"Chemistry for Sustainable Development": Bibliometric Portrait

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Abstract

A bibliometric analysis of the journal "Chemistry for Sustainable Development" within the period of 1993–2003 was carried out using Chemical Abstracts (CA) and Science Citation Index (SCISearch) data bases of the international scientific and technical net STN International in the online regime. The most active and cited authors of the journal, the most cited publications, scientific editions and organisations (home and foreign) referred to the journal under study were identified. For the first time an impact factor of the journal was estimated on the basis of publication citing in CA data base; it was 0.22 in 2002.

INTRODUCTION

Recently the bibliometric methods become more and more required for estimation of the activity of single researchers, research institutes, higher educational institutes, development of scientific trends and disciplines. As a rule, appropriate publications in the periodic scientific editions, in the first place in the journals, are exposed to the analysis. Naturally, scientific journals, involved in such investigations as the data source, become themselves the objects of bibliometric estimations, allowing, in particular, to establish their relative hierarchy [1–7].

The goal of the present work is to characterize the journal "Chemistry for Sustainable Development" (CSD) from the bibliometric point of view and to estimate its impact factor. The journal under study has been published by the Siberian Branch of the Russian Academy of Sciences for the last ten years – the time long enough for obtaining trusty bibliometric characteristics and for description of the existing "portrait" of the journal.

METHODOLOGY

The bibliometric analysis of CSD is based on the results of the search carried out in July 24, 2003 in the online regime in Chemical Abstracts (CA) [8] and Science Citation Index (SCISearch) [9] data bases. Both data bases (DB) are available over the international scientific and technical net STN International in the STN Centre at Novosibirsk Institute of Organic Chemistry (NIOCh), SB RAS [10].

The AC data base made by Chemical Abstracts Service (CAS) in the USA referees ~9000 periodic scientific editions on chemistry. Nearly 1400 journals among them, including CSD, are considered as the core journals, *i. e.*, as the most significant ones for the current development of chemistry.

The SCISearch data base made by the Institute for Scientific Information (ISI) in the USA is the most important source of integrated primary data for science-metric studies. There are 5600 leading scientific, technical and medical journals which are indexed in it. This DB does not referee directly CSD but the refer-

ences to its publications are present in the journals reviewed by SCISearch.

The search in DB was carried out with the purpose to reveal the main trends and subjects of the journal, the most active authors and institutes, the citing of CSD publications, and also to estimate its impact factor.

The results of the search were processed in the online regime with the use of command language STN Messenger [11], allowing to carry out the multiparameter statistic analysis of large data amounts. In particular, the publications found were analysed over a year, language, type (complete article, review), authors (including departmental and national tenancy) and some other criteria. When analysing CSD citing (calculation of the impact-factor), the Journal title matching and Citation matching procedures [5] were used.

In the number of cases the online analysis was completed with the hand editing of results obtained, the necessity of which was linked with different writing in the original publications of the authors' names (*i. e.,* Parmon, V. N. and Parmon, Valentin N. are considered in DB as two different authors), the organisations' names (*i. e.,* 24 and 35 variants of the name writing were revealed for the Boreskov Institute of Catalysis, SB RAS, in CA and SCISearch DB, respectively), and also with the technical mistakes (*i. e.,* Lyakhov, K. Z. instead of Lyakhov, N. Z.).

An important circumstance is the fact that in 1993–1996 CA DB advantageously reviewed the English version of CSD; since 1998 only Russian version of CSD has been refereed; data are completely absent for 1997 (Table 1). A special enquiry in CAS has shown that CSD issues No. 4–6 for 1996 and all issues for 1997 did not enter DB due to unknown reason. This certainly rather decreases some bibliometric characteristics of CSD, but the journal is presented to the most part of the international scientific community just in such a way.

All numerical results given bellow refer to the search date. If it is not particularly marked, in each case only 10 superior indicators are given. Complete data are available over an enquiry to the authors of the article.

