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QUANTITATIVE ANALYSIS OF RESEARCH PRODUCTIVITY OF MAHARSHI DAYANAND UNIVERSITY IN CHEMISTRY DURING 2001-10

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Abstract:

The present paper provides an analysis of the research productivity of Maharshi Dayanand University (MDU), Rohtak in the field of chemistry during 2001-10. The focus is on studying the year-wise contribution and growth of chemistry literature, most prolific authors of MDU in chemistry, authorship pattern of the papers, degree of collaboration among the authors, top institutions collaborating with the University, frequency distribution of papers in various sources, the top source journals, number of citations received by the papers and the highly cited papers.

KEY WORDS:

Chemistry, Scientometrics, Citation Analysis

INTRODUCTION

Maharshi Dayanand University, Rohtak is accredited with 'A' Grade by National Assessment and Accreditation Council (NAAC). The University came into existence by an Act No. 25 of 1975 of the Haryana Legislative Assembly in 1976 with the objective to promote inter-disciplinary higher education and research in the fields of environmental, ecological and life sciences. It was rechristened as Maharshi Dayanand University in 1977 after the name of a great visionary and social reformer, Maharshi Dayanand. It had a unitary and residential character in its nascent stage, but became an affiliating University in November 1978. The University secured the recognition of University Grants Commission – the higher education regulatory body of India - for central Govt. grants in Feb. 1983. The educational and research programmes in the University are offered through its 36 departments. Besides, the University runs some programmes through its Indira Gandhi P.G. Regional Centre, Meerpur (Rewari) and University Institute of Law & Management Studies (ULIMS), Gurgaon. The Regional Centre offers nine P.G. Programmes, while UILMS offers two. Over 490 Institutions/Colleges of general education, Engineering, Technology, Computer Sciences and Management Sciences located in 10 districts of the State are affiliated to this University.

There have been many studies related to analysis of research productivity of an institution in terms of their growth and contributions. Jeevan and Gupta (2002) provided a scientometric profile of research output from Indian Institute of Technology, Kharagpur. Mukherjee (2008) made an analysis of the scholarly literature from selected universities of Delhi and Uttar Pradesh. Kumbar and Gupta (2013) analysed the contribution of Karnataka University in Science and Technology during 2001-10. Baskaran (2013) studied the research growth trend and author collaboration of Alagappa University during 1999-2011.

2. OBJECTIVES OF THE STUDY

The main objective of the study is to analyse the research productivity of MDU in the area of

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chemistry during 2001-10. The specific objectives of the study can be stated as below:

- To study the year-wise output and growth of chemistry literature in MDU.
- To find out the most prolific authors of MDU in the field of chemistry.
- To analyse the authorship pattern and degree of collaboration in chemistry research.
- To find out the institutions collaborating with MDU for chemistry research.
- To study the media of communication and to identify the top source journals.
- To study the citations received by the articles and to find out the highly cited papers.

