

Highly Cited paper of Bharat Ratna Prof. CNR Rao: A Scientometric Attempt

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Abstract - This attempt scrutinizes Prof. CNR Rao's one of the highly cited papers, published in the year 2009, has received 767 citations during 2010-2017 out of which citations, 25 were self-citations and rest 742 citations by others. Highest numbers (139) of citing papers were published by 4 authors, in which 32 citing papers were published in the year 2015. The article has highly cited by authors published in the journals journal (688), and Reviews (70). Total number of 767 citing articles further received 35563 citations during 2010-2017.

Keywords: Bharat Ratna, Citation Analysis, Scientometrics, Highly Cited Paper, Scientometric Portrait

I. INTRODUCTION

Prof. CNR Rao has received India's highest civilian award i.e. Bharat Ratna in 2014. He is recognised as world leading chemist from India has published more than 2000 scientific research publications in which most of the papers have received citations from across the world and having the highest number of h-index, among high profile scientist in India. In this paper, Mahanti, Subodh, (2014). an attempt has been made to analysed the paper published by Prof. CNR Rao, entitled "Panchokarla, LS; Subrahmanyam, KS; Saha, SK; Govindaraj, A; Krishnamurthy, HR; Waghmare, UV; Rao, CNR Synthesis, Structure, and Properties of Boron- and Nitrogen-Doped Graphene. Advanced Materials: Weinheim, 2009."

II. SCOPE AND LIMITATIONS

An attempt has been made to analyse Prof. CNR Rao's one of the highly cited papers published in the year 2009. Thus the study is limited to highly cited paper and its citations (767) received during 2010-2017. Citations have been retrieved from the Web of Science database (June 2017).

III. METHODOLOGY

Information regarding activities of individual information Scientists perhaps evaluated in both the aspects like, quantitatively and qualitatively, (Arunachalam, Subbiah. 2004). Thus all the citations of CNR Rao's one of the highly cited papers been collected from the Web of Science database was published during 2009-17. The data has been analysed normal count procedure with the help of MS Excel.

IV. OBJECTIVES OF THE STUDY

The study highlighted often cited Prof. CNR Rao's paper which was published in 2009 and (received 767 citations thus the following objectives were set to study under scientometric framework

1. To identify the year-wise growth rate and distribution of citing article,
2. To find out the data type of citing articles
3. To know the language-wise scattering of citing articles
4. To examine channels of communications were used to publish citing articles
5. To know high impact factor journals, published citing articles
6. Authorship pattern of citing articles.

V. DATA ANALYSIS

An impact of scientific publications is also measured with the help of citations they received, (Bakri, A. and Willett, P. (2008) thus table I replicates the growth rate in the citing papers of CNR Rao's highly cited papers.

TABLE I YEAR-WISE GROWTH RATE OF CITING ARTICLES

Year wise Growth in citing articles during 2010-2017				
Year	No. of Citing Articles	%	Cumulative	Cumulative %
2010	29	3.78	29	3.78
2011	55	7.17	84	10.95
2012	102	13.30	186	24.25
2013	134	17.47	320	41.72
2014	144	18.77	464	60.50
2015	143	18.64	607	79.14
2016	119	15.51	726	94.65
2017	41	5.35	767	100.00
Total	767	100.00		

Prof. CNR Rao's one of the highly cited articles was published in the year 2009, which has cited 29 times in an immediate next year of its publication and continued till the date. With 144 (18.77%), 2014 year was found as the peak year of the citation. In the same year Prof. CNR Rao's name was honoured with India's highest civilian award Bharat Ratna.

