
Bibliometric Analysis of CSIR-CECRI Research Publications during 2010 -2015

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Abstract

Bibliometrics is one of the techniques to analyze the quantitative literature and can be applied to research articles published in national, international journals on related articles. This paper deals with the bibliometric analysis of CSIR-CECRI, Karaikudi research publications during the period 2010-2015. 650 articles were collected from Web of Science. This study examines the year-wise publications, journal-wise distributions, document-wise classifications, geographical presentations and productivity of researchers.

Keywords

Bibliometric study, Web of Science, CECRI Publications, Faculty Publications, Publications in India.

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INTRODUCTION

Central Electro Chemical Research Institute (CECRI) is one of the forty national laboratories established under Council of Scientific and Industrial Research (CSIR), New Delhi. It was founded in 1948 at Karaikudi, Tamil Nadu. CECRI came into existence on January 1953. It has been recognized as the premier institution for research and development in electrochemical science and technology in India. The research and development programs at CECRI are in the areas of corrosion science and engineering, industrial metal finishing, batteries, electrometallurgy, electroprometallurgy, electrochemicals, Materials Science, and electrochemical instrumentation & pollution control.

LITERATURE REVIEW

Dhawan and Gupta¹ (2007) analyzed High Productivity Institutions (HPI) in physics, identified that 64 institutions have together contributed 23,835 papers, accounting 88 percent of the total Indian contributions in physics during 1993 – 2001. Among 64 HPIs, eight belong to Institutes of National Importance (INIs), 23 are Research Institutions (RIs), and rests of the 33 institutes belong to Universities and Colleges. Sharma² (2009) revealed the research publications of Central Potato Research Institute (CPRI) during 1991-2007. He used Bibliometric techniques to identify the pattern of publication, authorship, and secondary journal coverage of publication trends. Vijayakumar³ (2017) reviewed the research output of Indian Institutes of Technology (IIT) during the period of 1994 -2004. There are 23 IITs in India, author analyzed 14879 papers to know authorship pattern, Degree of collaboration and Lotka's Law results etc. The average degrees of collaboration for the above mentioned period is 0.93 and 91.72% of publications with joint authors. Mulimani, Renuka S. and Hadagali, Gururaj S.⁴ (2017) made the study on International Journal of Toxicology from 2011 to 2015. The web of science based data subjected to Year-wise distribution, Volume-wise distribution, authorship pattern, citations distribution and geographical distributions etc. Belsito D.V. from Columbia University being first place with 51 publications and DeGeorge, G. from MB Research Labs, Pennsylvania with fewer publications (10) during the study period. Ramesh, P. and Gopalakrishnan, S.⁵ (2014), revealed the worldwide research output on brain tumour during the period of 1974-2013. There are 147696

publications retrieved from Scopus database, it has been analyzed by various scientometric parameters and results showing that constant growth rate brain tumour research output in every year; United States placed in first position with more research output 47354 (32.07%) wherein India bags 10th position with 2880 (1.95%) publications on above mentioned period. Sithi Jagannara, M.⁶ (2015), analyzed the research productivity of rabies during the period 1964 to 2015. The data retrieved from CAB direct online database, there are 11,567 publications on the above mentioned period. It subjected to different scientometric parameters to identify the growth of publications, country-wise distribution, language-wise publications etc. Average publications per year were 231.34; USA occupied a first place in rabies research publication with 782 which is 6.7% of total output globally.

OBJECTIVES OF THE STUDY

The main objective of this study is to analyze the publications of CSIR-CECRI, Karaikudi.

1. To know the number of contributions during study period.
2. To find out the year wise distribution of articles.
3. To study the publication pattern of CECRI.
4. To identify the most popular journals in term of publications.
5. To analyze the highly cited articles among CSIR-CECRI publications.

METHODOLOGY

The data were retrieved from ISI, Web of Science database – Citation Index Expanded (SCIE). The key words were used to search as CECRI, CSIR-CECRI; Central Electrochemical Research Institute, India, Central Electro Chemical Research Institute India, geographically ‘India’ and the period of study was ‘2010-2015’.

