Mapping of Indian Chemical Science Literature

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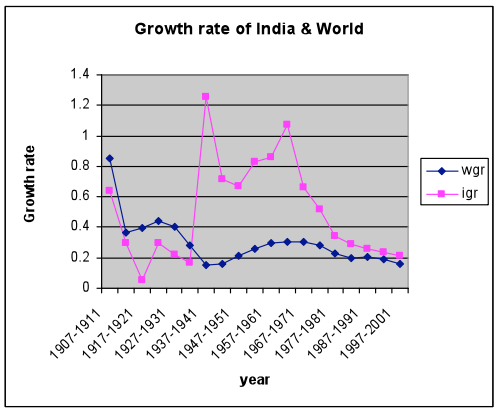
Introduction

A map is visual representation of an area - a symbolic depiction highlighting relationship between elements of that space such as objects, regions and themes. Mapping serves as a survey of research in a given field; it requires an understanding of the research process and its different forms. There are different types of maps; one of them is 'citation map'. This contain all the articles related to citations either the citing articles or the cited articles. It helps to establish links between authors through citations of their papers. Also help in identifying the frequency of author and establish the position of author view point, perspective and the theory of knowledge in relation to co-workers in the field. National research profiles provide evidence of the foci of research in terms of publication or citation volumes within a country, institution, or other defined locations for a selected domain of science in a given time period. As a visualization tool the maps may indicative developments of publication behaviour and official or hidden strategies of research and complement common quantitative Science and Technology indicators. In this paper we compare Indian Chemical Literature in different subfields as reflected in 'Chemical Abstracts'. Some of the notable studies from India were Jain (1988) and Karki (2000).

Methodology

For the present study SCI Finder Scholar – Chemical Abstract (CA) online has been used. Data for the India since 1907-2005 has been collected using online database and the data are further analysed into eighty sub fields using **CA Section Analysis** search option. The data has been gathered from April 2005 to July 2007



through **Company/Organisation** search option which was refined by Year and analysed by CA Section Analysis search option. A different set of data has been analysed for the study of author productivity, collaboration, ranking of periodicals, and institutional contributions using different statistical techniques and models.

Results and discussion

World and India

The total output of world and India has been shown in figure-1 (set of five year) along with the growth rate and doubling

time. It shows that the relative growth rate of world output decreases gradually from 0.852 to 0.156 except in the data set year 1927-1931 (0.444) and 1952-1956 (0.211) where there is an increase in growth rate till 1967-1971 (0.303). The reason for this growth may be due to

Figure -1.Growth rate of India and World

the end of World War. The doubling time (D_t) correspondingly increases from 0.813 to 4.428 with a corresponding decrease during increased growth rate during 1952 – 1972. The mean growth rate & doubling time for the world is **0.299** and **5.074** respectively. It also decreases gradually from 0.64 to 0.211 except in the data set 1942-1946 (1.252) and 1957-61 (0.826) till 1967-1971 (1.075). This growth may be due to the end of World War II and the establishment of major scientific institutions like CSIR, NPL, NCL etc. that resulted into more scientific research. Correspondingly the doubling time increases from 1.082 to 3.863 with a decrease during 1942-1946, 1957-1961 (0.553) to 1967-1971 (0.644). The mean growth rate and doubling time for Indian output is **0.504** and **3.863**.

Subject wise Growth Rate

This study has been done only for the period 1980-2005 with the aim to understand the structure and dimensions of Chemical Science Literature. The Analysis shows that growth rate for **Biochemistry** gradually decreases from 0.725 in the year 1980 to 0.062 in 2005 and correspondingly the doubling time increases from 0.956 in the year 1980 to 11.16 in 2005; for **Organic Chemistry** the growth rate decreases from 0.676 in the year 1980 to 0.0694 in 2005 and doubling time increases from 10.25 to 9.98; for **Applied Chemistry and Chemical Engineering** the growth rate gradually decreases from 0.650 to 0.063 and correspondingly the doubling time increases from 1.066 to 10.90; and for **Macromolecular** and **Physical, Inorganic & Analytical Chemistry** too the growth rate decreases from 0.57 to 0.071 and 0.688 to 0.539 respectively. Correspondingly the doubling time too increases from 1.216 to 9.79 and 1.007 to 12.83. The mean growth rate and doubling time for Biochemistry is 0.138; and 8.841; for Organic Chemistry is 0.131 and 7.925; for Applied Chemistry and Chemical Engineering is 0.148 and 6.675; for Macromolecular Chemistry is 0.135 and 7.38 and for Physical, Inorganic and Analytical Chemistry is 0.131 and 8.70 respectively. In a nut shell we can say that though there is growth in these fields the rate of growth is decreasing gradually.

Activity Index

The activity index of India's shown in Table-1 indicates that the research efforts of India was lower than the worlds' average in the field during 1907-1911 (2.025), 1912-1916 (1.359), even less than 1 during1922 -1926 (0.672) to 1937-1941 (0.459) and later picked higher than the world's in the years 1972-1976 (104.488) to 2002-2004 (132.199). Activity index has become almost double in the year 1967-1971 (40.87to 98.72). But if a year wise analysis has to be done the Activity Index is very less as maximum is 17.69. Since 1907 to 1944 the Activity index is even less than one and zero in the year 1922, 1924 and 1937. Average Activity Index is **50.649**.

Content Analysis of Five Major domains of Chemistry

The branch wise analysis of the subfields shows that within **Biochemistry** the five most contributing fields are Plant Biochemistry (3.38%), Toxicology (2.96%), Pharmacology (2.25%), Agrochemical Bioregulators (2.25%) and Fertilisers, Soils and Plant Nutrition (1.74%).

Author Productivity and Collaboration

The total data collected for the collaborative study (2000-2005) was

36856 which are again analysed according to different collaborative measures like authorship pattern, single versus multi authorship, collaborative index, collaborative coefficient and degree of collaboration. The total article and author analysed for the period 2000-2005 for the thirteen fields are 36856 and 109449 respectively.

Year	world output	Indian Output	Activity Index
1907-1911	81702	38	2.045729
1912-1916	110028	34	1.359167
1917-1921	84843	25	1.296048
1922-1926	133391	5	0.16487
1927-1931	228793	35	0.672857
1932-1936	315169	34	0.474496
1937-1941	306545	32	0.459148
1942-1946	206265	507	10.81134
1947-1951	258856	741	12.59091
1952-1956	404571	1374	14.93789
1957-1961	629799	3629	25.34441
1962-1966	948134	8811	40.87452
1967-1971	1313005	29472	98.72802
1972-1976	1772194	42100	104.4884
1977-1981	2201692	59009	117.8851
1982-1986	2302471	59649	113.9479
1987-1991	2482482	68006	120.492
1992-1996	3130955	80364	112.8969
1997-2001	3599227	94264	115.195
2002-2005	3464092	105013	131.3897
Mean			**50.649**

Table-1: Activity Index of India

Application of Poisson and Geometric Distribution

Maximum numbers of authors for some of the publications are up to 26 authors, so truncated Poisson distribution is applied. After obtaining the basic statistics, mean and variance values for the data in two block periods 2000-2002 and 2003-2005, probability distributions are applied and their value obtained are again tested with Chi Squire Test to know the applicability of these two distributions.

Conclusion

Mapping research profiles is taken as an indicator in R & D observation with substantial signal value and informative characteristics concerning national foci of research and as tool for the assessment of a given information space accomplished by a particular country.

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