

CITATION PROFILE OF DR. V. S. RAMACHANDRAN - A BIBLIOMETRIC ANALYSIS OF HIS HIGHLY CITED ARTICLES AND BOOKS IN THE AREA OF CEMENT AND CONCRETE CHEMISTRY

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The citation pattern of the citations received by the works of Dr. V. S. Ramachandran with special reference to his highest cited articles and books, is studied.

INTRODUCTION

A survey of the cement research literature for ten years (1975-1984) conducted by the American Ceramic Society and reported in its annual publication "Cement Research Progress" 1985 suggested that there were atleast 10,600 cement researchers in the world with atleast one research paper each to their credit. In those ten years Dr. V. S. Ramachandran was the ninth most quoted author.

This prompted the authors to study the cited works of Dr. V. S. Ramachandran. Two articles and two books, cited maximum, are studied in detail for citation analysis in the area of cement and concrete chemistry, a sub-field of building materials.

Table 1 gives the break-up of entire work of Dr. Ramachandran consisting of 161 publications comprising papers published in various Indian and foreign periodicals and those presented in conferences, the chapters in various books, the books published by the reputed publishers of the world, NRC, Canada publications, client reports and other publications. There are 19 papers published in Indian periodicals and 84 papers in foreign periodicals. Sixteen papers were presented in various national and international conferences. 49 papers published in the learned journals also form the part of the study.

Table 2 shows the break-up of publications under various categories of documents, number of papers and percentage of the works. It is seen in the table that 52.2% and 11.8% of documents were pub-

lished in the foreign and Indian periodicals respectively. 3.7 and 9.9 percent papers were presented in national and international conferences. Six books formed 3.7 percentage of the entire work. The table indicates that most of the work was published in foreign publications.

METHODOLOGY FOR CITATION ANALYSIS

For studying the citation counts for 49 articles, the data was collected from the volumes 1955-64, 1965-69, 1970-74, 1975-79 and Annual 'CITATION' cumulation volumes for the years 1980 to 1990 (April only) of the "Science Citation Index". under "Ramachandran, V.S."

DATA ANALYSIS

The break-up of 45 papers and 6 books has been tabulated in Table 3. and Table 4, Table 3 indicating the life span and frequency of citations per paper.

An article published in 1971 was cited 15 times during the span of 18 years and it is expected that the life span of the article may be even longer. This clearly showed that the research is almost of continuous importance. Similarly, another article published in the year 1971 was also cited 11 times during the span of 1970-1989 and was cited seven times during the years 1975-79. It may be expected that these two articles might be cited in future as well which establishes that the life span of an article cannot be ascertained so easily.

Table 4 shows the life span of each book and the frequency of citations to it. The citations to 5 books of Dr. V. S. Ramachandran were recorded. It is observed that two books were cited 26 times and 19 times respectively.

Table 5 shows the distribution of articles on the

Table 1.
Year-wise Break-Up of Publications

Sl.No.	Year	Papers Published in Journals				Other Publications							Total
		1	2	3	4	5	6	7	8	9	10	11	
		No. of Papers	Indian Periodicals	Foreign Periodicals	Pub. in Int. Conf. Proc.	Pub. in National Conf. Proc.	Books	Chapters in Books	NRC Canada IRC Div. Pub.	Client Reports	Other Publication		
1.	1952	3	3	-	-	-	-	-	-	-	-	3	
2.	1953	1	1	-	-	-	-	-	-	-	-	1	
3.	1954	2	2	-	-	-	-	-	-	-	-	2	
4.	1955	-	-	-	-	-	-	-	-	-	-	-	
5.	1956	-	-	-	-	-	-	-	-	-	-	-	
6.	1957	2	2	-	-	-	-	-	-	-	-	3	
7.	1958	-	-	-	-	-	-	-	-	-	-	-	
8.	1959	1	1	-	-	-	1	-	-	-	-	3	
9.	1960	2	2	-	-	-	-	-	-	-	-	2	
10.	1961	6	1	5	-	-	-	-	-	-	-	6	
11.	1962	2	1	1	1	-	-	-	-	-	-	3	
12.	1963	2	1	1	-	-	-	-	-	-	-	2	
13.	1964	9	1	8	1	-	-	-	-	-	-	11	
14.	1965	3	-	3	-	-	-	-	-	-	-	3	
15.	1966	3	1	2	-	-	-	-	-	-	-	3	
16.	1967	3	-	3	-	-	-	-	-	-	-	3	
17.	1968	6	2	4	-	-	-	-	-	-	-	6	
18.	1969	2	1	1	1	-	1	-	-	-	-	9	
19.	1970	-	-	-	-	-	-	-	-	-	-	-	
20.	1971	6	-	6	1	-	-	-	-	-	-	7	
21.	1972	4	-	4	-	-	-	-	1	-	-	5	
22.	1973	4	-	4	-	-	-	-	-	-	-	9	
23.	1974	3	-	3	-	-	-	-	2	-	-	6	
24.	1975	4	-	4	-	-	-	-	-	-	1	6	
25.	1976	2	-	2	-	-	1	-	-	-	-	4	

Contd.

