Citation Analysis of Scholarly Publications in Chemistry: A Study of Mangalore University

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Abstract

This study analyses citations of chemistry research publications at Mangalore University, focusing on the research productivity of authors and the quality of scholarly publications. The data from 2003-2023 shows a high citation ratio per publication, with no single-author publications. Multi-authorship dominates, with 77 (22.11%) of the five authors' publications receiving 958 citations. Elsevier is the most preferred publisher, with 73 publications receiving 4109 citations. The study provides insights into publication trends, author productivity, journal preferences, and research visibility within the university.

Keywords
Citation analysis; Chemistry; Research publications; Mangalore University; Web of Science

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INTRODUCTION

Citation analysis is a fundamental component of bibliometric studies, offering valuable insights into the intellectual structure, influence, and dissemination patterns within a given field of research. By examining how often and by whom scholarly works are cited, citation analysis helps identify seminal publications, influential authors, and core journals, while also shedding light on the evolution of research themes over time. Citation analysis measures the quality of a scholarly publication and the research productivity of an author. Citations indicate how frequently a publication is cited by other researchers and are used in the academic community to estimate the quality and relevance of research output. Web of Science is one of the most reputed bibliographic and citation databases. It offers comprehensive citation data for research articles published in different disciplines, including chemistry. The present study focuses on citation analysis of chemistry research publications of Mangalore University. Mangalore University (MU) is a state university established in 1980, which is located in Mangalore, Karnataka, India. It caters to the educational needs of the coastal regions of Karnataka and has grown to offer a wide array of undergraduate, postgraduate, and doctoral programs. It focuses on a variety of fields such as science, technology, humanities, and social sciences significant contributions to academic research through publications in journals, conferences, and books. Research output from the university is particularly visible in the fields of Chemistry and Physics. The university has consistently produced a growing number of high-quality research papers and conference presentations, supported by state-of-the-art laboratories and research infrastructure (MU, 2024). This study provides an overview of the scholarly productivity of chemistry research by conducting citation analysis on the chemistry publications of Mangalore University indexed in the Web of Science Core Collection which intends to explore several key metrics in citation analysis, such as the total number of citations, citation distribution, journal impact factor, and the relationship between the number of publications and citations.

REVIEW OF LITERATURE

Several works on citation analysis have been conducted to determine the research productivity of an institution and a researcher. Some of the studies that are conducted exclusively on chemistry subjects are reviewed for the present investigation as follows:

Kodandarama and Chandrashekara (2020) observed that most of the papers cited in chemistry publications are by three authors (19.97%), followed by two (18.90%) and four (16.31%), and Elsevier is the most preferred publisher for citing its journals in chemistry publications. The source-wise distribution of citations reveals that journal literature constitutes the majority, accounting for 89.98% of the total citations. The results indicate that literature published by Western countries received significantly higher citation rates.

Approximately 40% of chemistry publications in India originate from public universities, but only 0.86% of research papers from India are ranked among the top 1% of the most highly cited papers globally. Fewer than 39% of research papers from India are published in quartile 1 journals in contrast to 53.6% for China and 53.8% for South Korea. Approximately 20% of chemistry papers from India involve collaboration with international co-authors (Madhan et al., 2020). In chemistry, the core journals are mostly published in United States and the United Kingdom (Kodandarama & Chandrashekara, 2020; Nagarkar, 2014). India is third in chemistry publications after the USA and China (Maharana, Majhi and Sethi, 2011; Madhan et al., 2020). Chemistry is the most prominent research area compared to other subjects (Chavda & Dodiya, 2021). In the field of chemistry, journals are reported to contribute the most citations, followed by books (Ciriminna et al., 2023; Borthakur, 2020; Gohain & Saikia, 2014; Zhang, 2013).

Citation counts are associated with the quality of the research article, the citation capacity of the cited references, journal language, the different subfields of chemistry, and the authors' reputation (Bornmann et. al., 2012).Kademani et al. (2007) conducted a citation analysis of chemistry publications of the Bhabha Atomic Research Centre (BARC). The study observed that the average number of citations per year was 501.86. The average number of citations per publication was 6.37. The highest number of citations received was 877 in 2001. The citation rate peaked during 1990–2003, with a maximum of 9145 (82.82%) citations received during the period. Single-authored publications (168) have received 456 (4.13%) citations and 1565 multi-authored publications have received 10585 (95.87%) citations.

