Mapping of Green Biotechnology Research: A Scientometric Analysis

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Abstract

This study discusses that the publication developments of the database of web of science in Green Biotechnology during 2001 to 2012. This study also exposes the trend in authorship pattern and collaborative research in Green Biotechnology with a sample of 594 articles downloaded from the database of web of knowledge during 2001 to 2012 (four decades) with 9598 TCS measured. The growth trend is booming taken the sample duration in this field of Green Biotechnology research output.

Keywords

Green Biotechnology, relative growth rate, doubling time, citation scores.

Electronic access

The journal is available at www.jalis.in

Journal of Advances in Library and Information Science
ISSN: 2277-2219 Vol. 1. No.4. 2012. pp. 181-185

Introduction

Price (1963), on the basis of a survey of Chemical Abstracts observed a steady increase in the trend towards multiple authorship and held that "… if it continues at the present rate, by 1980 the single authored papers will be extinct". Karisiddappa et al. (1990) analyzed the authorship pattern in psychology and found that the proportion of single authored papers has fallen to 39.43% in 1988 when compared to 84% in the 1920's indicating the publication trend towards collaborative authorship. Studies of the relationship between science and technology have appeared since the 1980s. In order to extend the scope to a broader science and technology landscape in biotechnology, the current study is conducted by addressing issues including international publication activities, national or regional publication profiles, citation impact, international collaboration, as well as subfields distributions of publications and patents. Citation links between publications and patents are actually studied from two different perspectives publications cited by patents and publications citing patents.

Objectives of the Study

The major objectives are framed with the unique principle of the present study as mentioned below:

- To find the year wise and source wise distribution of Green Biotechnology output of the study from 2001 to 2012;
- To examine the growth rate and doubling time of Green Biotechnology output;
- To identify the most productive authors and dominating countries in the field of Green Bio technology;
- To identify the prolific journals and most productivity institute in Green Biotechnology research.

Data and Methodology

There are various sources contributing to the research output in the field of Green Biotechnology research by the scientists all over. In this study secondary sources are also taken for analysis. The necessary data were collected from the Science Citation Index (SCI) and Social Science Citation Index (SSCI) and Arts & Humanities Citation Index (ACHI) which are available on the Web of Science (WoS). The WoS is the search platform provided by Thomson Reuters (the former Thomson Scientific emerged from the Institute for Scientific Information (ISI) in

Philadelphia). SCI and SSCI database is oneof the very comprehensive databases covering all aspects of science. The study period 2001 to 2012 is selected as the database is available. A total of 594 records were downloaded and analyzed by using the Histcite software application as per the objectives of the study.

Data Analysis and Interpretations

1 Proportion of Collaborated Publications

The growth in the number of total publications and collaborative publications are considered in during periods have shown a consistent increasing trend with time since 2001 to 2012. However, table-1 reveals that the proportion of collaborative publications in total during years. The proportion of year wise publications is 4.4 percent in 2001 and it is risen the value of 15.2 percent during 2010 to 2011. It reveals that the growth rate is increase manifolds (nearly four times). The proportion of collaborative contributions in 2.9 percent in 2002; 5.9 percent at 2003; 4.9 percent at 2004; 7.2 percent of output at 2005; 7.4 percent of publications at 2006; 8.2 percent of output at 2007; 9.4 percent of output at 2008 and 2012; 9.9 percent of output at 2009; and 15.2 percent of output during 2010 to 2011.

Table 1: Total Publications and Collaborative Publications during 2001 to 2012

S.No	Publication Year	Recs	TCS	$\log_e 1^p$	$\log_e 2^p$	Rt(P)	Dt(P)
1	2001	26(4.4)	695	-	3.258		-
2	2002	17(2.9)	763	3.258	2.833	0.425	1.63
3	2003	35(5.9)	887	2.833	3.555	0.722	0.96
4	2004	29(4.9)	872	3.555	3.367	-0.188	-3.69
5	2005	43(7.2)	**1560**	3.367	3.761	0.394	1.76
6	2006	44(7.4)	1243	3.761	3.784	0.023	30.13
7	2007	49(8.2)	1145	3.784	3.891	0.107	6.48
8	2008	56(9.4)	929	3.891	4.025	0.134	5.17
9	2009	59(9.9)	588	4.025	4.077	0.052	13.33
10	2010	90(15.2)	716	4.077	4.499	0.422	1.64
11	2011	90(15.2)	181	4.499	4.499	0	0.00
12	2012	56(9.4)	19	4.499	4.025	-0.474	-1.46
	Total	**594**	**9598**			**1.617 (0.134)**	**55.95(4.662)**

As indicated in the table 1, authors from Green Biotechnology have contributed 594 publications during 2001 to 2012 in different scholarly journals. The highest number of research output 180 (30.4%) was produced in the years 2011and 2012 and the least research output was in the year 2002 with 17 (2.9 %). However, there was a gradual growth rate of publications after 2005. The annual average research output in Green Biotechnology is 49.5 records. A year wise growth of research output and citations received by the authors of Green Biotechnology is presented in the Table 1. On considering the citation profile of papers of Green Biotechnology 2001-2012, it was observed that 43 papers scored highest citation 1560 in the year 2005
.