Year-wise Distribution

The table 1 showed that number of publications 20.15% was produced in 2011 followed by 129 (19.85%) publications in 2014, 120 (18.46%) publications in 2010, 105 (16.15%) publications in 2015, 84(12.92%) publications in 2012 and less number publications in 2013 as 81 (12.46%).

Table 1 : Year-wise Distribution of Publications

Year	No. of Publications	Percent
2010	120	18.46%
2011	131	20.15%
2012	84	12.92%
2013	81	12.46%
2014	129	19.85%
2015	105	16.15%
Total	650	100%

Document wise distribution

Web of Science indexed the publications in different categories. It has been revealed that CECRI publications in seven broad types (Table 2) viz journal articles 623(95.85%), conference proceedings papers 15(2.31%) followed by reviews 10(1.54%), editorial materials 2 (0.31%).

Table 2: Document wise distribution of Publications

Document type	No. of Publications	Percent
Articles	623	95.85
Proceedings Papers	15	2.31
Reviews	10	1.54
Editorial Materials	2	0.31
Total	650	100.

Subject wise distribution

The table 3 shows the top 10 subject wise distribution of CSIR-CECRI publications during the study period. Chemistry stood at first place by large number of publications 252 (38.77%), Materials science subject contributions being the second with 243 (37.39%) followed by Electrochemistry with 147 (22.62%), Physics with 125 (19.23%), Engineering with 83 (12.77%) and other subject publications.

Table 3:Subject wise distribution of Publications

S. No.	Subject	No. of Publications	Percent
1	Chemistry	252	38.77
2	Materials Science	243	37.39
3	Electrochemistry	147	22.62
4	Physics	125	19.23
5	Engineering	83	12.77
6	Science Technology Other Topics	49	7.54
7	Energy Fuels	38	5.85
8	Polymer Science	33	5.08
9	Metallurgy Metallurgical	32	4.92

	Engineering		
10	Environmental Sciences Ecology	25	3.85

Most favored Journals

The table 4 shows the journal wise publications of CECRI, India. More number of the contributions appeared in RSC Advances (6.46%) followed by ElectrochimicaActa (3.39%), Journal of the Electrochemical Society (2.92%), Journal of Applied Electrochemistry (2.15%), Bulletin of Materials Science (2.00%) and other journals.

Table 4 :Most favored Journals for Publication

S. No.	Journal Name	No. of Publications	Rank	Percentage	Cumulative No. of Articles	Cumulative Percentage
1	RSC Advances	42	1	6.46	42	6.46
2	Electrochimica Acta	22	2	3.39	64	9.85
3	Journal of the Electrochemical Society	19	3	2.92	83	12.77
4	Journal of Applied Electrochemistry	14	4	2.15	97	14.92
5	Bulletin of Materials Science	13	5	2.00	110	16.92
6	Journal of Alloys and Compounds	11	6	1.69	121	18.61
7	Transactions of the Institute of Metal Finishing	11	6	1.69	132	20.30
8	Ionics	10	7	1.54	142	21.84
9	Journal of Applied Polymer Science	10	7	1.54	152	23.38
10	Journal of Materials Science Materials in Electronics	10	7	1.54	162	24.92
11	Surface Engineering	10	7	1.54	172	26.46
12	ECS Transactions	9	8	1.39	181	27.85
13	Journal of Electroanalytical Chemistry	9	8	1.39	190	29.24
14	Physical Chemistry Chemical Physics	9	8	1.39	199	30.63
15	4 different journals with 8 articles	32		4.92	231	35.55
16	5 different journals with 7 articles	35		5.40	266	40.95
17	3 different journals with 6 articles	18		2.76	284	43.71
18	9 different journals with 5 articles	45		6.93	329	50.64
19	11 different journals with 4 articles	44		6.82	373	57.46
20	16 different journals with 3 articles	48		7.36	421	64.82
21	46 different journals with 2 articles	92		14.26	513	79.08
22	137 different journals with 1 articles	137		20.55	650	99.63
	Total	650		99.63%		

Most Prolific Authors

Table 5 shows the rank list of top 15 authors who had published more articles. Among the authors, the

most prolific author during the period of study is, Jayachandran M with 48 (7.385%), Sridhar P with 35 (5.385%) stood at the second place, Pitchumani S with 34 (5.231%) in third place, Vasudevan S with 30

(4.615%), Shukla A K with 28 (4.308%) and others.