3. OBJECTIVES OF THE STUDY

The broader objective of the study is to examine citations of chemistry research publications of Mangalore University. The specific objectives are:

- to find out the year and publisher-based distribution of citations
- to identify the authorship pattern in chemistry publications;
- to know the most influential journals in which authors prefer to publish their research articles;
- to analyze the country-wise collaboration of research

METHODOLOGY

Clarivate Analytics' Web of Science (WoS, 2024) is a wide-ranging citation database used to gather the articles published by the five faculty members of the chemistry department (Table 1) at Mangalore University from 2003 to 2023. The data was collected in August 2024. The list of articles published by the chemistry faculty was retrieved by running an "Author Identifiers" search under the 'Researcher' tab for each author using Web of Science Research ID or ORCID. As journals are the most preferred channel for research communication, the study includes only journal articles, excluding books, conference articles, etc. The retraced articles that are not available in the Web of Science Core Collections are not included in the study. Overall, the search resulted in 305 research publications published in various journals. The article titles were analysed in a separate data sheet to filter out the duplicates so that unique titles remained. After filtering, 284 articles were obtained with 6885 citations. The whole dataset was analysed using MS Excel. The VOSviewer has been used to map the author and country network and for keyword density visualisation.

Table 1: Prolific authors of chemistry

Name of the Authors	H-Index	Number of Publications	Number of Citations
Bhoja Poojary	28	112	3656
G K Nagaraja	22	88	1241
Vishalakshi B	21	53	1179
Mahagundappa R Maddani	11	22	461
Jagadeesha Prasad D	10	30	1095

Table 1 presents the faculty of Mangalore University's chemistry department. The faculty was ranked based on their H-index value. Dr Bhoja Poojary is the most productive author, with 112 publications (3656 citations) and an H-index of 28 (as of December 06, 2024).

ANALYSIS AND INTERPRETATION OF DATA

Year-wise analysis of publications and citations

The study analyzes 6885 citations received from 284 chemistry publications of Mangalore University indexed in Web of Science Core Collections. Table 2 displays the year-wise publication growth and citations received for the chemistry publications covered in the study. The number of publications fluctuates over the years, with a notable peak in 2011, i.e., 43 (15.14%). It is common for older papers to have more citations as they have a more time to be cited. This is evident in the current analysis, as there are relatively fewer citations for the most recent years, such as 2022 (180 citations) and 2023 (36 citations).

Table 2: Year-based publication distribution of chemistry

Sl. No.	Year of Publication	Publi cations	%	Citations	Average Citations per Publication
1.	2003	3	1.06	505	168.33
2.	2004	6	2.11	108	18.00
3.	2005	11	3.87	364	33.09
4.	2006	12	4.23	849	70.75
5.	2007	5	1.76	187	37.40
6.	2008	5	1.76	438	87.60
7.	2009	8	2.82	197	24.63
8.	2010	13	4.58	330	25.38
9.	2011	43	15.14	467	10.86
10.	2012	12	4.23	338	28.17
11.	2013	10	3.52	188	18.80
12.	2014	13	4.58	260	20.00
13.	2015	20	7.04	555	27.75
14.	2016	13	4.58	167	12.85
15.	2017	7	2.46	137	19.57
16.	2018	19	6.69	425	22.37
17.	2019	20	7.04	387	19.35
18.	2020	20	7.04	449	22.45
19.	2021	20	7.04	318	15.90
20.	2022	14	4.93	180	12.86
21	2023	10	3.52	36	3.60
	Total	**284**	**100**	**6885**	**24.24**

The average citations per publication ratio for each year is the ratio of the total number of citations to the total number of publications for each year (ScienceDirect, 2024). It is clear from Table 2 that in 2003, a very high ratio of citations (168.33) per publication was received, followed by 2006 (87.60).

Co-authorship trend in chemistry

In the discipline of Chemistry, multi-authorship research is dominant (Gayan & Singh, 2021; Borthakur, 2020; Gohain & Saikia, 2014), and publications with a single authorship pattern are the least productive (Chavda & Dodiya, 2021). Table 3 remarkably shows that no single-author chemistry publications were found during the study. The dominance of multi-authorship is evident in the present study, also with 77 (22.11%) five authors' research publications having 958 citations, followed by 52 (18.31%) six authors' articles with 2143 citations. No notable association was found between the number of citations received and the number of authors, which aligns with the findings of the study conducted by Bornmann et al. (2020).

