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Publication Trends and Citation Impact of Microbiology Research in India: A Scientometric Study

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Abstract

This document evaluates India's contribution to world microbiology research during the period 2003–2014 based on Web of Science database. India's growth of research, global publication share, citation impact, the share of global collaborative publications, impact of major collaborative countries, prolific institutions and authors were studied. It is observed that India ranks in the 9th place with a global publication share of 3.87% and an annual average growth rate of 13.15% for the period 2003–2014. The citation impact of India's contribution is 12.26 which decreased from 22.42 during 2003–2008 to 7.43 during 2009-2014. India's international collaboration share in Microbiology research is 31.93%.

Keywords: Microbiology, Publication trend, Scientometrics, Citation impact, Collaboration.

Introduction

Microbiology took its birth in 1674, when Antonie van Leeuwenhoek became the first person to glimpse microbial life in a drop of water across a glass lens, since then, this science which deals with the study of the invisible life has developed infinitely[1]. Earlier, microbiology involved primarily the studies of fermentation and medicine, but as the miscellany characteristics and the character of these micro-organisms came to know, the scientific origin of this science expanded throughout the world[2]. In India, the field of microbiology focuses on two major facets, studying the ways through which microbes are the source of diseases, and endeavoring to harness the potential of these microbes for applications like fermentation, antibiotic production, biotechnological manipulations, bio-control agents, cloning vehicles, in bioremediation etc.[3]. In the twentieth century, microbiology in India further branched out into industrial microbiology, environmental microbiology, agricultural or soil microbiology, marine microbiology, clinical or medical microbiology, and food microbiology[4].

India is a developing country and its enormous population is constantly fighting an ever increasing number of many dreadful diseases like malaria, tuberculosis, HIV infection and cholera[5]. Researchers in India are presently investigating the process by which organisms acquire this drug resistance. Secondly, as India is an agrarian economy, major research has been diverted to the microbial research in this area. This involves studies related to nitrogen fixation, rhizosphere, anaerobic decomposition in biogas production, soil enzymes etc.[6]. Thirdly, industrialization is emerging in India tremendously its resulted in the release of enormous toxic pollutants into the environment that is posturing as health hazards. In this background, microbes have been extensive studies in laboratories across the country on the strategies for the waste management of such pollutants[7]. Microbial genetics has been a field which has endured massive development in the recent years and has emerged as a discrete discipline of molecular biology.

Review of Related Studies: There are numerous qualitative and quantitative studies on different branches of discipline evaluating India's impact have been accomplished earlier. Gupta and Gupta[8] examined the Indian contribution in Pneumonia disease research for the period 2004-2013 based on Scopus database. Gupta and Bala[9] analyzed the Indian research output in bone marrow research during 2003-12 based on Scopus Citation Database with an emphasis on measuring the Indian input and recognizing the most prolific institutions. Rajagopal, Archunan, Surulinath and Ponmanickam[10] examined the progress of pheromone biology research productivity in India based on the SCI of WoS database for the period 1978-2008. Sinha and Joshi[11] observed the position of solar photovoltaics research productivity in India for the period 2000-2009. Gupta, Kshitij, and Verma[12] undertook the study of Indian publication output in computer science during 1999-2008 based on SCOPUS database. Varaprasad and Ramesh[13] studied the Indian chemical research growth for the period of 1987- 2007 based on the SCOPUS database with a prominence on measuring the national contribution and recognizing the most productive organizations. Karpagam, Gopalakrishnan, Natarajan and Ramesh Babu[14] discussed the growth of nanoscience and nanotechnology research in India during 1990–2009. The study retrieved data from SCOPUS database with an emphasis on national and international collaboration output, contribution and impact of Indian Institutions and impact of Indian journals. Gupta, Kaur, and Kshitig[15] examined the Indian contribution in dementia study as revealed in SCOPUS during 2002 to 2011.