3. METHODOLOGY

Scopus database was used to retrieve the relevant information regarding chemistry research in MDU. It is the world's largest abstract and citation database of peer-reviewed literature. It covers nearly 20,500 titles from over 5,000 international publishers, of which 19,500 are peer-reviewed journals in the scientific, technical, medical, and social sciences (including arts and humanities). The string used for retrieving research productivity of MDU in chemistry was:

```
((AF-ID ("Maharshi Dayanand University" 60004880)) AND ( LIMIT-TO (SUBJAREA,"CHEM" ) ) )  
The results obtained were then limited to publication year 2001-10 and thus the final search string became:  
((AF-ID ("Maharshi Dayanand University" 60004880)) AND ( LIMIT-TO (SUBJAREA,"CHEM" ) ) )  
AND ( LIMIT-TO (PUBYEAR,2010) OR LIMIT-TO (PUBYEAR,2009) OR LIMIT-TO  
(PUBYEAR,2008) OR LIMIT-TO (PUBYEAR,2007) OR LIMIT-TO (PUBYEAR,2006) OR LIMIT-TO  
(PUBYEAR,2005) OR LIMIT-TO (PUBYEAR,2004) OR LIMIT-TO (PUBYEAR,2003) OR LIMIT-TO  
(PUBYEAR,2002) OR LIMIT-TO (PUBYEAR,2001)))
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For citations data, three-year citation window was used for calculating average citations per paper.

4. ANALYSIS

4.1 Year-wise Publication Output

MDU published a total of 285 papers in the field of chemistry during 2001-10 with an average of 29 papers per year. There have been variations in the number of papers published during different years (Table 1). The minimum number of papers (15) were published in 2001 and maximum (50) in 2005. Almost equal numbers of papers have been published during each five years span of 2001-05 and 2006-10. The average citation per paper (ACPP) seems to vary during different years but it was quite high during the last four years of study i.e. 2007-10. It was highest (5.78) during 2009 and lowest (1.33) during 2006. The first five years have a little low ACPP (2.39) as compared to the next five years (3.62). The ACPP for 10 year duration from 2001-10 was calculated to be 3.01.

Table : 1 Year-wise research productivity of MDU in chemistry during 2001-10

S. No.	Year	No. of Papers	Percent	Cumulative percent	ACPP
1	2001	15	5.26	5.26	2.20
2	2002	21	7.37	12.63	1.52
3	2003	30	10.53	23.16	2.20
4	2004	26	9.12	32.28	2.92
5	2005	50	17.54	49.82	2.66
6	2006	30	10.53	60.35	1.33
7	2007	24	8.42	68.77	3.67
8	2008	32	11.23	80	3.22
9	2009	27	9.47	89.47	5.78
10	2010	30	10.53	100	4.33
Total	2001-05	142	49.82		2.39
	2006-10	143	50.18		3.62
	2001-10	285	100.00		3.01

4.2 Type of Publications

The most common type of document was articles (97%). The other publication types included reviews, conference papers, letters and article in press.

Table :2 Type of documents

Document Type	No. of Publications	Percentage
Articles	277	97.19
Reviews	3	1.05
Conference Papers	2	0.70
Letters	2	0.70
Articles in Press	1	0.35
Total	285	100.00

4.3 Most Prolific Authors

The authors affiliated to MDU having 10 or more publications during 2001-10 were studied to see their contribution in the field of chemistry. Ten authors were selected according to this criterion (given in Table 3). Among the top 10 authors of MDU, J. Mohan had the highest number of contributions (58), followed by J.K. Makrandi (35), K.C. Singh (29) and V.K. Sharma (24). Other authors in the top list were I. Singh (19), C.S. Pundir (15), J.S. Yadav (13), D. Khatter (11), S.P. Khatkar (11) and B.R. Deshwal (10). Among these J.S. Yadav and B.R. Deshwal are from A.I.J.H.M. College, C.S. Pundir is from Department of Biochemistry and the rest seven authors are from Department of Chemistry of MDU. The average productivity of these ten authors was 22.5 and four authors score higher productivity than this average productivity. Among these ten authors, the highest h-index was of V.K. Sharma (29) and the lowest was of D. Khatter (3).

Table : 3 Top 10 most prolific authors of MDU in chemistry 2001-10

S. No.	Author	No. of Publications	h-index
1	Mohan, J.	58	17
2	Makrandi, J.K.	35	5
3	Singh, K.C.	29	11
4	Sharma, V.K.	24	29
5	Singh, I.	19	15
6	Pundir, C.S.	15	14
7	Yadav, J.S.	13	5
8	Khatter, D.	11	3
9	Khatkar, S.P.	11	9
10	Deshwal, B.R.	10	11

4.4 Authorship Pattern