Table 1. (Contd.)

Sl.No	1	2	3	4	5	6	7	8	9	10	11	Total
26.	1977	1	-	1	-	-	-	1	-	-	-	2
27.	1978	6	-	6	-	-	-	1	-	-	-	7
28.	1979	1	-	1	-	-	-	1	1	-	-	3
29.	1980	1	-	1	4	-	-	2	-	-	-	7
30.	1981	-	-	-	-	-	1	1	1	-	1	4
31.	1982	3	-	3	1	-	-	2	-	-	-	6
32.	1983	1	-	1	-	1	-	2	-	-	-	4
33.	1984	2	-	2	1	-	1	4	-	-	-	8
34.	1985	2	-	2	1	2	-	-	-	-	-	5
35.	1986	6	-	6	2	-	1	-	-	-	-	9
36.	1987	4	-	4	2	-	-	-	-	-	-	6
37.	1988	5	-	5	-	1	-	-	-	3	-	9
38.	1989	1	-	1	1	-	-	-	-	1	-	3
Total		103	19	84	16	6	6	17	5	4	4	161

Table 2.

Break-up of Publications Under Different Categories of Documents

Sl. No.	Various Categories of Documents	Number of Publications	%
1.	Indian Journals	19	11.8
2.	Foreign Journals	84	52.2
3.	Int. Conference Proceedings	16	9.9
4.	Nat. Conference Proceedings	6	3.7
5.	Books	6	3.7
6.	Book Chapters	17	10.6
7.	NRC Canada, IRC Div. Pub.	5	3.1
8.	Client Reports	4	2.5
9.	Other Special Publications	4	2.5
	Total	161	100

Table 3.
Life Span and Frequency of Citations of Articles

Year of publication of Articles	1955-59		1960-64		1965-69		1970-74		1975-79		1980-84		1985-89		Total
	SC	CO	SC	CO	SC	CO	SC	CO	SC	CO	SC	CO	SC	CO	
1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	19
1954	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2
1954	-	-	-	1	-	-	-	-	-	-	-	1	-	-	2
1959	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
1961	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
1961	-	-	1	1	-	-	-	-	1	-	-	-	2	4	5
1961	-	-	-	1	-	-	1	-	-	-	-	-	2	4	4
1961	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1
1962	-	-	-	-	-	3	-	1	-	-	1	-	1	6	6
1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
1964	-	-	-	-	-	2	1	1	-	-	-	-	-	3	4
1964	-	-	-	-	-	1	2	-	-	-	-	-	1	4	5
1964	-	-	-	-	-	6	-	-	-	-	1	-	-	7	8
1964	-	-	-	-	2	2	2	-	1	-	1	-	-	6	6
1964	-	-	-	-	-	2	-	-	-	-	-	-	-	2	2
1965	-	-	-	-	-	-	-	-	1	1	-	-	-	3	4
1967	-	-	-	-	-	-	1	-	-	-	-	-	-	1	1
1967	-	-	-	-	-	-	-	-	1	1	-	-	-	1	2
1968	-	-	-	-	-	-	-	-	1	1	1	-	-	2	2
1968	-	-	-	-	-	-	-	-	2	-	1	-	-	3	3
1971	-	-	-	-	-	-	1	-	-	4	-	-	-	5	5
1971	-	-	-	-	-	-	-	-	4	4	-	-	1	4	5
1971	-	-	-	-	-	-	-	-	4	4	1	2	1	7	9
1971	-	-	-	-	-	-	1	2	7	6	-	-	1	10	11
1971	-	-	-	-	-	-	1	4	-	6	1	-	3	14	15
1972	-	-	-	-	-	-	-	-	2	2	1	1	1	7	9
1972	-	-	-	-	-	-	-	-	3	3	1	1	-	5	7
1972	-	-	-	-	-	-	-	-	3	3	1	1	1	3	5
1972	-	-	-	-	-	-	-	-	5	5	1	1	1	8	8

Contd.