Table 3: Co-authorship trend in chemistry

Sl. No.	Number of Authors	Publications	%	Citations	%	Cumulative Citations	Cumulative %
1.	Single	0	0.00	0	0.00	0	0.00
2.	Two	43	15.14	938	13.62	938	13.62
3.	Three	29	10.21	527	7.65	1465	21.28
4.	Four	40	14.08	1235	17.94	2700	39.22
5.	Five	77	27.11	958	13.91	3658	53.13
6.	Six	52	18.31	2143	31.13	5801	84.26
7.	Seven	24	8.45	614	8.92	6415	93.17
8.	Eight	11	3.87	233	3.38	6648	96.56
9.	Nine	2	0.70	53	0.77	6701	97.33
10.	Ten	3	1.06	119	1.73	6820	99.06
11.	More than ten	3	1.06	65	0.94	6885	100.00
	Total	**284**	**100.00**	**6885**	**100.00**		

Cumulative citation refers to the running total of citations from all previous years or groups, added up to and including the current year or group. Each year/group accumulates citations from all earlier years/groups. The six authors' publications have the highest citations i.e., 2,143 (31.13%), and also the cumulative citations are heavily dominated by publications with a six-author group, which has accumulated 58.32% of all citations.

Year-wise distribution of co-authorship trend

Table 4 clearly shows that the growth of multi-authorship is not significantly consistent with the year, but overall growth can be observed from two-author publications to more than five-author publications. 33 (11.6%) five-authored articles were published in the year 2011.

Table 4: Year-based authorship trends in chemistry

Sl. No.	Year of Publication	Two	Three	Four	Five	> Five	Total	(%)
1.	2003	1	0	1	0	1	3	1.06
2.	2004	0	1	2	2	1	6	2.11
3.	2005	3	1	2	3	2	11	3.87
4.	2006	1	1	3	4	3	12	4.23
5.	2007	1	1	0	2	1	5	1.76
6.	2008	1	1	0	1	2	5	1.76
7.	2009	4	0	0	2	2	8	2.82
8.	2010	4	2	2	4	1	13	4.58
9.	2011	1	3	3	33	3	43	15.14
10.	2012	2	0	6	2	2	12	4.23
11.	2013	1	0	1	4	4	10	3.52
12.	2014	1	1	3	5	3	13	4.58
13.	2015	4	0	4	1	11	20	7.04
14.	2016	0	2	1	1	9	13	4.58
15.	2017	4	0	1	0	2	7	2.46
16.	2018	3	3	5	2	6	19	6.69
17.	2019	6	5	1	5	3	20	7.04
18.	2020	4	2	2	2	10	20	7.04
19.	2021	1	4	1	1	13	20	7.04
20.	2022	0	2	1	1	10	14	4.93
21	2023	1	0	1	2	6	10	3.52
	Total	**43**	**29**	**40**	**77**	**95**	**284**	**100.00**

Publisher-wise distribution of citations

The scholarly information is published by a group of publishers worldwide. The selection of journals for publishing scholarly work and the subscription choices in libraries are often influenced by the reputation of the publishers. Thus, investigator has ranked publishers based on the number of publications published (and the number of citations received) by the faculty of the chemistry department at Mangalore University. Table 5 reveals that 'Elsevier' is the most preferred publisher, with 73 (21.83%) publications having received 4109 (59.68%) citations. Similar findings were obtained by Kodandarama and Chandrashekara (2020) and Nagarkar (2014). The second most preferred publisher is 'Wiley' with 65 (22.89%) publications having received 755 (10.97%) citations. Among Indian publishers, 'Connect Journals' leads the other with 10 (3.52%) publications and 18 citations (0.26%).

Table 5: Publisher-wise distribution of citations

Rank	Publisher's Name	Publications	%	Citations	%
1	Elsevier	73	21.83	4109	59.68
2	Wiley	65	22.89	755	10.97
3	Springer	39	13.38	560	8.13
4	Taylor & Francis	28	9.86	278	4.04
5	The Royal Society of Chemistry	13	4.58	324	4.71
6	Connect Journals	10	3.52	18	0.26
7	Walter De Gruyter Gmbh	9	3.17	37	0.54
8	NISCAIR (National Institute of Science Communication and Information Resources)	8	2.82	169	2.45
9	MDPI (Multidisciplinary Digital Publishing Institute)	5	1.76	17	0.25
10	International Union of Crystallography	5	1.76	2	0.03
11	American Chemical Society	4	1.41	245	3.56
12	Cell Press	4	1.41	80	1.16
13	Indian Academy of Sciences	4	1.41	39	0.57
14	Arkat USA Inc.	3	1.06	65	0.94
15	Newlands Press Ltd.	2	0.70	42	0.61
16	Hindawi Publishing Corporation	2	0.70	35	0.51
17	Universidade Federal De Mato Grosso Do Sul	2	0.70	6	0.09
18	Pharmaceutical Society of Korea	1	0.35	65	0.94
19	Sage Publications Ltd.	1	0.35	16	0.23
20	Georg Thieme Verlag KG	1	0.35	9	0.13
21	Desalination	1	0.35	6	0.09