The authorship pattern depicted in Table 4 shows that very few papers (6%) were single authored and most of them (94%) were written by two or more authors. This indicates that authors of MDU collaborated with other authors for chemistry research. Among the multi-authored papers 43% had two authors, 22% had three authors, 13% had four authors and 15% had more than four authors. One paper even had ten authors.

Table : 4 Authorship pattern in chemistry research in MDU 2001-10

Year	One Author	Two Authors	Three Authors	Four Authors	>Four Authors	Total
2001	3	7	2	2	1	15
2002	2	14	1	4	-	21
2003	6	15	4	4	1	30
2004	1	10	9	4	2	26
2005	2	26	11	3	8	50
2006	2	11	13	1	3	30
2007	-	11	6	1	6	24
2008	-	13	6	5	8	32
2009	-	9	6	6	6	27
2010	1	7	6	7	9	30
Total	17	123	64	37	44	285
%age	5.96	43.16	22.46	12.98	15.44	100.00

4.5 Degree of Collaboration

The degree of collaboration was calculated using formula by K. Subramanyam (1983). The degree of collaboration was found to be very high (0.94) during 2001-10 as the maximum papers were multi-authored. The year-wise degree of collaboration during this time period is shown in Table 5. It was found that the degree of collaboration was highest (1.00) in the years 2007, 2008 and 2009 in which all the papers were multi-authored. The lowest degree of collaboration (0.80) was seen in 2001 and 2003.

Table : 5 Year-wise degree of collaboration

Year	Degree of Collaboration
2001	0.80
2002	0.90
2003	0.80
2004	0.96
2005	0.96
2006	0.93
2007	1.00
2008	1.00
2009	1.00
2010	0.97
Total (2001-10)	0.94

4.6 Top Collaborating Institutions

The authors of MDU collaborated with other authors at national as well as international level. Table 6 lists the institutions which have atleast three collaborative papers with authors of MDU. The main international institution collaborating with MDU in chemistry research is Korea Institute of Energy Research (25 papers). Other international collaborative institutions included Yonsei University (12 papers) and Chungnam National University (4 papers). The major national organizations collaborating in chemistry research with MDU during 2001-10 are Guru Jambheshwar University of Science and Technology (912 papers), Guru Gobind Singh Indraprastha University (9 papers), Hindu College (7 papers) and A.I.J.H.M. College (5 papers) among others.

Table : 6 Top institutions collaborating with MDU in chemistry research

S. No.	Affiliation	No. of Papers
1	Korea Institute of Energy Research	25
2	Guru Jambheshwar University of Science and Technology	12
3	Yonsei University	12
4	Guru Gobind Singh Indraprastha University	9
5	Hindu College	7
6	A.I.J.H.M. College	5
7	National Physical Laboratory India	4
8	Chungnam National University	4
9	Chaudhary Devi Lal University, Sirsa	4
10	GVM Girls College	3
11	Indian Institute of Technology, Delhi	3
12	Rega Institute for Medical Research	3
13	Deenbandhu Chhotu Ram University Of Science and Technology, Murthal	3

4.7 Media of Communication

The papers of MDU in the subject of chemistry appeared in 64 different national and international journals. The frequency distribution of publications in various source journals is shown in Table 7. There were 26 journals in which only single article was published, 10 journals which had only two articles and 7 journals each had 3 and 4 articles respectively. 63 papers were published in just one journal viz. "Indian Journal of Heterocyclic Chemistry", 25 papers in another journal "Indian Journal of Chemistry Section B Organic and Medicinal Chemistry" and 15 papers in another journal "Indian Journal of Chemistry Section A Inorganic Physical Theoretical and Analytical Chemistry."

Table :7 Frequency distribution of papers in various source journals

Number of Papers	No. of Source Journals
1	26
2	10
3	7
4	7
5	5
6	1
8	1
9	1
12	1
13	1
14	1
15	1
25	1
63	1

4.8 Top Source Journals

The list of top 14 journals having at least 5 papers is given in Table 8. These accounts for 67% of the total publications which means that two-third of the total papers are published in just 14 journals. The most preferred journal for publication by MDU authors in chemistry is Indian Journal of Heterocyclic Chemistry which have 63 papers published in it from 2001-10. Other journals preferred by authors are Indian Journal of Chemistry Section B Organic and Medicinal Chemistry (25 papers), Indian Journal of Chemistry Section A Inorganic Physical Theoretical and Analytical Chemistry (15 papers), Asian Journal