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Table 3 (contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1973	1	-	-	-	-	-	-	-	-	1	1	-	1	-	-	1	2	3
1973	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1
1973	1	-	-	-	-	-	-	-	-	1	2	-	1	-	3	1	6	7
1973	1	-	-	-	-	-	-	-	-	1	4	1	-	-	1	2	5	7
1976	1	-	-	-	-	-	-	-	-	-	1	1	1	-	1	1	3	4
1976	1	-	-	-	-	-	-	-	-	-	1	1	-	4	1	1	5	6
1978	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	1
1978	1	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	2	2
1978	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	1
1978	1	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2	2	2
1978	1	-	-	-	-	-	-	-	-	-	-	-	1	-	5	6	6	6
1979	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	2
1980	1	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	1	1
1982	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
1982	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2	2
1983	1	-	-	-	-	-	-	-	-	-	-	1	-	-	1	1	1	1
1984	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
1984	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3
1986	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1
1986	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1
1986	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1
1987	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1
Total	49	-	2	2	2	2	17	3	17	12	54	10	20	3+1	41	32+1	156	189

SC - Self Citation
CO - Cited by Others

Table 4
Life Span and Frequency of Citations per Book

Year of Publication	No. of Books	CITATION												Total		
		1955-59		1960-64		1965-69		1970-74		1975-79		1980-84			1985-89	
		SC	CO	SC	CO	SC	CO	SC	CO	SC	CO	SC	CO	SC	CO	
1959	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	4
1969	1	-	-	-	-	-	1	2	-	1	-	1	3	10	4	22
1976	1	-	-	-	-	-	-	-	-	1	-	1	-	4	-	6
1981	1	-	-	-	-	-	-	-	-	-	1	1	-	17	1	18
1984	1	-	-	-	-	-	-	-	-	-	-	-	1	2	1	2
Total	5	-	-	-	2	-	-	1	2	9	1	6	4	33	6	52

SC - Self Citation
CO - Cited by Others

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Table 5

Distribution of Articles on the Basis of Citedness

Sl. No.	Citedness of Article (S)	No. of Articles	Total No. of Citations received	Cum. of Citations
1.	Cited Once	14	14	14
2.	Cited Twice	10	20	34
3.	Cited Thrice	3	9	43
4.	Cited Four Times	4	16	59
5.	Cited Five Times	5	25	84
6.	Cited Six Times	4	24	108
7.	Cited Seven Times	3	21	129
8.	Cited Eight Times	2	16	145
9.	Cited Nine Times	2	18	163
10.	Cited Ten Times	0	0	163
11.	Cited Eleven Times	1	11	174
12.	Cited Twelve Times	0	0	174
13.	Cited Thirteen Times	0	0	174
14.	Cited Fourteen Times	0	0	174
15.	Cited Fifteen Times	1	15	189

Table 6

Distribution of Books on the Basis of Citedness

Sl. No.	Citedness of Books	No. of Books	Total No. of Citations Received	Cum. of Citations
1.	Cited Thrice	1	3	3
2.	Cited Four Times	1	4	7
3.	Cited Six Times	1	6	13
4.	Cited Nineteen Times	1	19	32
5.	Cited Twenty Six Times	1	26	58

Table 7.

Analysis of the Paper Published in "Thermochim Acta 1971, 2, 41-45" and Cited 11 times

Sl. No.	Year of citation	Citation		Citing Journal (s)	Citing Authors
		Self	Others		
	1	2	3	4	5
1.	1972	-	1	Analyt Chem 66, R523, 72	Murphy, C V
2.	1973	1	-	J Appl Chem 23, 625, 73	Ramachandran, V
3.	1974	-	1	J Appl Chem 24, 157, 74	Traetter, A
4.	1975	-	1	J Amer Con 50, 94, 75	Setta, P J

Contd.

Table 7 (Contd.)

Sl.No	1	2	3	4	5
5.	1975	-	1	J Amer Con 58, 87, 75	Ramdoi, L
6.	1975	-	1	J Test Eval 3, 375	Shelni, J
7.	1976	-	1	Ind J Tech 14, 389, 76	Singh, N B
8.	1976	-	1	J Sci Ind Res 35, 75, 76	Singh, N B
9.	1977	-	1	Inorg Mat 13, 1505, 77	Men, E N
10.	1977	-	1	J Appl Chem 47, 2506, 77	Chivos, H
11.	1988	-	1	Thermochim Acta 12, 89, 78	Bedant, L

Table 8.