Gupta, Kaur, and Bala[16] analyzed the diabetes research productivity of India during 1999-2008. The study concentrated on characteristics of highly cited papers and international collaboration. Kademani, Sagar, and Bhanumurthy[17] studied an Indian materials science research evaluation for a period of 1999-2008 based on the SCOPUS database. The study revealed the progress of both national and international collaboration, highly prolific authors and organizations, and also most cited publications. Balasubramani and Murugan[18] study analyzed and compared the Tapioca (Sago) research in India with a number of documents, journals and international collaboration from 1973 to 2010. The study constructed historiography for India based on Local and Global citation scores using HistCite developed by Garfield and colleagues as well as the key papers were also identified. The present study is intended to analyze the Indian status of Microbiology research during the period of 12 years from 2003-2014.

Objectives: The main objective of this study is to analyze: i. To study the India's global publication share in Microbiology, ii. To study the growth of Indian contribution in Microbiology, iii. To study the international collaborative papers and partner countries, iv. To study the output of productive authors and organizations.

Methodology

The data for the present study retrieved from the- The Science Citation Index of Web of Science database. The search was conducted during the period of 12 years from 2003–2014. The search tag SU=Microbiology and CU=India have been used to retrieve the data. Thus, a total of 19,195 papers published by the Indian authors have been considered for this study.

Results and Discussion

Top countries: The publication share of the top ten countries in the world in Microbiology research diverges from 3.73% to 27.29% through the period 2003–2014 (Table-1). The 79% of world Microbiology research output collectively produced by these top countries. The USA tops the list with a share of 27.29% followed by the China with 9.32% and Germany with 7.68%. These three countries together produced 44% of world publications. India positioned ninth among the top ten productive countries with a world publication share of 3.87%.

Indian Microbiology output: India shared 19,915 publications to world microbiology research during the period 2003–2014 with an average of 1,660papers per year (Table-2). Cumulative publications have enhanced from 6,418 in 2003–2008 to 13,497 in 2009–2014 with a growth rate of 269%. These papers received a total of 2,44,295 citations from its time of publication up to April 5, 2015. Of 19,915 papers, 16,638 papers received one or more citations for their publication. Citations per paper were 12.26 during the period of the study, which has decreased from 22.42 in 2003–2008 to 7.43 in 2009–2014.

The total number of publications in microbiology research given by Indian scientists improved from 700 in 2003 to 2,562 in 2014. The coefficient of determination of publications is found to be R2 = 0.7393 which shows that the research in microbiology was growing at a significant growth rate (Figure-1). The linear best fit for the study was found to be y = 241.24X where y is a number of papers and x are the predicting year.

Table-1
Share of Top Countries in Microbiology 2004-2015

Country	TP	World share	Rank
USA	1,40,341	27.29	1
China	47,913	9.32	2
Germany	39,495	7.68	3
Japan	35,920	6.98	4
England	30,929	6.01	5
France	27,960	5.44	6
Spain	23,360	4.54	7
South Korea	20,503	3.99	8
India	19,915	3.87	9
Italy	19,192	3.73	10
World	5,14,327	100.00	

*TP= Total Publications

Table-2
Indian Microbiology Annual Output and Citation Impact

Year	TP	TC	CPP
2003	700	20,613	29.45
2004	726	17,716	24.40
2005	898	22,656	25.23
2006	1,062	26,115	24.59
2007	1,242	27,080	21.80
2008	1,790	29,701	16.59
2009	1,889	26,984	14.28
2010	1,973	23,302	11.81
2011	2,348	19,884	8.47
2012	2,334	15,278	6.55
2013	2,391	9,868	4.13
2014	2,562	5,098	1.99
2003-2008	6,418	1,43,881	22.42
2009-2014	13,497	1,00414	7.43
2003-2014	19,915	2,44,295	12.26

*TP= Total Publications, TC= Total Citations, CPP= Citations per Paper.