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of Chemistry (14 papers), Thermochemica Acta 913 papers) and Indian Journal of Chemical Technology (12 papers).

Table :8 Top source journals

S. No.	Source	No. of Publications
1	Indian Journal of Heterocyclic Chemistry	63
2	Indian Journal of Chemistry Section B Organic and Medicinal Chemistry	25
3	Indian Journal of Chemistry Section A Inorganic Physical Theoretical and Analytical Chemistry	15
4	Asian Journal of Chemistry	14
5	Thermochemica Acta	13
6	Indian Journal of Chemical Technology	12
7	Journal of Solution Chemistry	9
8	Sensors and Actuators B Chemical	8
9	Journal of Luminescence	6
10	Bulletin of Electrochemistry	5
11	Match	5
12	Journal of Inclusion Phenomena and Macrocyclic Chemistry	5
13	Journal of Molecular Structure THEOCHEM	5
14	European Journal of Medicinal Chemistry	5
Total papers in top 14 journals		190
%age of total publications		66.67%

4.9 Citation Profile and Highly Cited Papers

The citation profile of the papers is given in Table 9. It shows that 61 papers published during 2001-10 did not receive any citation and the rest 224 papers received one or more citations. Thus 79% of the papers were cited by other authors. Out of these, 134 papers received 1-5 citations, 49 papers received citations 6-10 citations, 15 papers received 11-15 citations, 9 papers received 16-20 citations, 16 papers received 21-50 citations and 1 paper received more than fifty citations.

The list of 18 highly cited paper (receiving 20 or more citations) is given in Table 10. These 18 papers appeared in 11 journals. Among these 18 highly cited papers, 4 appeared in the journal Sensors and Actuators, B: Chemical and 3 each in European Journal of Medicinal Chemistry and Journal of Molecular Modeling. Out of these 18 papers four were published in 2005, three each in 2007, 2008 and 2009, two in 2004 and one each in 2001, 2002 and 2010. These top papers received total of 603 citations with an average of 34 citations per paper. All these papers were collaborative papers i.e. they have two or more authors.

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Table : 9 Citation received by papers

No. of Citations	No. of Papers	Percentage
Zero citations	61	21.40
1-5	134	47.02
6-10	49	17.19
11-15	15	5.26
16-20	9	3.16
21-25	4	1.40
26-30	3	1.05
31-35	4	1.40
36-40	1	0.35
41-45	1	0.35
46-50	3	1.05
51-55	1	0.35
Total	285	100.00

Table : 10 Highly cited papers

S. No.	Document Title	Authors	Journal	No. of Citations
1	Prediction of anti-inflammatory activity of N-arylanthranilic acids: Computational approach using refined Zagreb indices	Bajaj S., Sambi S.S., Madan A.K.	Croatica Chemica Acta, 2005, 78(2)	53
2	Synthesis of Pd or Pt/titanate nanotube and its application to catalytic type hydrogen gas sensor	Han C.-H., Hong D.-W., Kim I.-J., Gwak J., Han S.-D., Singh K.C.	Sensors and Actuators, B: Chemical, 2007, 128(1)	49
3	Catalytic combustion type hydrogen gas sensor using TiO ₂ and UV-LED	Han C.-H., Hong D.-W., Han S.-D., Gwak J., Singh K.C.	Sensors and Actuators, B: Chemical, 2007, 125(1)	48
4	Application of graph theory: Relationship of molecular connectivity index, Wiener's index and eccentric connectivity index with diuretic activity	Sardana S., Madan A.K.	Match, 2001, 43	48
5	Predicting anti-HIV activity of 2,3-diaryl-1,3-thiazolidin-4-ones: Computational approach using reformed eccentric connectivity index	Kumar V., Sardana S., Madan A.K.	Journal of Molecular Modeling, 2004, 10(5-6)	44
6	Development of a lactate biosensor based on conducting copolymer bound lactate oxidase	Suman S., Singhal R., Sharma A.L., Malthotra B.D., Pundir C.S.	Sensors and Actuators, B: Chemical, 2005, 107(2)	37
7	Synthesis, antimicrobial and antiviral evaluation of substituted imidazole derivatives	Sharma D., Narasimhan B., Kumar P., Judge V., Narang R., De Clercq E., Balzarini J.	European Journal of Medicinal Chemistry, 2009, 44(6)	34