Table 5 : Most Prolific Authors

S. No.	Ran k	Authors	Reco rds	% of 650
1	1	Jayachandran M	48	7.385
2	2	Sridhar P	35	5.385
3	3	Pitchumani S	34	5.231
4	4	Vasudevan S	30	4.615
5	5	Shukla A K	28	4.308
6	6	Subramanian B	26	4
7	7	Murali K R	25	3.846
8	8	Maruthamuthu S	24	3.692
9	9	Sanjeeviraja C	23	3.538
10	10	Pillai V K	20	3.077
11	10	Mohan S	20	3.077
12	11	Sozhan G	19	2.923
13	11	Lakshmi J	19	2.923
14	11	Kumar T P	19	2.923
15	11	Bhat S D	19	2.923
16	12	Kulandainathan M A	18	2.769
17	12	Gopukumar S	18	2.769
18	13	Kalaiselvi N	17	2.615
19	14	Sahu A K	16	2.462
20	14	Radhakrishnan S	16	2.462
21	14	Berchmans S	16	2.462
22	14	Berchmans L J	16	2.462
23	15	Stephan A M	15	2.308

Author Productivity

Table 6 shows that productivity of authors during the study period of 2010 -2015. A total of 1659 authors have contributed 650 publications with an average contribution of 2.55 and 0.39 is the productivity per author.

Table 6 : Author Productivity

Year	Total No. of Publica tions	Total No. of Author s	Total AAPP	Total PPA
2010	120	279	2.33	0.43
2011	131	305	2.33	0.43
2012	84	193	2.30	0.44
2013	81	249	3.07	0.33
2014	129	356	2.76	0.36
2015	105	277	2.64	0.38
Total	650	1659	2.55	0.39

Notes: Average Authors Per Paper (AAPP) = Number of authors/ Number of papers.

Productivity per author (PPA) = Number of papers/ Number of authors.

Geographical Distribution:

Table 7 shows that geographical distribution analysis of 650 CECRI, research publications during study period, carries the collaboration with foreign countries; Fully 650 publications were contributed by authors from CECRI. The co-authors from South Korea contributed 36 (5.5%), United States have contributed 17 (2.62%) articles, authors from Japan have contributed 16 (2.46%), co-authors of Taiwan contributed 13 articles (2%) authors from Singapore and Germany have contributed equally with 11 articles (1.69%) and less number of co-authors from the countries such as Australia, Malaysia, France, Peoples R China and others.

Table 7: Geographical Distribution of Research Publications

Rank	Country	Total contrib utions (N=650)	Perc enta ge %
1	India	650	100
2	South Korea	36	5.5
3	USA	17	2.62
4	Japan	16	2.46
5	Taiwan	13	2
5	Germany	11	1.69
6	Singapore	11	1.69
7	Australia	9	1.38
8	Malaysia	7	1.08
9	France	6	0.92
10	Peoples R China	5	0.77
11	Bahrain	4	0.62
11	England	4	0.62
11	Italy	4	0.62
12	Brazil	2	0.31
12	Canada	2	0.31
12	Finland	2	0.31
12	Hungary	2	0.31
12	Israel	2	0.31

Highly Cited Articles:

Table 8 shows that the top 10 highly cited articles of CECRI, India research publications during the period

of 2010-2015. These articles are highly influenced with other scientists which are noticed by its citation count.