Rank	Publisher's Name	Publications	%	Citations	%
	Publications				
22	Bentham Science Publication Ltd.	1	0.35	4	0.06
23	Japan Institute Heterocyclic Chemistry	1	0.35	3	0.04
24	IOP Publishing Ltd.	1	0.35	1	0.01
25	Pleiades Publishing Inc.	1	0.35	0	0.00
	Total	**284**	**100.00**	**6885**	**100.00**

Citation-based ranking of chemistry journals

Table 6 ranks the journals in which the Mangalore University faculty's chemistry publications are published. Out of 97 journals, the top 20 are ranked from highest to lowest based on the citations received. The 'European Journal of Medicinal Chemistry', published by Elsevier, is ranked one and has received 1808 (26.2%) citations for 17 research articles. Similar findings were obtained in the study conducted by Kodandarama and Chandrashekara (2020) on chemistry publications of the University of Mysore and Karnataka University. Among the top 20 listed journals, a total of 40 (14.1%) research articles are published in journals published by Elsevier. Out of 20 journals, 14 are paywalled and only 6 are open access.

Table 6: Ranking of chemistry journals

Rank	Journal Title	Publisher	IF	Access Type	Publication	Citations
1	European Journal of Medicinal Chemistry	Elsevier	6.0	Paywall	17	1808
2	Bioorganic & Medicinal Chemistry Letters	Elsevier	2.5	Paywall	2	572
3	International Journal of Biological Macromolecules	Elsevier	7.7	Paywall	12	537
4	Polymer	MDPI	4.7	Open Access	1	206
5	Acta Crystallographica Section E	Wiley	0.5	Open Access	36	176
6	ChemistrySelect	Wiley	3.3	Open Access	10	134
7	Medicinal Chemistry Research	Springer	2.6	Paywall	8	133
8	Indian Journal of Chemistry Section B-Organic Chemistry Including Medicinal Chemistry	NISCAIR	0.4	Open Access	8	127
9	RSC Advances	Royal Society of Chemistry	3.9	Open Access	5	119
10	Journal of the Iranian Chemical Society	Springer	2.2	Paywall	11	115
11	ACS Omega	American Chemical Society	3.7	Open Access	2	115
12	New Journal of Chemistry	Royal Society of Chemistry	2.7	Paywall	5	113
13	Journal of Organic Chemistry	American Chemical Society	3.4	Paywall	1	103
14	Polymer Engineering and Science	Wiley	3.2	Paywall	2	101
15	Radiation Physics and Chemistry	Elsevier	2.8	Paywall	2	97
16	Corrosion Science	Elsevier	7.4	Paywall	1	89
17	Tetrahedron Letters	Elsevier	1.5	Paywall	2	83
18	Journal of Molecular Structure	Elsevier	4.0	Paywall	4	81
19	Phosphorus, Sulfur, and Silicon, and the Related Elements	Taylor and Francis	1.4	Paywall	5	79
20	Applied Nanoscience	Springer	3.8	Paywall	3	78
21	Other Journals	---	---	---	147	2019
	Total				**284**	**6885**

Author collaboration network

The authors who have published at least five publications and received a minimum of ten citations

were selected for mapping the co-authorship network. Thus, out of 509 authors, 66 authors meet the threshold. The top twenty authors are ranked and presented in Table 7 based on their strength of collaboration (Total link strength).

Table 7: Author-collaboration strength

Sl. No.	Author	Documents	Citations	Total Link Strength
1.	Nagaraja, G. K.	53	646	169
2.	Poojary, Boja	92	2912	167
3.	Kouser, Sabia	16	348	75
4.	Manasa, D. J.	16	348	75
5.	D'Souza Josline Neetha	15	339	73
6.	Fun, Hoong-Kun	28	54	72
7.	Dinesha	21	296	58
8.	Navada, K. Meghana	12	273	58
9.	Prabhu, Ashwini	10	261	50
10.	Prasad, D. Jagadeesha	22	299	42
11.	Sumangala, V.	13	218	40
12.	Viveka, S.	12	51	37
13.	Prashantha, Kalappa	7	213	36
14.	Kayarmar, Reshma	11	72	34
15.	Lokanath, N. K.	10	67	31
16.	Poojary, B.	23	950	28
17.	Vishalakshi, B.	35	971	28
18.	Kumar, Vasantha	15	296	27
19.	Puthran, Divyaraj	9	42	26
20.	Prabhuswamy, M.	7	15	25