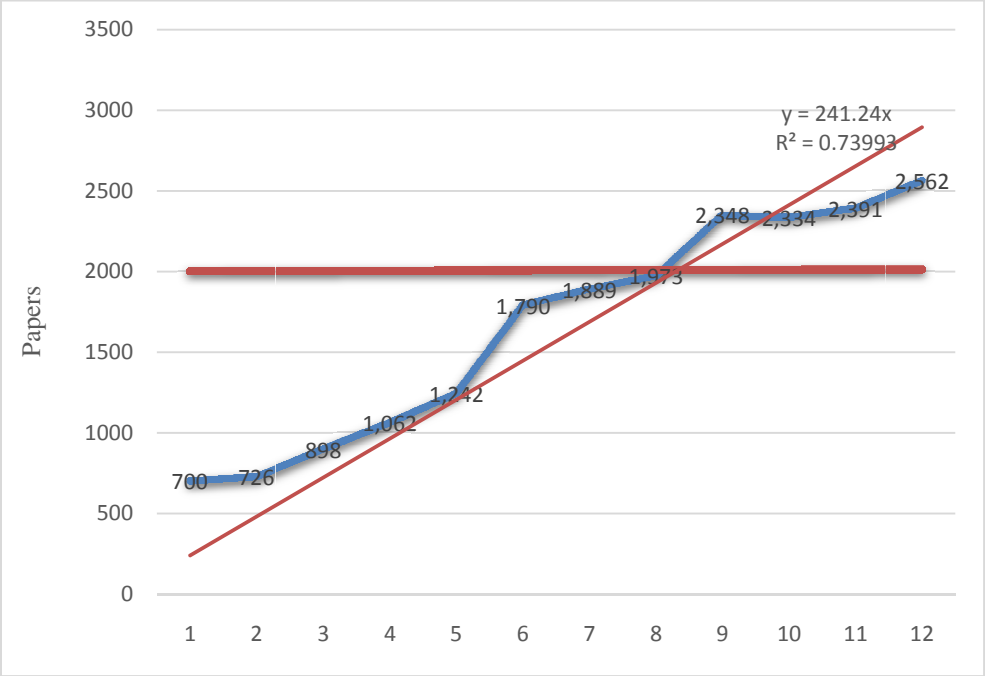

Figure-1
Linear Model of Papers from 2003–2014

Collaborative Papers: The publication share of international collaborative papers in India's total publication in Microbiology research is 31.93% during the period 2003– 2014, which has increased from 28.9% in 2003–2008 to 33.37% in 2009–2014 (Table-3). In Table-4 foremost International partner countries are detailed and India collaborated with total 132 countries during the study period. There were 6,359 international links and the internationalization index is 31.93 (=100x number of international links / total number of papers by India)[19] for microbiology research by Indian researchers and scientists.

Among the collaborative countries, the USA had maximum links with 1,311 publications. Six (G7) and Four (G5) countries are recorded among chief partner countries, which highlights that India has more persistent collaboration with scientists from both G7 and G5 countries.

Prolific Indian Institutes: In the Table-6 Institutes which have published more than 1% of the country's output during 2003-2014 are contemplated prolific institutes and listed. These 28 prolific institutes contributed 8,024 papers (40%) to the country's output with a range of 203 and 765 papers. Papers contributed by these productive organizations received 1,21,403 citations (50%) from their time of publication of a total 2,44,295 citations.

The leading five institutes (University of Delhi, New Delhi; Banaras Hindu University, Uttar Pradesh; Indian Institute Of Technology, New Delhi; Indian Institute of Science IISc, Bengaluru; Institute of Microbial Technology India, Chandigarh) contributed 2,404 papers considered for 12% of the country's output. The CPP of these productive institutes varies from 4.01 to 27.3. Among the prolific institutes, the National Institute Interdisciplinary Science Technology India, Thiruvananthapuram, Kerala received the highest CPP 27.3 followed by IIT Kharagpur, West Bengal (24.96) and Aligarh Muslim University, Uttar Pradesh (18.63). Among the prolific institutes Universities together produced 2916 (15% of the country's output) papers and research institutes contributed 2820 (14% of the country's research output) papers related to microbiology during 2003-2014 and these suggest that these are institutes with specialization in microbiology research in India. The highest h-index was attained by the University of Delhi, New Delhi (49), followed by IIT Delhi, New Delhi (43) and IIT Kharagpur, West Bengal (42), while the lowest is by the Vellore Institute of Technology, Tamil Nadu (14) among the prolific institutes.

