzaneh, University of Sistan and Baluchestan, Zahedan, Iran. Velayat University, Iranshahr, Iran. IJCB 56 (2) 2017, 160 - 164	18
2	Vekariya, Rajesh H., Patel, Hitesh D., Gujarat University, Ahmadabad, Gujarat, India. IJCB 56 (8) 2017, 890 - 896	15
**3	Godhani, Dinesh R., Jogel, Anand A., Sanghani, Anil M., Maharaja Krishnalcumarsinhji Bhavnagar Univ, Bhavnagar, Gujarat, India. Sir PP Institute of Science, Bhavnagar, Gujarat, India. IJCB 54 (4) 2015, 556 -564	15
**4	Singh, Rajesh K., Bala, Renu., Kumar, Sahil, Shivalik College of Pharmacy, Nangal (Panjab) India. Baddi University of Emerging Science and Technology, Panjab, India. IJCB 55 (3) 2016, 381 - 386	14
5	Yaragorla, Srinivasarao., Kumar, G. Srikanth, Central University of Rajasthan, Bandarsindri, India. IJCB 54 (2) 2015, 240 - 244	12
6	Muthuvel, I., Dineshkumar, S., Thirumurthy, K., Rajasri, S., Thirunarayanan, G., Annamalai University, Annamalaiagar, Tamil Nadu, India. IJCB 55 (2) 2016, 252 - 260	11
7	Srinivas, A., Sunitha, M., Vaagdevi Degree and PG College, Warangal, Andhra Pradesh, India. IJCB 55 (1) 2016, 102 - 109	11
**8	Praveena, C., Parthasarathy, K., Kumar, P. Senthil, Perumal, P. T., CSIR Central Leather Research Institute, Chennai, Tamil Nadu, India. Orchid Chemicals and Pharmaceuticals Ltd, Chennai 600119, Tamil Nadu, India. IJCB 54 (3) 2015, 373 - 382	11
9	Mistry, B. D., Desai, K. R., Intwala, S. M., BKM Science College, Valsad, Gujarat, India. IJCB 54 (1) 2015, 128 - 134	10

*Papers in international collaboration, **Papers in domestic collaboration

two journals. Papers having three or four authors have been categorized as multi-authored and papers having more than four authors as mega-authored papers. Data on the pattern of authorship has been presented in Table 6. Data presented in Table 6 indicates that the share of single authored is less than 5 %. Share of multi-authored papers is highest for both the journals followed by mega-authored papers. This indicates that the discipline of chemistry is highly collaborative.

Table 5: Pattern of citations in IJCA and IJCB.

Number of citations	Pattern of citations in IJCA		Pattern of citations in IJCB	
	Papers (%)	Total citations	Papers (%)	Total citations
0	190 (41.7)	0	217 (39.6)	0
1	96 (21.1)	96	119 (21.7)	119
2	53 (11.6)	106	71 (13.0)	142
3	34 (7.5)	102	48 (8.8)	144
4	28 (6.1)	112	32 (5.8)	128
5	20 (4.4)	100	17 (3.1)	85
6-10	27 (6.0)	196	36 (6.6)	193
> 10	8 (1.6)	135	8 (1.5)	103
Total	456 (100)	847	548 (100)	910

Table 6: Pattern of authorship for IJCA and IJCB.

Journal	Single authored papers (%)	Two authored papers (%)	Multi-authored papers (%)	Mega-authored papers (%)	Total
IJCA	22 (4.8)	112 (24.6)	198 (43.4)	124 (27.2)	456
IJCB	23 (4.2)	126 (23.0)	242 (44.2)	157 (28.6)	548
Total	45 (4.5)	238 (23.7)	442 (44.0)	281 (28.0)	1004

Pattern of Domestic and International Collaboration

IJCA: Of the 811 papers published in IJCA during the period of six years (2015–2020), 697 (85.9 %) were published in domestic collaboration by 19 countries. Eleven countries (Japan, Germany, Czech Republic, Colombia, Hungary, Spain, Taiwan, Mauritius, Chile, United Arab Emirates and Ireland) published no paper in domestic collaboration. Twenty-five countries published 93 (11.5%) papers in international collaboration and five countries namely Vietnam, Pakistan, Thailand, Indonesia and Romania published no paper in international collaboration. Table 7A depicts the distribution of papers in domestic and international collaboration by top nine publishing countries. Of the 697 papers published in domestic collaboration, 458 (65.7 %) papers were published by India followed by China (132), Iran (38) and Turkey (28). Thus, these four countries published 656 (94.1 %) papers in domestic collaboration and the remaining 41 (5.9 %) papers were published by 15 countries. Of the 93 papers published in international collaboration, 26 papers were published by India followed by China (12) and the remaining 55 papers by other 25 countries. Among these countries, India published the highest (26) papers in international collaboration. India published papers in collaboration with 12 different countries. India's share of collaborative papers was the highest with Malaysia (5) followed by South Korea, Italy and Japan (3 each). With the USA, Germany, Czech Republic, and Hungary India had 2 collaborative papers each and with Ireland, Mauritius, Taiwan and United Arab Emirates it had one paper in collaboration with each country.