Analysis of the Paper Published in "Materials and Structure 1971, 41, 3-12" and Cited 15 times.

Sl. No.	Year of Citation	Citation		Citing Journals (s)	Citing Authors
		Self	Others		
1.	1972	1	-	J Appl Chem 22, 1073, 72	Ramachandran
2.	1972	-	1	J Mat Sci 7, 330, 72	Berman, H A
3.	1972	-	1	Analyt Chem 4, R583, 72	Murphy, C V
4.	1974	-	1	J Appl Chem 24, 157, 74	Traefaq, A
5.	1974	-	1	Rev Chem 19, 371, 74	Theoreanu, J
6.	1975	-	1	J Amer Con 58, 87, 75	Banjok
7.	1975	-	1	J Test Eval 33, 12, 75	Canto, A
8.	1975	-	1	J Amer Con 58, 14, 75	Fres, A T
9.	1975	-	1	J Test Eval 3, 303, 75	Skalay, T
10.	1975	-	1	Thermochim Acta 12, 87, 75	Bandol, L
11.	1976	-	1	J Amer Con 59, 29, 76	Avsrov A V
12.	1983	-	1	Analyt Chem 5, 3508, 87	Issa Mqri, D
13.	1986	-	1	Cem Con Res 16, 17, 86	Brown, B M
14.	1987	-	1	J Amer Con 64, 1102, 87	Diamona, S
15.	1987	-	1	Cem Con Res 17, 907, 87	Arya, C

Table 9.

Citing Pattern of the Book "Concrete Science. London, Heyden, 1981" (Cited 19 times).

Sl. No.	Year of citations	Citation		Citing Journals	Citing Author (s)
		Self	Others		
	1	2	3	4	5
1.	1983	-	1	J Mat Sci 2, 627, 83	Laus, V
2.	1984	1	-	J Chem Tech A34, 184, 84	Ramachandran, VS
3.	1986	-	1	Cem Con Res 16, 554, 86	Beaudoin, J J
4.	1986	-	1	Mag Con Res 38, 23, 86	Marsh, B K
5.	1986	-	1	Cem Con Res 16, 161, 86	Poom, C S
6.	1986	-	1	Cem Con Res 16, 207, 86	Kosger, H
7.	1986	-	1	Cem Con Res 16, 17, 86	Brown, P W

Contd.

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Table 9 (Contd.)

Sl.No	1	2	3	4	5
8.	1987	-	1	Cem Con Res 17, 996, 87	Aitcin, P C
9.	1987	-	1	Mas Rev 56, 263, 87	Alla A J Pivicesh
10.	1987	-	1	J Kuwait, 14, 251, 87	Ecrayyes, M S, Jr
11.	1987	-	1	Jr Mat Sci 6, 197, 87	Beaudoin, J J
12.	1988	-	1	Mag Con Res 40, 28, 88	Hanmat, D J
13.	1988	-	1	Mat Sci 4, 277, 88	Jennings, H M
14.	1988	-	1	Mat Sci 4, 291, 88	Jennings, H M
15.	1988	-	1	Cem Con Res 18, 636, 88	Kayyali, O A
16.	1988	-	1	J Mat Sci 23, 501, 88	Henderso, E
17.	1988	-	1	J Appl Chem 61, 2045, 88	Imozemts, Y P
18.	1989	-	1	Mag Con Res 41, 171, 89	Almudaih, J
19.	1989	-	1	Mag Con Res 41, 19, 89	Penttala, V E

Table 10.

Citation Pattern of the Book "Application of Differential Thermal Analysis in Cement Chemistry. New York, Chemical Publishers, 1969" (cited 26 times).