TABLE 1
Distribution of CSD-E and CSD-R summaries over years (CA DB)

CSD version	Publication year										
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
CSD-E (Chemistry for Sustainable Development)	38	29	25	30	0	0	0	0	0	0	0
CSD-R (Khimiya v interesakh ustoichivogo razvitiya)	8	0	0	0	0	48	83	99	90	87	35

TABLE 2

Distribution of CSD summaries over CA sections

Number of documents	% of documents	CA section
56	9.77	Air Pollution and Industrial Hygiene
48	8.38	Industrial Inorganic Chemicals
47	8.20	Fossil Fuels, Derivatives, and Related Products
35	6.11	Water
31	5.41	Waste Treatment and Disposal
27	4.71	Extractive Metallurgy
26	4.54	Cellulose, Lignin, Paper, and Other Wood Products
20	3.49	Unit Operations and Processes
17	2.97	Ceramics
17	2.97	Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms

RESULTS AND DISCUSSION

General characteristics

Over the issues ISSN CSD-R (0869–8538: Khimiya v interesakh ustoichivogo razvitiya) and CSD-E (0869–8546: Chemistry for Sustainable Development) 573 publications were found in CA DB (see Table 1), among which 451 (79 %) are from CSD-R (40 among them are in English) and 122 (21 %) are from CSD-E. Among 573 articles, 120 (21 %) are reviews.

Thematic range

In addition to the given in the original bibliographical information (data about an author, title, source of a publication) the CA data base provides controlled indexed terms, *i. e.,* CAS registration numbers of substances, their "role" in the article (a reagent, a solvent, a catalyst, a product), topic titles, *etc.* One of the most important indexed terms is the "CA section". Each publication enters one of the 80 parts of CA corresponding to its objective scope (contents). Publications in CSD are assigned to 62 sections of CA which is the evidence of multidisciplinary character of the journal corresponding to its editing policy. More frequently encountered CA sections (in 324 from 573 records, *i. e.,* in 57 % of treated documents) and subject titles (one document can have several of them for the most exact description of the publication gist) are given in tables 2, 3. In total, 1066 subject titles 2223 times met in the CSD publications, *i. e.,* near 3.9 per a document, are attached to the found documents; 10 most wide spread titles occur in 37 % of documents. So,

TABLE 3

Subject (thematic) titles assigned to CSD publications

Number of documents	% of documents	Controlled vocabulary
35	6.11	Air pollution
25	4.36	Mechanical activation
24	4.19	Environmental pollution
23	4.01	Wastewater treatment
20	3.49	Similation and modeling, Physicochemical
18	3.14	Mechanochemical reaction
18	3.14	Oxidation catalysts
16	2.79	Wastes
16	2.79	Water pollution
15	2.62	Recycling

TABLE 4
Contribution of different institutes to CSD publications

Number of documents	Institute name
74	Boreskov Institute of Catalysis, SB RAS, Novosibirsk
68	Institute of Inorganic Chemistry, SB RAS, Novosibirsk
63	Institute of Solid State Chemistry and Mechanochemistry, SB RAS, Novosibirsk
35	Institute of Chemistry and Chemical Technology, SB RAS, Krasnoyarsk
25	Institute of Petroleum Chemistry, SB RAS, Tomsk
18	Vorozhtsov Institute of Organic Chemistry, SB RAS, Novosibirsk
17	Faborsky Institute of Chemistry, SB RAS, Irkutsk
14	Institute of Chemical Kinetics and Combustion, SB RAS, Novosibirsk
13	Institute of Geology and Geophysics, SB RAS, Novosibirsk
11	Baikal Institute of Nature Management, SB RAS, Ulan Ude

Tables 2, 3 characterise the multifield character of trends and the main areas of investigations in CSD publications, respectively.

Authors and Institutes

In CA DB, 1448 authors met 2094 times in 573 CSD publications are found. So, an article in CSD has in average 3.65 collaborators. The most active authors of CSD are met in 18 % of documents.

The identification of institutes giving the largest contribution to CSD is complicated by the fact that CA DB points a work place only for a first author of a publication and does not

TABLE 5
Most cited CSD articles (SCISearch DB)

