

Review

Bibliometric Analysis of Solar Desalination Systems Powered by Solar Energy and CFD Modelled

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Abstract: Solar desalination is a sustainable approach to producing fresh water from saline water. Researchers have tried modifications to solar desalination systems to enhance the distillate output. This survey aims to recognize the characteristics of research work for investigating solar desalination systems. The essential terms to be focused on are computational fluid dynamics (CFD) and solar radiation consideration for the investigation. The data for this bibliometric study was taken from Scopus, with 1932 publications. The characteristics of the research work were analyzed by identifying the research publications, research subject areas, journals, most contributed countries, and data from the authors. The research trend was investigated utilizing yearly research growth, geographical contributions, source quality of publications, and participation of various institutions. VOSviewer software was used for network analysis of essential keywords used in relevant research works and to understand collaborations between the authors and co-authors. About 76% of the total publications belong to the document type articles. It illuminates research tendencies related to the topic under consideration. Results show that desalination research work concerned with CFD or solar radiation was mainly investigated in Engineering and Environmental Science, with their share of more than 50% of the total publications. Further study of relevant research works was assessed using network analysis that helped to link different keywords and authors' collaborations. This survey helps to spot the increasing research trends and the necessity of further research.

Keywords: desalination; solar still; computational fluid dynamics; radiation



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1. Introduction

The demand for freshwater has increased with increasing population size and industrial and social development. As freshwater availability on earth is limited and shares only about 1% of the total water, the need to produce potable water by suitable means is inevitable. Various desalination techniques have been developed to produce fresh water from saline water. Solar desalination systems have been thoroughly investigated as a sustainable method to provide drinkable water by utilizing solar energy [1]. A solar still is a low-cost device for desalination, but due to its low distillate output, it requires consideration of various design parameters to enhance potable water production [2]. Solar collectors or

solar concentrators have increased water temperature and, consequently, the freshwater output of solar-based desalination systems.

Solar stills integrated with a flat plate collector are more productive than conventional solar stills [3,4]. A solar desalination system consisting of a solar concentrator is also an effective solution for freshwater production [5,6], with significantly higher production than the conventional system. Kumar et al. [7] coupled an evacuated tube collector with a solar still and verified the setup's performance with a thermal model's help. They observed that the forced mode of water circulation through evacuated tubes gave higher output than the natural mode of water circulation. Panchal and Shah [8] presented the double basin solar still design with its lower basin connected to vacuum tubes and analyzed the system's performance for different water depths. Mosleh et al. [9] combined a parabolic trough with a heat pipe and evacuated tube to analyze the production and efficiency of the system. They observed that using oil as a heat transfer medium increases system efficiency to 65.2%. A simple helical coil heat exchanger with a thermal desalination unit was also observed to be very effective in considerably augmenting freshwater production [10,11]. Ahmed et al. [12] experimentally studied the performance of a solar still attached to an inbuilt condenser. This passively operated condenser augmented solar yield by about 16.7% compared to a conventional solar still. Kabeel et al. [13] used nanofluids in a solar still attached to an external condenser. They also used a vapor extracting fan that increased the system's overall productivity by about 116% compared to the conventional still.

Fath [14] reported a transient study of a solar distillation machine operating in a passive mode. He conducted numerical research and discovered the unit's first-to-second effects volume ratio, sun intensity, and base and sidewall insulation. He also took the starting temperature of the basin water, which had a substantial impact on the unit's productivity. Abu-Qudais et al. [15] performed experimentation on a solar still connected to an external condenser with a vapor extracting blower. They simulated it using energy balance equations for the components of the system. They found that the system's efficiency was increased by about 47% compared to the conventional still. Madhlopa and Johnstone [16] undertook a numerical analysis of a single slope solar still attached to a condenser consisting of two basins. Vapor transport from the still to the condenser is due to diffusion and purging. They found the productivity of the still to be 62% higher than that of the conventional solar still. Understanding the heat transfer process in a thermal desalination unit can help to improve system output [17] with the help of exergy analysis. Sharshir et al. [18] reviewed diverse solar stills and commented that energy and exergy analysis helps to study the design and operating parameters of a solar still unit. They also noticed that research areas involving intricacy have not yet been analyzed. Experimental and analytical investigation of a solar desalination system has limitations while studying complex unexplored parameters. Such complex research areas can be explored by employing a mathematical model or numerical simulation. During the last few decades, computational fluid dynamics (CFD) has been applied as an effective tool for analyzing various complicated systems such as cyclone separators, heat pipes, heat exchangers, etc. [19–26], and influenced the simulation of solar desalination systems.

This paper analyzes data related to research work on solar desalination systems. It focuses on computational fluid dynamics and solar radiation for the investigation using a bibliometric method. The data of most productive research publications, research subject areas, journals, most contributed countries, and authors are analyzed to interpret the characteristics of research work for the investigation of solar-based desalination systems.