Table-3
Share of Collaborative Papers

Block Period	TP	ICP	%ICP
2003-2008	6,418	1,855	28.90
2009-2014	13,497	4,504	33.37
Total	19.915	6,359	31.93

*TP= Total Publications, ICP = International Collaborative Papers

Table-4
Collaborating Countries

Collaborating country	No of publications	%
USA	1,311	20.62
South Korea	431	6.78
Germany	412	6.48
Japan	322	5.06
England	297	4.67
France	231	3.63
China	200	3.15
Australia	199	3.13
Canada	164	2.58
Brazil	134	2.11
Saudi Arabia	131	2.06
Switzerland	126	1.98
Italy	124	1.95
Netherland	123	1.93
Taiwan	121	1.90
Malaysia	115	1.81
Spain	101	1.59
Belgium	101	1.59
Sweden	100	1.57
Others	1,616	25.41
Total	6,359	100.00

Prolific Indian Authors: Authors contributing more than 0.5% of the country's research output during the period of 2003–2014 are contemplated prolific authors and enumerated in Table-5. Amid the 13 most prolific authors, 6 authors are from IIT's and 2 from University of Delhi. Kumar, An of IIT Kanpur, Uttar Pradesh was the most prolific author of 353 papers (1.77%) followed by Kumar, S of IIT Roorkee, Uttarakhand, and Singh, S of AIIMS, Raipur. Pandey, An of NIIST, Thiruvananthapuram had the top CPP of 32.53 followed by Singh, An of BHU, Uttar Pradesh (14.64) and Kumar, R of University of Delhi (13.66). The prolific authors had h-index in the vary from 17 to 44. The author Pandey, A had the highest h-index value of 44 while Kumar, V had the lowest at 17.

Table-5
Prolific Authors

Author	Affiliation	TP	TC	CPP	H-index
Kumar, A	IIT Kanpur, Uttar Pradesh	353 (1.77%)	4082	11.56 (8)	34 (2)
Kumar, S	IIT Roorkee, Uttarakhand	334 (1.68%)	3261	9.76 (9)	28 (3)
Singh, S	All India Institute of Medical Sciences, Raipur	237 (1.19%)	2788	11.76 (7)	25 (5)
Pandey, A	National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram	232 (1.16%)	7548	32.53 (1)	44 (1)
Sharma, S	Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh	213 (1.07%)	2667	12.52 (6)	27 (4)
Kumar, R	University of Delhi, New Delhi	198 (0.99%)	2705	13.66 (3)	24 (6)
Sharma, K	Sukhadia University, Udaipur, Rajasthan	174 (0.87%)	1654	9.51 (10)	19 (9)
Singh, A	Banaras Hindu University, Uttar Pradesh	152 (0.76%)	1982	13.04 (4)	23 (7)
Singh, R	Indian Agricultural Research Institute, New Delhi	142 (0.71%)	2079	14.64 (2)	22 (8)
Kumar, V	University of Delhi, New Delhi	142 (0.71%)	1174	8.27 (12)	17 (11)
Kumar, P	CSIR-Institute of Genomics & Integrative Biology (IGIB), New Delhi	121 (0.61%)	1081	8.93 (11)	18 (10)
Ghosh, S	University of Calcutta, West Bengal	121 (0.61%)	1423	11.76 (7)	19 (9)
Singh, A.K	Central University of Gujarat, Gandhinagar,	120 (0.60%)	1535	12.79 (5)	22 (8)

Prolific Journals: The prolific journals, which issued more than 1% of the publications, published by Indian authors are recorded in Table-7. These top 24 journals jointly contributed 9,346 publications contributed by Indian authors covering 47% of the overall Indian output. Among them only 3 journals are from India (Journal of Pure and Applied Microbiology, Research Journal of Biotechnology and Indian Journal of Biotechnology) and the enduring journals originated from different countries. The situation specifies that Indian authors choose International Journals to publish their research papers more than in Indian journals. Bio resource Technology ranked top with both 1,263 papers and also in terms of CPP with 28.13. Process Biochemistry acknowledged the second highest CPP with 25.08 while it is graded 9th in terms of a number of publications. Biochemical Engineering Journal graded third in terms of CPP with 23.34 while it is graded 21st in the case of a number of papers.

Highly Cited Papers: The top 20 highly cited papers of Indian Microbiology research during the period 2003-2014 are presented in Table-8. These top 20 papers were published in 14 different international journals. Among the 20 papers, one paper is single authored while other papers have collaborators. These 20 papers share 9,323 cumulative citations accounting for 4% of all citations.