Number of author's citings	Cited article	Number of article's citings	Number of author's citings	Cited article	Number of article's citings
37	1994, Vol. 2, P. 1	16	10	1994, Vol. 2, P. 613	1
	1994, Vol. 2, P. 475	9		1994, Vol. 2, P. 535	5
	1994, Vol. 2, P. 532	1		1996, Vol. 4, P. 213	4
	1994, Vol. 2, P. 541	10	9	1996, Vol. 4, P. 71	4
	1994, Vol. 2	1		1998, Vol. 6, P. 135	1
14	1999, Vol. 7, P. 451	14		1998, Vol. 6, P. 141	4
13	1994, Vol. 2, P. 1	2	8	1998, Vol. 6, P. 199	1
	1994, Vol. 2, P. 259	1		1998, Vol. 6, P. 207	7
	1994, Vol. 2, P. 529	8	8	1993, Vol. 1, P. 397	1
	1994, Vol. 2, P. 605	2		1994, Vol. 2, P. 493	2
12	1995, Vol. 3, P. 177			1995, Vol. 3, P. 217	1
	1997, Vol. 5, P. 619	9		1995, Vol. 3, P. 237	1
12	1994, Vol. 2, P. 523	1		1996, Vol. 4, P. 539	1
	1994, Vol. 2, P. 597	1		1999, Vol. 7, P. 575	2
	1996, Vol. 4, P. 67	2	7	1999, Vol. 7, P. 601	3
	1996, Vol. 4, P. 69	1		2000, Vol. 8, P. 623	2
	1996, Vol. 4, P. 187	1		2001, Vol. 9, P. 169	2
	1996, Vol. 4, P. 245	2			
	1996, Vol. 4, P. 263	1			
	1997, Vol. 5, P. 279	3			

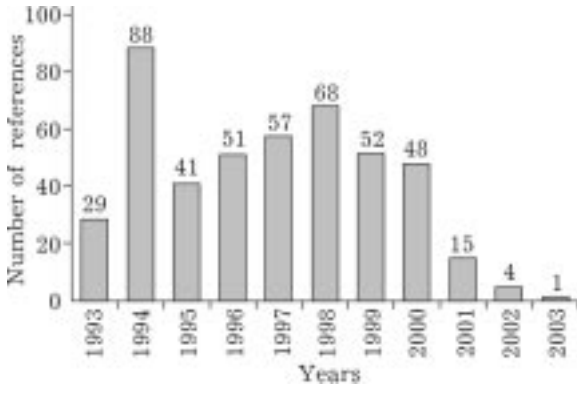

Fig. 1. Distribution of references to CSD articles of different years.

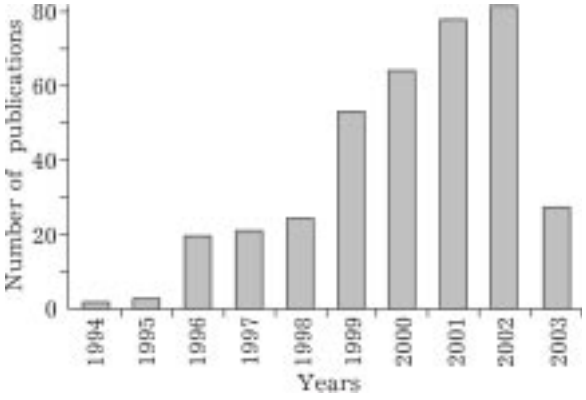

Fig. 2. Distribution of the number of citings of CSD over years (SCISearch DB).

unify an organisation name. A ranged list of institutes in which the most active first authors of CSD are working is given in Table 4. All 10 institutes relate to SB RAS, 6 of them are in Novosibirsk. Nevertheless, in whole, the author audience is large enough and includes foreign researchers. The distribution of foreign authors of CSD articles over the countries is the following: 8 – Japan, 6 – the Netherlands, 6 – the USA, 5 – Israel, 4 – Mongolia, Slovakia, Great Britain, 2 – Austria, 2 – Germany, 2 – India, 2 – China, 2 – Yugoslavia, 1 – Australia, Canada, France, Italy, Poland, South Korea.

Citing

Citing is a world-recognized science-metric indicator of intradisciplinary relations [12]. Since 1999 in CA DB for publications in ~6700 journals using Latin type, cited references have been given – those publications to which an article' authors referred. In this regard, CA DB (along with SCISearch DB) can be used for analysis of citing of articles, authors, institutes, journals, disciplines, countries.