Table 2: Ranking of Authors Based on Publication

S. No	Author	Records	TLCS	TGCS	Rank
1.	Stewart CN	5	3	56	1
2.	Yoshizaki G	5	2	18	1
3.	Bamba T	4	2	6	2
4.	DeLisa MP	4	7	247	2
5.	Jin E	4	5	53	2
6.	Melis A	4	8	95	2
7.	Takeuchi Y	4	2	18	2
8.	Almarales A	3	3	20	3
9.	Bermudez RC	3	3	20	3
10.	Bock R	3	10	219	3

Table 2 indicates that the ranking of authors by their number of publications in the subject of green biotechnology. Authors "Stewart, CN" and "Yoshizaki, G" have published highest number of articles for the study period with each 5 records. Five authors were published each 4 articles and being second rank in order to the position of Green biotechnology. "DeLisa MP" has highest citation scores (247 GCS) authors are distinguished from the sample taken authors. "Bamba T" has having very low citation scores among the ten authors.

2 Citation Mapping of Highly Cited Papers

From this study, the researcher has identified the highly cited articles along with their cited authors. Here the below figure 1 has mentioned the cited details of; the title "Metal-enhanced fluorescence: an emerging tool in biotechnology" written by "Aslan, K, et.al.," in the journal of "CURRENT OPINION IN BIOTECHNOLOGY" at 2005 and 250 times has cited by others. From this study, the researcher has identified the highly cited articles along with their cited authors. Here the below figure 2 has mentioned the cited details of; the title **"**Development of series of gateway binary vectors, pGWBs, for realizing efficient construction of fusion genes for plant transformation" written by "Nakagawa, T, et.al.," in the journal of "JOURNAL OF BIOSCIENCE AND BIOENGINEERING" at 2007 and 244 times has cited by others. Fig.1 & 2 has shown the first generation citation details.

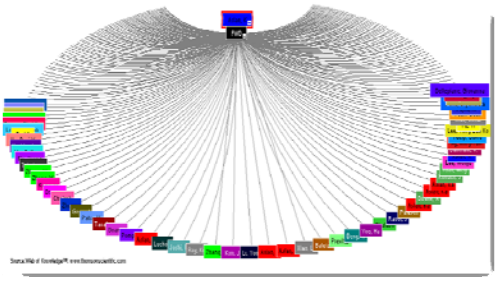

Fig.1: Citatd Shown the Details of "Aslan, K, et.al.,"

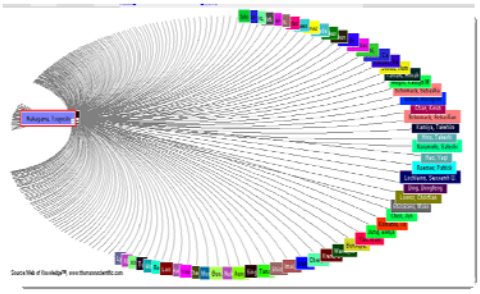

Fig.2: Citatd Shown the Details of "Nakagawa, T, et.al,"

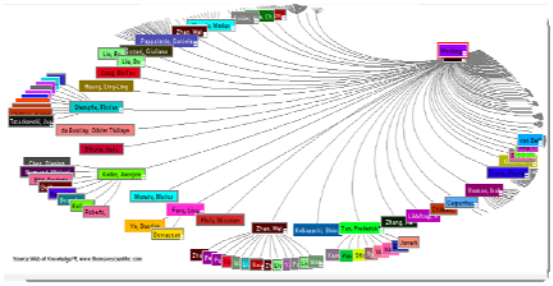

Fig.3: Citatd Shown the Details of "Mecking, S"

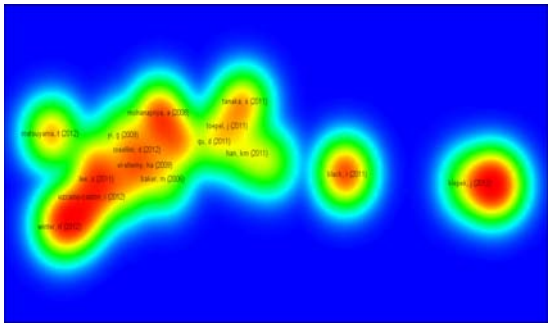

Fig.4: Cluster of Author Wise

From this study, the researcher has identified the highly cited articles along with their cited authors. Here the below figure 3 has mentioned the cited details of; the title **"**Nature or petrochemistry? Biologically degradable materials" written by "Mecking, S" in the journal of "ANGEWANDTE CHEMIE-INTERNATIONAL EDITION" at 2004 and 164 times has cited by others. Fig.3 has shown the third generation citation details.Fig.4 has mentioned the cluster of author wise used VOSviewer software.