TABLE II YEAR-WISE DISTRIBUTION OF AUTHORSHIP PATTERN OF CITING ARTICLES

Authorship Pattern of citing Articles	Authorship Pattern of Citing Article During 2010-2017								Total No. of Citing Articles
	2010	2011	2012	2013	2014	2015	2016	2017	
1*		2	1	5	1	1	2		12
2*	9	8	12	8	16	14	15	3	85
3*	4	11	15	16	18	13	12	6	95
4*	5	11	18	21	25	32	21	6	139
5*		4	12	23	24	25	24	6	118
6*	6	10	14	14	21	16	10	6	97
7*	1	5	11	18	9	17	12	4	77
8*	2		5	13	14	12	9	2	57
9*	2		4	4	7	2	5	3	27
10*		1	1	6	5	7	3	2	25
11*			4	2	3	2	1	1	13
12*		1	1	2	1	1	2		8
13*			1				2	1	4
14*		1	1				1	1	4
15*				1					1
17*			1						1
18*		1	1						2
22*				1		1			2
Total	29	55	102	134	144	143	119	41	767

Table II shows that, authorship pattern of citing articles, single authors to 22 authors (in which * is denotes author) publications have cited this article, in which 4 authors

publications have cited this paper 139 times during 2010-2017, followed by 5 authors publications have cited 118 times during 2011-2017.

TABLE III CHANNELS OF COMMUNICATIONS WERE USED TO PUBLISH CITING ARTICLES DURING 2010-2017

S. No.	Channels of Communication	Year wise distribution of citing Articles 2010-2017								Total	Impact factor
		2010	2011	2012	2013	2014	2015	2016	2017		
1	Carbon		1	4	6	11	10	11	1	44	7.082
2	RSC Adv.			4	5	7	11	12	1	40	2.936
3	J. Phys. Chem. C		2	5	7	6	7	3	3	34	4.484
4	J. Mater. Chem. A				8	6	10	5	3	32	9.931
5	Phys. Chem. Chem. Phys.		1		3	7	8	6		28	3.906
6	ACS Nano			7	5	5	4	3	1	25	13.709
7	Electrochim. Acta				1	4	4	7	5	21	5.116
8	Nanoscale		2	1		3	10	5		21	7.233
9	ACS Appl. Mater. Interfaces					2	4	3	6	18	8.097
10	Phys. Rev. B		3	2	5	6	1		1	18	3.813
11	J. Mater. Chem.		4	4	9					17	--
12	Adv. Mater.		1	2	3	2	3		2	14	21.95
13	Appl. Phys. Lett.		2	2	3	2	3	2		14	3.495
14	Sci Rep				2	2	2	3	3	14	4.122
15	J. Power Sources		1		2	2	2	4	1	13	6.945
16	Small				1	5	3	1	1	12	9.598
17	Nanotechnology		1		2	2	1	1	3	11	3.404
18	Appl. Surf. Sci.			1	1	1			4	10	4.439

19	Nano Lett.	1	1	3	2	1	1		1	10	12.08
20	Chem. Phys. Lett.		2		2	2		3		9	1.686
21	Int. J. Hydrog. Energy				1	3	4		1	9	4.229
22	J. Mater. Chem. C				5	2		1	1	9	5.976
23	Chem.-Eur. J.			1	1	3	1	1		7	5.16
24	Nano Energy				3	2		2		7	13.12
25	Solid State Commun.	1			3		1	1	1	7	1.549
26-33	6 each citing articles published in 8 Channels	5	8	8	4	8	11	2	2	48	--
34-39	5 each citing articles published in 6 channels	0	3	3	6	5	7	3	3	30	--
40-47	4 each citing articles published in 8 Channels	0	2	5	5	10	5	4	1	32	--
48-94	3 each citing articles published in 12 Channels	0	3	8	5	9	5	4	2	36	--
60-95	2 each citing articles published in 66 Channels	1	5	10	12	8	15	16	5	72	--
96-200	1 each citing articles published in 105 Channels	4	6	12	17	15	24	24	3	105	--
	Total	29	55	102	134	144	143	119	41	767	--

Table III, shows the channels of communications used to publish citing articles of Prof. CNR Rao's one of the highly cited paper, which was published in the year 2009, an immediate next year started receiving citations from across the world, these citing papers were published in the 200 different channels of communications among which with 44

citing articles published in the journal Carbon (impact factor 7.082), followed by 40 citing papers published in the journal RSC Advances (impact factor 2.936). among top 25 channels of communication (journal) 24 journals are having an impact factor, which shows that the quality of work.