For CSD-R articles published in English (unlike the articles in Russian) CA DB gives references to other publications made in them, *i. e.*,

TABLE 6

Journals which cite CSD more often (SCISearch DB)

Number of documents	% of documents	Journal
32	8.63	Russian Journal of Applied Chemistry
21	5.66	Journal of Structural Chemistry
13	3.50	Kinetics and Catalysis
11	2.96	Inorganic Materials
11	2.96	Journal of Materials Synthesis and Processing
11	2.96	Russian Journal of Physical Chemistry
11	2.96	Uspekhi Khimii
10	2.70	Journal of Analytical Chemistry
10	2.70	Russian Journal of Coordination Chemistry
9	2.43	Russian Journal of Inorganic Chemistry
9	2.43	Solid State Ionics
8	2.16	Geologiya i Geofizika
8	2.16	Theoretical Foundations of Chemical Engineering
7	1.89	Russian Chemical Bulletin
6	1.62	Catalysis Today

TABLE 7

Organizations citing CSD (SCISearch DB)

Number of documents	Organization
65	Institute of Solid State Chemistry and Mechanochemistry, SB RAS, Novosibirsk
64	Institute of Inorganic Chemistry, SB RAS, Novosibirsk
51	Boreskov Institute of Catalysis, SB RAS, Novosibirsk
33	Institute of Geology and Geophysics, SB RAS, Novosibirsk
31	KEIO UNIV., FAC. SCI. & TECHNOL., YOKOHAMA, KANAGAWA 223, JAPAN
24	Institute of Chemistry and Chemical Technology, SB RAS, Krasnoyarsk
23	Novosibirsk State University
18	Novosibirsk Institute of Bioorganic Chemistry, SB RAS, Novosibirsk
12	Vorozhtsov Institute of Organic Chemistry, SB RAS, Novosibirsk
12	Moscow State University

CSD here is the citing journal. So, if for DB SCISearch CSD is only a cited journal, for CA DB it is a cited and also a citing one. As the number of CSD English publications in CA DB since 1999 is not large, only cited CSD is considered below.

SCISearch data base having records since 1974 allows one to carry out an analysis of citing CSD publications for all the years of its edition. In total, for 573 CSD publications within 1993–2003, 455 citings were found. The articles published in the journal in 1994 were more frequently cited (Fig. 1).

The most cited CSD articles are given in Table 5. In total, 189 authors cited 455 times in 434 documents were revealed.

In SCISearch DB, 132 journals which 371 times cite CSD publications were found. It is interesting that CSD itself is absent from this list. The titles of journals in which references to CSD articles appeared most frequently (more than 5 times) are given in Table 6. More than 90 % of publications citing CSD are denoted in SCISearch DB as written in English. As a rule, these are translations of Russian journals (see, for example, Table 6). Though, two citing documents in Czech were revealed. About 8 % references appeared in reviews, whereas nearly 90 % – in journal articles.

Distribution of the citing number over time shows that the number of publications citing CSD increases each year (Fig. 2).

Unlike the CA DB, the SCISearch DB indicates affiliation of each author. In total, 558 organisation names occurring in records 704 times, the employers of which cited CSD in their publications were found. In the absence of standardization (Table 7), a figure of 558 characterizes the upper limit ("not more than"). The organisations of 26 so called distant foreign countries citing CSD are met 160 times in records (in 196 documents, which make up 48 % of their total number). A brightly expressed leader is Japan (Fig. 3).

Impact factor

An impact factor is one of the most important bibliometric characteristics of a scientific journal [13]. For determination of the impact-factor, a summary citing in investigated year (for example, in 2002) of the journal publications for two previous years (2000–2001) is divided

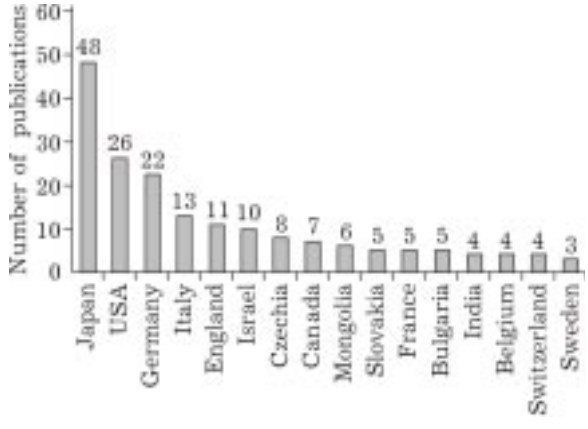

Fig. 3. Countries citing CSD.