Sl. No.	Year of citation	Citation		Citing Journal (s)	Citing Authors(s)
		Self	Others		
1.	1970	-	1	Ann Chem 44, 8168, 70	Murphy, E V
2.	1971	-	1	Mid Sci 84, 655, 71	Kenneple, N A
3.	1971	1	-	J Therm Anal 3, 383, 71	Ramachandran, V S
4.	1975	-	1	MAP Soc 1, 83, 75	Klethani, J
5.	1975	-	1	MTP Core 75, 1486, 75	Klethani, J
6.	1976	-	1	Bk No 336, 76	Fruadman, H C
7.	1976	-	1	J Amer Con 47, 1701, 76	Virobov, K S
8.	1976	-	1	J Scientific Ind Res 75, 76	Sivesh N.B.
9.	1976	-	1	J Appl Chem B.28, 159, 76	Visht, Y
10.	1976	-	1	J Amer Con 55, -, 76	Gowda, Y R
11.	1981	-	1	Rev Royal Chem 76, 1213, 81	Toreginu, I
12.	1984	-	1	Thermochim Acta 78, 101, 84	Volantie, G
13.	1984	-	1	Mag Con Res 36, 146, 84	Khoury, G A
14.	1985	-	1	Thermochim Acta 93, 69, 85	Handa, S K
15.	1985	-	1	Thermochim Acta 91, 905, 85	Bhattiji
16.	1985	-	1	Thermochim Acta 93, 613, 85	Bushnew S M
17.	1986	1	-	Thermochim Acta 106, 273, 86	Ramachandran, V S
18.	1986	-	1	Thermochim Acta 98, 71, 86	Santoro, L
19.	1986	-	1	Thermochim Acta 106, 93, 86	Bhattiji
20.	1987	-	1	Thermochim Acta 116, 145, 87	Santoro, L
21.	1987	-	1	Thermochim Acta 119, 235, 87	Bhattiji
22.	1987	1	-	Thermochim Acta 112, 252, 87	Ramachandran, V
23.	1987	-	1	Mag Con Res 39, 221, 87	Shiang, M
24.	1988	1	-	Thermochim Acta 127, 385, 88	Ramachandran, V S
25.	1988	-	1	Cem Con Res 18, 91, 88	Valantic, G L
26.	1988	-	1	Amer Ceram Soc 67, 12222, 88	Chiang, M H