Among the 20 papers seven papers have international collaboration while others have domestic collaboration. The highest cited paper is “Silver nanoparticles as a new generation of antimicrobials,” authored by Rai, Mahendra., Yadav, Alka., & Gade, Aniket for Biotechnology Advances in the year 2009 it is a review paper. This paper has received 1,236 citations from its time of publication through April 10, 2015.

Table-6
Prolific Institutes

Institutes	TP	TC	CPP	H-index
University of Delhi, New Delhi	765(3.84)	12,747	16.66 (8)	49
Banaras Hindu University, Uttar Pradesh	526(2.64)	7,698	14.63 (16)	41
Indian Institute Of Technology, New Delhi	422(2.12)	7,654	18.14 (5)	43
Indian Institute Of Science IISc, Bengaluru	362(1.82)	4,408	12.18 (22)	33
Institute of Microbial Technology India, Chandigarh	329(1.65)	5,094	15.48 (11)	35
Indian Agricultural Research Institute, New Delhi	329(1.65)	3744	11.38 (23)	29
All India Institute of Medical Sciences, New Delhi	304(1.53)	5,128	16.87	37
Indian Institute of Technology IIT, Kharagpur, West Bengal	298(1.50)	7,438	24.96	42
Central Food Technological Research Institute India, Mysuru, Karnataka	296(1.49)	4,033	13.62	33
Bhabha Atomic Research Center, Mumbai, Maharashtra	286(1.44)	4,644	16.24	31
University of Hyderabad, Telangana	272(1.37)	2,902	10.67	25
Jawaharlal Nehru University, New Delhi	265(1.33)	3,742	14.12	33
National Chemistry Laboratory, Pune, Maharashtra	252(1.27)	3,802	15.09	29
National Institute Interdisciplinary Science Technology India, Thiruvananthapuram, Kerala	244(1.23)	6,661	27.30	42
PGIMER Chandigarh	232(1.16)	3,541	15.26	30
Panjab University, Chandigarh	230(1.15)	2,556	11.11	24
National Institute of Cholera Enteric Diseases India, Kolkata, West Bengal	230(1.15)	3,601	15.66	31
Vellore Institute of Technology	228(1.14)	915	4.01	14
Indian Institute of Technology IIT Madras	228(1.14)	3,523	15.45	29
Indian Veterinary Research Institute, Bareilly, Uttar Pradesh	226(1.13)	1,698	7.51	21
University of Pune, Maharashtra	225(1.13)	3,250	14.44	31
Anna University	225(1.13)	3,110	13.82	27
Indian Institute of Technology IIT Bombay	214(1.07)	2,911	13.60	28
Centre for Cellular Molecular Biology India	214(1.07)	3,718	17.37	34
Indian Council of Medical Research	208(1.04)	2,331	11.21	24
Indian Institute of Chemical Technology	206(1.03)	3,759	18.25	34
Anna University Chennai	205(1.03)	3,014	14.70	27
Aligarh Muslim University, Uttar Pradesh	203(1.02)	3,781	18.63	34