Table 7A: Distribution of papers in domestic and international collaboration in IJCA.

#	Collaborating countries	Papers in collaboration (IJCA)		Total Number of papers published
		Domestic (%)	International	
1	India	458	26	503
2	China	132	12	145
3	Iran	38	4	42
4	Turkey	28	3	32
5	Egypt	7	3	10
6	USA	4	5	9
7	Malaysia	2	6	8
8	Bangladesh	5	3	8
9	South Korea	3	5	8
	Sub-total	677	67	765
	Other countries	20	26	46
	Total	697	93	811

IJCB: Out of 1021 papers published in IJCB during 2015–2020, 884 papers were published in domestic collaboration by 19 countries as 15 countries namely Spain, Brazil, France, Portugal, Italy, England, Canada, South Korea, Slovakia, Nigeria, Bulgaria, Czech Republic, Taiwan, Mexico and Slovenia did not publish papers in domestic collaboration. Of the 34 countries only 25 countries published 98 papers in international collaboration. Iran, Turkey, Japan, Indonesia, Poland, Egypt, Algeria, Macedonia, and Pakistan did not publish papers in international collaboration. Table 7B depicts the distribution of papers in domestic and international collaboration by top seven publishing countries. Of the 884 papers published in domestic collaboration, 755 (85.4 %) papers were published by India followed by Iran (30), China (25), and Turkey (26). Thus, these four countries published 836 (94.6 %) papers in domestic collaboration and the remaining 48 (5.4 %) papers were published by the remaining countries. Of the 98 papers published in international collaboration, 32 papers were published by India followed by Spain (12). India published papers in international collaboration with 16 different countries. India's share of collaborative papers was the highest with South Africa (5) followed by Brazil and France 3 each. With South Korea, Vietnam, China, Nigeria, Italy, England, Saudi Arabia, and Portugal India published 2 papers each. The USA, Bulgaria, Taiwan, Germany and Slovenia published one paper each in international collaboration with India.

DISCUSSION AND CONCLUSION

The present study examined the pattern of growth of publication output of IJCA and IJCB for papers published during 2015–2020. The study also identified prolific countries, institutions and authors and the impact of their output using

Table 7B: Distribution of papers in domestic and international collaboration in IJCB.

#	Collaborating countries	Papers in collaboration (IJCB)		Total Number of papers published
		Domestic	International	
1	India	755	32	815
2	Iran	30	0	36
3	China	25	2	28
4	Turkey	26	0	26
5	Japan	14	0	15
6	Spain	0	12	12
7	South Africa	2	8	10
	Sub-total	852	54	942
	Others (27 countries)	32	44	79
	Total	884	98	1021

citation per paper (CPP) and papers not cited (PnC). The study also examined the pattern of citations, identified the highly cited papers of both IJCA and IJCB and pattern of domestic and international collaboration. Analysis of data indicates a decreasing trend of output for IJCA and an inconsistent trend of output for IJCB during the study period. IJCB published a much higher number of articles per volume as compared to IJCA. There is a need for Indian authors to publish more in journals of Indian origin in every field instead of adding to the productivity of journals of foreign origin. A highly skewed distribution of research output has been observed for countries for both the journals. Nine most prolific countries produced 94.3% articles in IJCA, while seven prolific countries published 92.3 % papers in IJCB. India and China were the major contributors to IJCA, while India and Iran were the major contributors to IJCB. The value of CPP for Indian and foreign authored papers was almost the same for both the journals. However, share of uncited papers (PnC %) was more for India as compared to all foreign countries for both IJCA and IJCB. Academic institutions from India and abroad contributed the highest number of papers and most of the prolific institutions were from India for IJCA and IJCB. However, Islamic Azad University (Iran) and Cairo University (Egypt) were prolific institutions from abroad for IJCA. CSIR–CSMCRI (Bhavnagar) had the highest value of CPP for IJCA and the value of CPP for IJCB was the highest for Gujarat University and MBKU. Of the 12 highly cited papers in IJCA five papers were written in domestic

collaboration and one in international collaboration, while of the nine highly cited papers in IJCB, four papers were written in domestic collaboration and none in international collaboration. Three highly cited papers were contributed by authors from Bangladesh, China and South Africa in IJCA and only one in IJCB was contributed by an author from Iran. Rest of the highly cited was authored by Indian authors in IJCA and IJCB. Most of the papers published in domestic and international collaboration were published by Indian authors. Based on the bibliometric analysis it can be suggested that editors of both journals should try to get review articles to be published in both the journals as no reviews were published during 2015–2020. It will help in raising the impact factor of the journals. Contributions from foreign countries are 38 % in IJCA and about 20 % in IJCB. Therefore, more contributions from developed foreign countries and Indians staying abroad must be sought.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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