Table 7 reveals that the author of Poojary, Boja, has published the highest number of documents (92), which have received 2912 citations, followed by the author Vishalakshi, B., with 971 citations for 35 publications. Among the total link strength, the author Nagaraja G. K. topped the list with 169 link strength.

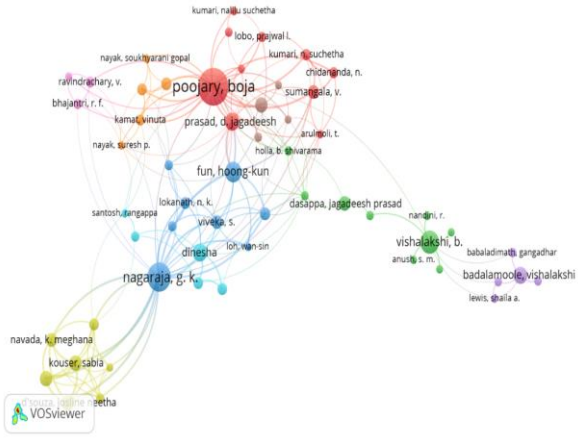


Figure 1*: Co-authorship network*

The co-authorship network presented using the VOSviewer revealed the presence of nine author clusters based on their collaboration, as shown in Figure 1. These clusters consist of a total of 175 links, and the total link strength is 804. Cluster 1 (indicated in red color) contained Prof. Boja Poojary as most prolific author with 28 links and 167 total link strength, followed by cluster 2 (indicated in blue) highlighting Prof. Nagaraja, G. K as top author having 24 links with 169 total link strength.

Country collaboration network

Figure 2 represents the co-authorship relationships between countries. The publications with a maximum of 25 countries, the minimum number of documents, and citations per country is 1 was the threshold set for filtering the countries to be included in the mapping of country-collaboration network. Thus, 19 countries were eligible for the mapping, with 12 clusters and 26 links. The country collaboration network reveals that Malaysia and Saudi Arabia are the most prominent collaborators with India. The cluster one (denoted in green color) has 18 links, and the total strength of the links is 58.

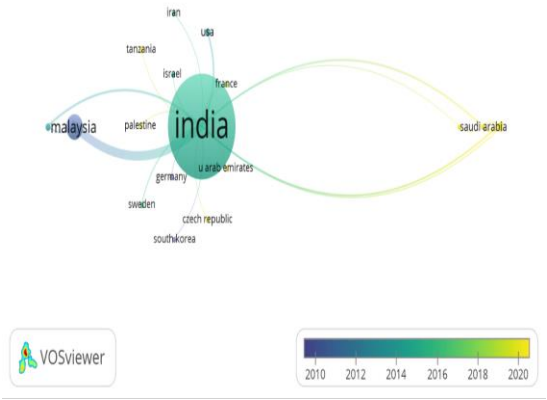


Figure 2: *Country-collaboration network*

Keyword Density Visualisation

In the density visualisation, the colours range from blue to green to yellow. The colour of a point shifts toward yellow as the density of neighbouring keywords increases and the associated weights of those keywords become higher. Conversely, when the number of neighbouring keywords is low and their corresponding weights are minimal, the point's colour tends toward blue. Keywords placed closer together are more frequently co-occurring in publications.

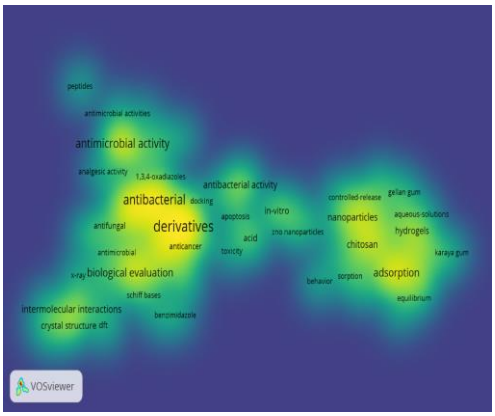


Figure 3: *Keyword Density Visualisation*

As presented in Figure 3, the terms 'derivatives' and 'antibacterial' (represented in yellow) represent core research themes with a high frequency of occurrence and strong interconnections. The term 'derivatives' has occurred 51 times with a total link strength of 180, followed by the term 'antibacterial', which has occurred 40 times with a total link strength of 155. The keywords such as 'antifungal', 'antimicrobial', 'anticancer', and 'docking' show co-relevance with the above two terms.