Table-7
Prolific Journals

Journal	Publisher	TP	Rank (%)	TC	CPP
Bio resource Technology	Elsevier science ltd. England	1263	1 (6.34)	35,526	28.13 (1)
Applied Biochemistry and Biotechnology	Humana press inc, USA	765	2 (3.84)	4,840	6.33 (17)
Journal of Pure and Applied Microbiology	Dr. M. N. Khan, Bhopal, India	677	3 (3.40)	154	0.23 (24)
World Journal of Microbiology Biotechnology	Springer, USA	647	4 (3.25)	6,513	10.07 (14)
African Journal of Biotechnology	Academic Journals, Nigeria	531	5 (2.67)	3,007	5.66 (18)
Research Journal of Biotechnology	Research Journal of Biotechnology, Indore, India	487	6 (2.45)	238	0.49 (23)
Indian Journal of Biotechnology	National Institute of Science Communication (NISCAIR), New Delhi, India	482	7 (2.42)	1,049	2.18 (21)
Indian Journal of Microbiology	Springer, USA	402	8 (2.02)	1,620	4.03(19)
Process Biochemistry	Elsevier science ltd. England	399	9 (2.00)	10,005	25.08(2)
Biomed Research International	Hindawi publishing corporation, USA	395	10(1.98)	653	1.65(22)
International Journal of Systematic and Evolutionary Microbiology	Microbiology Society, England	298	11 (1.50)	3,336	11.19(10)
Current Microbiology	Springer, USA	274	12(1.38)	2,980	10.88(13)
Plant Cell Tissue and Organ Culture	Springer, Netherlands	269	13 (1.35)	3,000	11.15(11)
Applied Microbiology and Biotechnology	Springer, USA	267	14 (1.34)	5,972	22.37(4)
Journal of Medical Microbiology	Microbiology Society, England	250	15 (1.26)	2,758	11.03(12)
Journal of Clinical Microbiology	Amer Society for Microbiology, USA	242	16 (1.22)	4,280	17.69(7)
Journal of Chemical Technology and Biotechnology	Wiley- Blackwell, USA	227	17 (1.14)	2,565	11.30(9)
Journal of Basic Microbiology	Wiley- Blackwell, USA	225	18 (1.13)	1,598	7.10(15)
Journal of Biotechnology	Elsevier science ltd. Netherlands	220	19 (1.10)	1,413	6.42(16)
Biomass & Bioenergy	Pergamon-Elsevier Science ltd. England	210	20 (1.05)	4,695	22.36(5)
Biochemical Engineering Journal	Elsevier science BV. Netherlands	209	21 (1.05)	4,879	23.34(3)
Biotechnology Letters	Springer, Netherlands	203	22 (1.02)	2,371	11.68(8)
Antimicrobial Agents and Chemotherapy	Amer Society for Microbiology, USA	203	22(1.02)	4,401	21.68(6)
Annals of Microbiology	Springer, USA	201	23 (1.01)	656	3.26(20)

Table-8
Highly cited papers

Authors	TC	DT	Collaborative Country
Rai Mahendra, Yadav Alka and Gade Aniket (2009). Silver nanoparticles as a new generation of antimicrobials. *Biotechnology Advances*, 27(1), 76-83.	1,236	Review	India
Bhardwaj Nandana and Kundu Subhas C. (2010). Electro spinning: A fascinating fiber fabrication technique. *Biotechnology Advances*, 28(3), 325-347.	734	Review	India
Peri S., Navarro J.D., Amanchy R., Kristiansen T.Z., Jonnalagadda C.K., Surendranath V. and Pandey A. (2003). Development of human protein reference database as an initial platform for approaching systems biology in humans. *Genome Research*, 13(10), 2363-2371.	628	Article	India, USA, Spain, Denmark, Belgium,
Croft S.L., Sundar S. and Fairlamb A.H. (2006). Drug resistance in leishmaniasis. Clinical Microbiology Reviews, 19(1), 111-126.	604	Review	India, London, Scotland, Switzerland
Brudey K., Driscoll J.R., Rigouts L., Prodinger W.M., Gori A., Al-Hajoj S.A. and Sola C. (2006). Mycobacterium tuberculosis complex genetic diversity: Mining the fourth international spoligotyping database (SpolDB4) for classification, population genetics and epidemiology. BMC Microbiology, 6(23), 1-17.	510	Article	India, USA, Belgium, Austria, Italy, Saudi Arabia, Venezuela, Spain, Brazil, Argentina, Malaysia, Germany, England, South Africa, Netherlands, Denmark, Vietnam, Russia, Indonesia,
Chandran S.P., Chaudhary M., Pasricha R., Ahmad A. and Sastry M. (2006). Synthesis of gold Nano triangles and silver nanoparticles using Aloe vera plant extract. Bioresource Technology, 22(2), 577-583.	477	Article	India
Sud Dhiraj, Mahajan Garima and Kaur M.P. (2008). Agricultural waste material as potential adsorbent for sequestering heavy metal ions from aqueous solutions – A review. *Bioresource Technology*, 99(14), 6017-6027.	422	Review	India
Achtena W.M.J., Verchot L., Franken Y.J., Mathijs E., Singh V.P., Aerts R. and Muys B. (2008). Jatropha bio-diesel production and use. *Biomass and Bioenergy*, 32(12), 1063-1084.	414	Review	India, Belgium, Kenya, Netherlands
Ahluwalia Sarabjeet Singh and Goyal Dinesh (2007). Microbial and plant derived biomass for removal of heavy metals from wastewater. *Bioresource Technology*, 98(12), 2243-2257.	412	Review	India
Nampoothiri K.M., Nair N.R. and John R.P. (2010). An overview of the recent developments in polylactide (PLA) research. *Bioresource Technology*, 101(22), 8493–8501.	390	Review	India
Gupta R., Gupta N. and Rathi P. (2004). Bacterial lipases: an overview of production, purification and biochemical properties. *Applied Microbiology and Biotechnology*, 64(6), 763-781.	387	Review	India
Reddy C.S.K., Ghai R., Rashmi and Khalia V.C. (2003). Polyhydroxyalkanoates: an overview. Bio resource Technology, 87(2), 137-146.	371	Review	India
Kumar R., Singh Sompal and Singh Om V. (2008). Bioconversion of lignocellulosic biomass: biochemical and molecular perspectives. *Journal of Industrial Microbiology & Biotechnology*, 35(5), 377-391.	370	Review	India
Reddy K.V.R., Yedery R.D. and Aranha C. (2004). Antimicrobial peptides: premises and promises. *International journal of antimicrobial agents*, 24(6), 536-547.	364	Review	India
Gupta R., Gigras P., Mohapatra H., Goswami V.K. and Chauhan B. (2003). Microbial alpha-amylases: a biotechnological perspective. Process Biochemistry, 1-18.	350	Review	India