3 Document Wise Distribution of Publications

The study reveals that the major source of publications covered by web of science on Green Biotechnology research in journal articles (69.2%), while review comprises (22.2%) and conference proceedings with (4.9%) of the remaining literature

.

Table 3: Document wise Distribution of Publications

S.No	Document Type	Records	%	TLCS	TGCS
1	Article	411	69.2	82	4474
2	Review	132	22.2	96	4205
3	Article; Proceedings Paper	29	4.9	10	299
4	Editorial Material	8	1.3	5	22
5	Article; Book Chapter	6	1.0	2	71
6	Review; Book Chapter	4	0.7	1	279
7	Letter	1	0.2	0	32
8	Meeting Abstract	1	0.2	0	0
9	News Item	1	0.2	0	0
10	Unknown	1	0.2	0	20

4 Journal Wise Distributions of Publications

The study found that the total research output of the Green Biotechnology for the study period (2001-2012) published in 359 journals. As the major portion of the research productivity (76.2%) covered by 25 journals that is coincide with the theory of Bradford's Law of scattering of journals in research productivity. The journal "Journal of Bioscience and Bioengineering" topped with 37 publications with the Global Citation Score of 335, next "Applied Microbiology and Biotechnology" 18 publications with the Global Citation Score of 873 and "Journal of Biotechnology" with 10 publications with the Global Citation Score of 208 respectively.

Table 4: Distribution of Green Biotechnology in Publications

S.No	Journals	Recs	TLCS	TGCS
1	JOURNAL OF BIOSCIENCE AND BIOENGINEERING	37	2	335
2	APPLIED MICROBIOLOGY AND BIOTECHNOLOGY	18	17	873
3	JOURNAL OF BIOTECHNOLOGY	10	2	208
4	CHEMBIOCHEM	8	3	192
5	PLANT SCIENCE	8	1	72
6	CURRENT OPINION IN BIOTECHNOLOGY	7	10	403
7	JOURNAL OF APPLIED PHYCOLOGY	7	1	50
8	TRENDS IN BIOTECHNOLOGY	7	6	249
9	JOURNAL OF MOLECULAR BIOLOGY	6	5	253
10	PLANT BIOTECHNOLOGY JOURNAL	6	1	74

5 Institution Wise Distribution of Publications

The below table analysis indicates Institution-wise research productivity. It is noted that 200 institutions were contributed of the total research productivity in the subject of Green Biotechnology. It is noted that Chinese Academy of Sciences contributed the highest number of research publications (10) at the same time it ranks first in terms of Global Citation Score 167. It is found that the journal of "Chinese Academy of Sciences" is identified the most productive journal.

Table 5: Institution wise Distribution of Publication (Top 10)

S.No	Institution	Records	%	TLCS	TGCS
1	Unknown	11	1.9	3	9
2	Chinese Academy of Sciences	10	1.7	6	167
3	Osaka University	9	1.5	4	89
4	University of Maryland	8	1.3	7	516
5	Rhein Westfalia TH Aachens	7	1.2	1	36

6	Tech University Denmark	7	1.2	5	333
7	University Calif Berkeley	7	1.2	8	101
8	University of Queensland	7	1.2	8	201
9	University of Tennessee	7	1.2	3	88
10	Cornell University	5	0.8	3	107
11	Ohio State University	5	0.8	1	71

6 Country Wise Distributions

Table 6 indicates that the country wise number of publications. Highest number of Records has published in USA (23.4%) at the same time it ranks first in terms of Global Citation Scores 3320, followed by Japan, China and Germany have above 50 articles related this subject productivity .remaining countries were having less contribution of green biotechnology research productivity .

Table 6: Country wise Distribution of Publication (Top 10)

S.No	Country	Records	%	TLCS	TGCS
1	USA	139	23.4	68	3320
2	Japan	64	10.8	15	908
3	Peoples R China	53	8.9	7	374
4	Germany	51	8.6	23	1302
5	UK	41	6.9	23	655
6	Unknown	39	6.6	17	478
7	India	38	6.4	18	796
8	Australia	25	4.2	17	484
9	South Korea	19	3.2	9	175
10	France	14	2.4	5	179

Conclusion

From this analysis the researcher have found the following remarks:

1. During 2011 and2010 have highest contribution.
2. It is identified the authors of "Stewart, CN" and "Yoshizaki, G" are most productivity authors.
3. Among 10 types of Bibliographic formats, the journal format has contributed leading position.
4. The journal of "Journal of Bioscience and Bioengineering" has produced more articles.
5. Chinese Academy of Sciences contributed the highest number of research publications in green biotechnology.
6. USA, Japan and China have produced more than 50 percent of articles in subject.

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