FINDINGS AND CONCLUSIONS

Citation analysis serves as an influential tool for assessing the research performance of research institutions and can guide upcoming tactics for improving research quality and visibility. The citation analysis of the chemistry research publications from Mangalore University, indexed in the Web of Science Core Collection, offers valuable insights into the global impact and scholarly influence of the institution's research. The findings of the present study reveal that there are 284 chemistry publications of the faculty of Mangalore University indexed in the Web of Science Core Collection from 2003 to 2023 and 6885 citations are received for these publications. The number of publications fluctuates over the years, with a notable peak in 2011 i.e., 43 publications (15.14%).The dominance of multi-authorship is evident in the present study with 77 (22.11%) five authors' research publications having 958 citations. The six authors' publications have the highest citations i.e., 2,143 (31.13%), and also the cumulative citations are heavily dominated by publications with a six-author group, which has accumulated 58.32% of all citations. 'Elsevier' is the most preferred publisher and The 'European Journal of Medicinal Chemistry' published by Elsevier is the most preferred journal for publishing chemistry publications among chemistry authors.

REFERENCES

1) Bornmann, L., Schier, H., Marx, W., & Daniel, H. (2012). What factors determine citation counts of publications in chemistry besides their quality?. *Journal of Informetrics, 6*(1), 11-18. https://doi.org/10.1016/j.joi.2011.08.004

2) Borthakur, P. (2020). Citation Analysis of Theses and Dissertations in Chemistry Submitted to the LNB Library, Dibrugarh University, 2009-13. *International Journal of Research in Library Science, 1*(2). ISSN: 2455-104X.

3) Chavda, P. & Dodiya, I. (2021). Mapping the Scholarly publications of Central University of Gujarat. *Library Philosophy and Practice (e-journal).* 6475. https://digitalcommons.unl.edu/libphilprac/6475.

4) Ciriminna, R., Angellotti, G., Luque, R., & Pagliaro, M. (2023). Citations in Chemistry at the Dawn of Open Science. *ACS omega, 8*(48), 46043–46050. https://doi.org/10.1021/acsomega.3c07037

5) Gayan, M. A. & Singh, S. K. (2021). Citation analysis of doctoral theses in chemistry: a study of Tripura University. *Journal of Indian Library Association, 57* (1).

6) Gohain, A. & Saikia, M. (2014). Citation analysis of Ph.d theses submitted to the department of chemical sciences, Tezpur University, Assam. *Library Philosophy and Practice (e-journal).* 1066. https://digitalcommons.unl.edu/libphilprac/1066.

7) Kodandarama & Chandrashekara, M. (2020). A citation analysis of chemistry publications by faculty members and research scholars at University of Mysore and Karnatak University. *Library Philosophy and Practice (e-journal)*. 4553. https://digitalcommons.unl.edu/libphilprac/4553.

8) Madhan, M., Gunasekaran, S., Rani, M. T., Arunachalam, S., & Abinandanan, T. A. (2020). Chemistry research in India in a global perspective – A scientometrics profile. arXiv, 1-39, https://arxiv.org/pdf/2002.03093

9) Maharana, B., Majhi, S. & Sethi, B. B. (2011). Citation analysis of top research papers in chemistry with specific reference to India. *Library Review, 60*(6), 501-512. DOI 10.1108/00242531111147215.

10) MU. (2024). Mangalore University. Retrieved September 5, 2024 from https://www.mangaloreuniversity.ac.in/

11) Nagarkar, S. (2014). A bibliometric analysis of publications of the Chemistry Department, University of Pune, India, 1999-2012. *Annals of Library and Information Studies (61),* 85-92.

12) ScienceDirect. (2024). Average Citation. Retrieved November 29, 2024 from https://www.sciencedirect.com/topics/computer-science/average-citation

13) WoS. (2024). Web of Science. Retrieved August 28, 2024 from https://www.webofscience.com/

14) Zhang, L. (2013). A comparison of the citation patterns of doctoral students in chemistry versus chemical engineering at Mississippi state university, 2002–2011. *Science & Technology Libraries, 32*(3), 299–313. https://doi.org/10.1080/0194262X.2013.791169