8	Predicting anti-HIV activity of phenethylthiazolethiourea (PETT) analogs: Computational approach using Wiener's topochemical index	Bajaj S., Sambi S.S., Madan A.K.	Journal of Molecular Structure: THEOCHEM, 2004, 684(1-3)	32
9	Hansch analysis of substituted benzoic acid benzylidene/furan-2-yl-methylene hydrazides as antimicrobial agents	Kumar P., Narasimhan B., Sharma D., Judge V., Narang R.	European Journal of Medicinal Chemistry, 2009, 44(5)	31
10	Predicting anti-HIV activity of TIBO derivatives: A computational approach using a novel topological descriptor	Sardana S., Madan A.K.	Journal of Molecular Modeling, 2002, 8(8)	31
11	Micro-bead of nano-crystalline F-doped SnO ₂ as a sensitive hydrogen gas sensor	Han C.-H., Han S.-D., Singh I., Toupance T.	Sensors and Actuators, B: Chemical, 2005, 109(2)	29
12	Molecular interactions in binary mixtures containing o-toluidine	Dimple, Yadav J.S., Singh K.C., Sharma V.K.	Thermochimica Acta, 2008, 468(1-2)	28

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13	Topochemical models for prediction of cyclin-dependent kinase 2 inhibitory activity of indole-2-ones	Dureja H., Madan A.K.	Journal of Molecular Modeling, 2005, 11(6)	27
14	Predicting anti-HIV-1 activity of 6-arylbenzotriazoles: Computational approach using supraaugmented eccentric connectivity topochemical indices	Dureja H., Gupta S., Madan A.K.	Journal of Molecular Graphics and Modelling, 2008, 26(6)	25
15	Preparation and characterization of long persistence strontium aluminate phosphor	Han S.-D., Singh K.C., Cho T.-Y., Lee H.-S., Jakhar D., Hulme J.P., Han C.-H., Kim J.-D., Chun I.-S., Gwak J.	Journal of Luminescence, 2008, 128(3)	23
16	Fabrication of dissolved O ₂ metric uric acid biosensor using uricase epoxy resin biocomposite membrane	Arora J., Nandwani S., Bhambi M., Pundir C.S.	Analytica Chimica Acta, 2009, 647(2)	22
17	Supraaugmented eccentric connectivity indices: New-generation highly discriminating topological descriptors for QSAR/QSPR modeling	Dureja H., Madan A.K.	Medicinal Chemistry Research, 2007, 16(7-9)	22
18	Benzylidene/2-chlorobenzylidene hydrazides: Synthesis, antimicrobial activity, QSAR studies and antiviral evaluation	Kumar D., Judge V., Narang R., Sangwan S., De Clercq E., Balzarini J., Narasimhan B.	European Journal of Medicinal Chemistry, 2010, 45(7)	20

5. SUMMARY AND CONCLUSIONS

Maharshi Dayanand University published 285 papers in chemistry during 2001-10 with the highest number of papers (50) being published in 2005. The number of papers published during 2001-05 and 2006-10 were almost equal. J. Mohan was the highest contributing author with 58 papers. The author with highest h-index (29) was V.K. Sharma. A trend in author collaboration was observed in chemistry research with 94% papers having two or more authors and very few (6%) papers were found which were single-authored. The degree of collaboration was calculated to be 0.94 during 2001-10. The authors collaborated for research with other authors of same as well as other institutions at national and international levels. The top collaborative international institutions were Korea Institute of Energy Research (25 papers), Yonsei University (12 papers) and Chungnam National University (4 papers). Among the national institutions, Guru Jambheshwar University of Science and Technology with 12 papers topped the list, followed by Guru Gobind Singh Indraprastha University (9 papers), Hindu College (7 papers) and A.I.J.H.M. College (5 papers). The journal which was preferred by the authors of MDU in chemistry for publication was Indian Journal of Heterocyclic Chemistry having 63 papers during the time span of 10 years under study. Next in the preference list was Indian Journal of Chemistry Section B Organic and Medicinal Chemistry with 25 papers. It was found that 26 journals were having only one paper each published in them by the chemistry fraternity of MDU. The quality of papers published by the authors was indicated from the fact that 224 papers (79%) out of the total received one or citations. The highest citation received by any paper was 53. There were 18 articles which received 20 or more citations.

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