TABLE 8
Journals in which CSD publications of 2000–2001 were cited in 2002

Number of documents		Journal
CA DB	SCISearch DB	
4	4	Russian Journal of Applied Chemistry
3	3	Doklady Chemistry
3	4	Journal of Structural Chemistry
2	1	Hydrometallurgy
2	–	Ionics
2	–	NATO Science Series, II: Mathematics, Physics and Chemistry
2	2	Russian Chemical Reviews (Uspekhi khimii)
1	1	Annales de Chimie (Paris, France)
1	–	Atmospheric and Oceanic Optics
1	1	Biochemistry (Moscow, Russian Federation)
1	1	Bulletin of Materials Science
1	1	Chemical Physics
–	1	Chemistry of Natural Compounds
1	1	Collection of Czechoslovak Chemical Communication
–	1	Combustion Explosion and Shock Waves
1	–	Doklady Biochemistry and Biophysics
1	1	Doklady Earth Sciences
–	1	Geochimica et Cosmochimica Acta
1	1	High Energy Chemistry
1	1	Inorganic Materials
1	1	Journal of Analytical Chemistry
1	1	Journal of Solid State Chemistry
1	1	Kinetics and Catalysis
1	–	Materials Research Society Symposium Proceedings
	1	Metastable, Mechanically Alloyed and Nanocrystalline Materials
1	1	Physical Review B
1	–	Proceedings – Korus-2002, The Russian-Korean International Symposium on Science and Technology, 6th, Novosibirsk, Russian Federation, June 24–30, 2002
1	1	Progress in Lipid Research
1	–	Progress in Mining and Oilfield Chemistry
1	1	Russian Chemical Bulletin
1	1	Russian Journal of Bioorganic Chemistry
1	1	Russian Journal of Coordination Chemistry
	1	Russian Journal of Inorganic Chemistry
1	1	Theoretical Foundation of Chemical Engineering
1	–	Water Resources (Translation of "Vodnye resursy")

by the total number of journal publications for the same period of time (2000–2001).

In CA DB 39 publications of 2002 having 43 references to CSD publications of 2000–2001 were revealed (CSD articles of 2000 are cited 29 times, of 2001 – 14 times). The division of 43 CSD citings in 2002 by 189 publications in it in 2000–2001 (see Table 1) determines the impact factor of CSD of 2002 as 0.22.

According to the data of SCISearch DB, in 2002 36 publications 39 times cited CSD articles of 2000–2001. In the same time, 28 citings were obtained by the publications of 2000; 11 – by the publications of 2001. Taking into

account the total number of publications of CSD in 2000–2001, taken from CA DB (SCISearch, as it was noted, does not referee CSD directly), this leads to the value of impact-factor of 0.21, conformed with the one obtained above.

Table 8 comprises the titles of articles and some other scientific editions in which according to the data of CA and SCISearch DB, in 2002 CSD articles of 2000–20001 were more often cited. Once again the absence of CSD itself among them draws attention.

CONCLUSION

Bibliometric description and analysis of the CSD first decade based on the results of the search in CA and SCISearch international scientific technical net STN International, allow us to make the following conclusion. CSD has a brightly expressed multidisciplinary character; despite the moderate impact-factor it has obtained the international recognition, which was expressed in its including in the number of 1400 leading chemical journals by CA DB [14]. CSD is stably developing; the evidence of that is citing of its publications increasing every year.

It will be possible in 5 years to judge surely on the basis of DB materials about an objective prevailing in the CSD development of definite trends when, for example, one can compare two 5-year periods divided by time interval. Till this time CA DB with the accumulation of references will become yet more important source of statistic material. Since the results of citing (of the journal, articles, authors) of last years are practically the same for CA and SCISearch DB, so it will be possible to use CA DB for estimation of long-term impact factors of CSD. Moreover, it is extremely desirable that CSD becomes referred (cited) in SCISearch DB (the criteria of including into BD see in [15]), because there are some advantages of the latter in comparison with CA DB (in particular, an indication of work place for all authors, different policy of the entering the authors' names) which create a possibility of more general and exhaustive analysis. It is also important that the citing exists only for publications in English. In this regard, more articles in English will be in CSD, more references will appear to Russian publications.

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