TABLE IV CITATION PATTERN AND AUTHORSHIP PATTERN OF CITING ARTICLES DURING 2010-2017

Authorship Pattern	Authorship Pattern of Self Citations							Total	Authorship Pattern	Authorship Pattern of Citations by others							Total	Total Citations
	2010	2011	2012	2013	2014	2015	2016			2010	2011	2012	2013	2014	2015	2016		
1*								1*		2	1	5	1	1	2		12	12
2*	1					1		2*	8	8	12	8	16	13	15	3	83	85
3*	1	1		2	1			3*	3	10	15	14	17	13	12	6	90	95
4*	1	1	2	1	1			4*	4	10	16	20	24	32	21	6	133	139
5*		2						5*		2	12	23	24	25	24	6	116	118
6*	3	2			2			6*	3	8	14	14	19	16	10	6	90	97
7*							1	7*	1	5	11	18	9	17	11	4	76	77
8*				1				8*	2		5	12	14	12	9	2	56	57
9*	1							9*	1		4	4	7	2	5	3	26	27
10*								10*		1	1	6	5	7	3	2	25	25
11*								11*			4	2	3	2	1	1	13	13
12*								12*		1	1	2	1	1	2		8	8
13*								13*			1				2	1	4	4
14*								14*		1	1				1	1	4	4
15*								15*				1					1	1
17*								17*			1						1	1
18*								18*		1	1						2	2
22*								22*				1		1			2	2
Total	7	6	2	4	4	1	1	Total	22	49	100	130	140	142	118	41	742	767

Table IV replicates that, citation pattern of citing articles of Prof. CNR Rao's one of the highly cited papers. 25 citations were self-citations and rest 742 citations by others, which also replicates authorship pattern of citing articles, in which self-citations single authored publications haven't cited this

paper during 2010-2017. Highest numbers of self-citation citing papers were authored by 6 authors with 7 citing papers and the highest number of citation by others publications were authored by 4 authors.

TABLE V DATA TYPE AND YEAR WISE DISTRIBUTION OF CITING ARTICLES

S. No.	Data type of Citing Articles	Data Type and Year wise Distribution of Citing Articles during 2010-2017								Total
		2010	2011	2012	2013	2014	2015	2016	2017	
1	Article	25	50	93	122	128	128	106	36	688
2	Article; Proceedings Paper	1		1	1	2	1	1		7
3	Letter							1		1
4	Review	3	5	8	10	14	14	11	5	70
5	Review; Book Chapter				1					1
	Total	29	55	102	134	144	143	119	41	767

Table V replicates that, data type and year wise distribution of citing articles, in which 688 citing papers published as

articles in journals which followed by Review articles (70).

TABLE VI LANGUAGE-WISE DISTRIBUTION OF CITING ARTICLES DURING 2010-2017

Language	Language-wise Distribution of Citing Articles during 2010-2017								Total	%
	2010	2011	2012	2013	2014	2015	2016	2017		
Chinese			5	3	2	1	1		12	1.56
English	29	55	97	131	142	142	118	41	755	98.44
Total	29	55	102	134	144	143	119	41	767	100.00

Table VI replicates that, language wise distribution of citing articles, in which only two languages have been cited this paper in which highest number of citing articles were published in English language with 755 (98.04%) and rest 12 (1.56%) citing papers in Chinese language.

VI. CONCLUSION

Scientometrics plays an important role in the propagation of a particular scientist whose interest lays in the number of important papers he or she has published. Thus an impact of the publications often measured by the citations they receive. The study replicates an importance of his highly cited paper, which has been receiving citations from across the world. In the above case study Prof. CNR Rao has actually sophisticated our understanding of domains dealing with Physical Chemistry and other allied subjects and received good number of citations for his qualitative work which also replicates that emulating young scientists.

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