Authors	TC	DT	Collaborative Country
Parolini O., Alvino F., Bagnara G.P., Bilic G., Buhring H.J., Evangelista M. and Storm S.C. (2008). Concise review: isolation and characterization of cells from human term placenta: outcome of the first international Workshop on Placenta Derived Stem Cells. Stem Cells, 26(2), 300-311.	342	Review	India, Italy, USA, Switzerland, Germany, Austria, China, Japan
Hermjakob H., Montecchi-Palazzi L., Bader G., Wojcik J., Salwinski L., Ceol A. and Apweiler R. (2004). The HUPOPSI's Molecular Interaction format - a community standard for the representation of protein interaction data. Nature Biotechnology, 22(2), 177-183.	336	Article	India, England, USA, Italy, Germany, China, France, Scotland, France, Canada
Pandey A. (2003). Solid-state fermentation. *Biochemical Engineering Journal*, 13(2-3), 81-84.	334	Article	India
Shankar S.S., Ahmad A. and Sastry M. (2003). Geranium leaf assisted biosynthesis of silver nanoparticles. *Biotechnology Progress*, 19(6), 1627-1631.	321	Article	India
Kavitha D. and Namasivayam C. (2007). Experimental and kinetic studies on methylene blue adsorption by coir pith carbon. *Bioresource Technology*, 98(1), 14-21.	321	Article	India, South Korea

Conclusion

The present study analyses the microbiology research output in India during the period of 2003-2014 based on Web of Science database. Indian scientists published a total of 19,915 papers during the period of study which received 2,44,295 citations, with global publication share of 4.91% and with 6,359 (31.93%) papers produced by international collaborations. Indian literature in microbiology has developed by 269% during 2003-2008 and 2009-2014, which indicates that research activities in microbiology subject are increasing. India stood 9th among the top ten highly productive countries of the world in microbiology research during 2003-2014. Though, India produced a small number of publications in comparison to the USA and the China, which contributed 10% or above to world publications. But, 31.93% of the India's papers have collaborated papers and the USA were the most preferred country. The internalization index is 31.93 it indicates the integrating status of India in microbiology research. Productive institutes produced 40% of the country's output, which shows that the number of institutes involved in microbiology research is less in number. Prolific authors contributed 12.74% to the country's output, which specifies that Indian microbiology research is dispersed with many authors. The study finally resolves that the Indian impact to world microbiology literature was escalating at a substantial growth rate. However, it is renowned that world microbiology research is currently headed by the USA, the China and the Germany based on the number of publications.

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