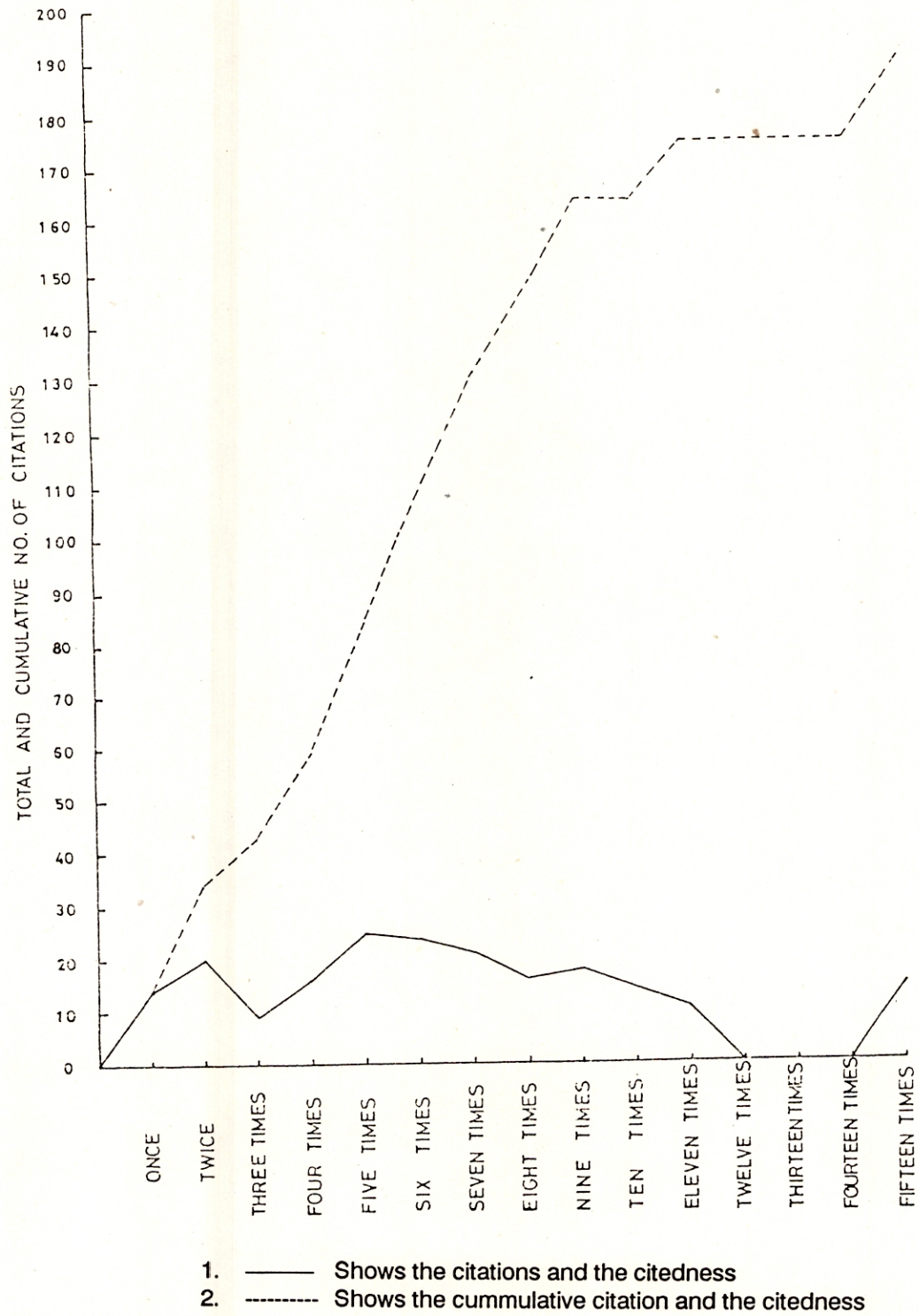


Fig. 1 DISTRIBUTION OF ARTICLES ON THE BASIS OF CITEDNESS

basis of the frequency of their citations. From the table it is observed that the article receiving 15 citations is the most cited one followed by another article receiving 11 citations. Frequency graph of rated citations is also plotted [Fig. 1] indicating the citations and cumulative number of citations for articles authored by Ramachandran. Similarly, Table 6 records the distribution of books on the basis of citations. The table shows that the books were cited 4 to 26 times.

It is considered worthwhile to study in detail the citation pattern of articles which received maximum number of citations.

CITATION ANALYSIS OF HIGHLY CITED ARTICLES

Table 7 illustrates the details of citation pattern of the article published in *Thermochimica Acta* Vol 2 (1) pp. 41-45 (NRC No. 11676), 1971. The article was cited 11 times. The journal is covered by SCI data base. It was first cited one year after its publication and continued to be cited a number of times after 1,2,3,4,5,6 and 18 years. The article was cited three times in the year 1975 and two times in 1976 and two times in 1977. There was no citation for ten years and again in 1988, the article was cited leading to the fact that the life span of any article can not be determined firmly. The article was cited three times by the *Journal of Applied Chemistry* and twice by the *Journal of American Concrete Institute*.

Table 8 gives an account of the pattern of citations to an article published in *Materials and Structure* in 1971. The article was first cited one year after its publication. It was cited 15 times in 16 years. It was cited a number of times after 1,2,3,4,5,12,15 and 16 years of its publication. The article was cited three times in 1972, twice in each 1973 and 1974, five times in 1975 and once in 1976. The article was again cited after the lapse of 7 years and the trend of its citation continued upto 1987 when it was cited twice.

It is inferred that the work is expected to get more citations in future.

Unfortunately, this journal is not covered in SCI database. Therefore, its coverage in the SCI data-

base is strongly recommended.

CITATION ANALYSIS OF HIGHLY CITED BOOKS

Dr. V. S. Ramachandran had authored 6 books. Five books were studied for bibliometric analysis. Two of them which are highly cited by the fellow scientists are analyzed below:

The book titled "Concrete Science" received as many as 19 citations. It was quoted by various scientists working in the field of concrete technology which is a fast developing field in building materials. The citation profile of the book indicated that it was well cited. It was cited a number of times after 2,3,5,6,7 and 8 years of its publication in 1981. (Table 9).

The book was first cited just 2 years after its publication and it was cited 5 times in 1986, 4 times in 1987 and 6 times during 1988 which shows that it was continuously cited. *Cement Concrete Research* cited the book 6 times and *Magazine of Concrete Research* 4 times. Table 10 records the citation pattern of the highest cited book. The title of the book is "Application of DTA in Cement Chemistry". It is published by Chemical Press, New York in 1969. It was immediately cited once after the publication of the book in 1970.

The book is cited a number of times after 1,2,6,7,12,15,16,17,18 and 19 years of its publication in 1969, i.e. 5 times in 1976, 3 times in 1985 and 3 times in 1986, 4 times in 1987 and 3 times in 1988. It is observed that the book was cited constantly.

CONCLUSION

From the above study it is clear that Dr. Ramachandran is one of the highly quoted scientists in the area of cement concrete chemistry. He was more quoted for his books in comparison to his articles.

It is suggested that a survey similar to the one carried out during 1975-1984 may be conducted by the American Ceramic Society. This survey is very much due for 1985-1991 which may throw some more light on the citedness of the works of Dr. V. S. Ramachandran.