Table 8:Top 10 Highly Cited Articles

S. No.	Bibliographic Details	No. of Times Cited
1	Solution-Combustion Synthesized Nanocrystalline Li ₄ Ti ₅ O ₁₂ As High-Rate Performance Li-Ion Battery Anode By: Prakash, A. S.; Manikandan, P.; Ramesha, K.; et al. Chemistry of Materials, Volume: 22 Issue: 9 Pages: 2857-2863 Published: MAY 11 2010	235
2	Synthesis, Structure, and Electrochemical Properties of the Layered Sodium Insertion Cathode Material: NaNi _{1/3} Mn _{1/3} Co _{1/3} O ₂ By: Sathiya, M.; Hemalatha, K.; Ramesha, K.; et al. Chemistry of Materials, Volume: 24 Issue: 10 Pages: 1846-1853 Published: MAY 22 2012	186
3	Molecularly Imprinted Electrochemical Sensors By: Suryanarayanan, Vembu; Wu, Cheng-Tar; Ho, Kuo-Chuan Electroanalysis, Volume: 22 Issue: 16 Pages: 1795-1811 Published: AUG 2010	110
4	Electrochemical Preparation of Luminescent Graphene Quantum Dots from Multiwalled Carbon Nanotubes By: Shinde, Dhanraj B.; Pillai, Vijayamohan K. Chemistry-A European Journal, Volume: 18 Issue: 39 Pages: 12522-12528 Published: SEP 2012	95
5	Electrochemical Unzipping of Multi-walled Carbon Nanotubes for Facile Synthesis of High-Quality Graphene Nanoribbons By: Shinde, Dhanraj B.; Debgupta, Joyashish; Kushwaha, Ajay; et al. Journal of the American Chemical Society, Volume: 133 Issue: 12 Pages: 4168-4171 Published: MAR 30 2011	89
6	XRD and XPS characterization of mixed valence Mn ₃ O ₄ hausmannite thin films prepared by chemical spray pyrolysis technique By: Raj, A. Moses Ezhil; Victoria, S. Grace; Jothy, V. Bena; et al. Applied Surface Science, Volume: 256 Issue: 9 Pages: 2920-2926 Published: FEB 15 2010	81
7	Electrochemistry: as cause and cure in water pollution-an overview By: Vasudevan, Subramanian; Oturan, Mehmet A. ENVIRONMENTAL CHEMISTRY LETTERS Volume: 12 Issue: 1 Pages: 97-108 Published: MAR 2014	70
8	A comparative study of titanium nitride (TiN), titanium oxy nitride (TiON) and titanium aluminum nitride (TiAlN), as surface coatings for bio implants By: Subramanian, B.; Muraleedharan, C. V.; Ananthakumar, R.; et al. Surface & Coatings Technology, Volume: 205 Issue: 21-22 Pages: 5014-5020 Published: AUG 25 2011	55
9	The adsorption of phosphate by graphene from aqueous solution By: Vasudevan, Subramanian; Lakshmi, Jothinathan RSC Advances, Volume: 2 Issue: 12 Pages: 5234-5242 Published: 2012	54
10	Facile synthesis of hollow sphere amorphous MnO ₂ : the formation mechanism, morphology and effect of a bivalent cation-containing electrolyte on its supercapacitive behavior By: Munaiah, Y.; Raj, B. GnanaSundara; Kumar, T. Prem; et al. Journal of Materials Chemistry A, Volume: 1 Issue: 13 Pages: 4300-4306 Published: 2013	53

FINDINGS AND CONCLUSION

650 research publications have been published by scientists from CECRI, India during the study period 2010 – 2015. The maximum number of publications was 131 in 2011.

Journal articles occupy the predominant position among the sources of publication i.e. 623 articles published (95.85%). Research and development output in Chemistry stood first with 252 (38.77%) among 650 contributions. More number of articles published in RSC Advances, followed by ElectrochimicaActa and Journal of The Electrochemical Society. Jayachandran M stood in first position with 48 (7.385%), Sridhar P and Pitchumani S stood in second, third place with 35 (5.385) and 34 (5.231%) respectively.

Among 650 publications, average contribution of authors per paper is 2.55 and productivity per author is 0.39. The researchers from foreign countries have contributed with CECRI publications, South Korean scientists being in first position by their 36 (5.5%) contributions.

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