2. Related Works

Rahbar and Eshafani [27] numerically investigated a single-slope solar still using a 2-D CFD model to estimate the hourly yield performance. They observed that the accuracy of CFD analysis was satisfactory for predicting the Nusselt number. Akbar and Ismail [28] proposed a new design of a multistage solar still with the evacuated tubes. They validated the setup as well as results with the help of structural analysis and CFD analysis for the

evaporation and condensation process in the solar still. Aung and Soe [29] used a solar pond integrated with a single basin solar still to improve the freshwater yield. For the validation purpose of the experimental results, they prepared a simulation model in ANSYS CFX software. They found a good agreement between them on the results. They observed a system yield increment of 40.78%. Maheshwari and Reddy [30] fabricated a single slope and double slope solar still with various modifications and results compared with the ANSYS CFX simulation results. They found that the 20-degree glass cover inclination is better than the 15-degree inclination for both single and double slope cases. Panchal and Shah [31] fabricated a hemispherical solar still and compared the experimental results with the CFD simulation results. They used water temperature, vapor temperature, and inner glass cover temperature as input for the CFD simulation. Then, distillate output was matched with experimental results. Khare et al. [32] performed experimentation on a single basin single slope solar still. They prepared its multiphase CFD model for the three phases in the solar still, i.e., air, water, and water vapors. They analyzed variations in water volume fraction at variations in time for the solar still and correlated simulation results to the experimental results. Rahbar et al. [33] estimated the distillate output of a tubular solar still utilizing CFD and theoretical analysis and found good agreement between the two. They also proposed a new correlation between distillate output and heat and mass transfer coefficients. Keshtkar et al. [34] carried out a transient model CFD simulation of a solar still with instantaneous weather data. They calculated the evaporation and condensation rate with the help of Fick's law without any complex multiphase analysis. Taamneh [35] performed experiments on two pyramid-shaped solar stills, one filled with saline water only while another one with Jordanian zeolite water. Experimental results were validated with CFD analysis using the volume-of-fluid model. The freshwater productivity of a solar still with zeolite is augmented compared to without zeolite. Mahmood et al. [36] studied various parameters of a single slope solar still using ANSYS Fluent. They used constant values of the top surface temperature of the solar still of 293 K while the bottom surface temperature of the solar still was 403 K. They also validated hourly distillate yield of simulation with experimental data.

Mouhsin et al. [37] suggested a cascade solar still design with a stepped structure of absorber plates. They applied solar radiation for CFD analysis of the still model and observed improved system efficiency. Siva Sankaran and Sridharan [38] used CFD to investigate a double slope solar still and found good agreement with experimental results. Zarei et al. [39] analyzed a humidification dehumidification (HDH) system consisting of a tray column humidifier with the help of CFD simulation. They confirmed a reduced pressure drop of the proposed system concerning a conventional HDH system. Yan et al. [40] analyzed a tubular solar still with the help of CFD for the variables radius ratios and operating pressures. They studied parameters such as vapor mass fraction and vorticity for analysis and interpreted freshwater productivity. Shahzamanian et al. [41] studied the design of variable geometry ejectors of a vapor compression desalination system utilizing CFD analysis. They performed simulations for various operating conditions and dimensions of the ejector geometry. A review of recent simulation studies in the field of solar desalination systems [42] shows the investigation of an inclined solar still, single slope solar still, double slope solar still, double basin solar still, tubular solar still, integrated with a parabolic trough collector, vapor compression desalination system, humidification and dehumidification systems, etc. It assures that CFD is a suitable tool for validation purposes. It promotes exploring the scope of simulation work for various types of solar desalination systems.

From the above literature review, very few researchers have applied computational fluid dynamics for either radiation modeling or investigation of system parameters of a solar desalination unit. A rapid increase in the utilization of CFD tools to analyze desalination work has made it necessary to ensure the characteristics of research work and further scope for its applications.

3. Methodology for Bibliometric Analysis

The data presented for bibliometric analysis was taken from the Scopus website. The Scopus database is one of the most authentic and largest abstract and citation databases of peer-reviewed literature: scientific journals, books, and conference proceedings. Scopus features smart tools to track, analyze, and visualize research by delivering a comprehensive overview of the world's research output in science, technology, medicine, social sciences, social sciences, and arts and humanities. As research becomes increasingly global, interdisciplinary, and collaborative, one can ensure that critical research from around the world is not missed when choosing Scopus. Data were downloaded in the form of Microsoft excel, which included information on the title of publication, author name, keywords, year of publication, source, country, citation, etc. Scopus was searched using the combination of essential keywords, as shown in Table 1. The initial search led to 2482 publications for the used combination of keywords. The search concentrating only on all CFD works of desalination systems revealed 330 publications. After refinement of keyword combinations focusing on CFD and radiation for analysis of solar desalination systems, it showed only 24 publications. The source details such as CiteScore, CiteScore Rank, and source categories were taken from the Scopus website. The impact factors were taken from the homepages (webpage) of respective source journals.

Table 1. Significant keywords and their combinations (source: <https://www.scopus.com/> (accessed on 13 July 2022)).

Keywords	Search Results
(DESALINATION OR "SOLAR STILL") AND (CFD OR "COMPUTATIONAL FLUID DYNAMIC*" OR RADIATION) OR ("SOLAR INTENSITY")	2482
(DESALINATION OR "SOLAR STILL") AND (CFD OR "COMPUTATIONAL FLUID DYNAMIC*" OR RADIATION)	1932
(DESALINATION OR "SOLAR STILL") AND (CFD OR "COMPUTATIONAL FLUID DYNAMIC")	330
(DESALINATION OR "SOLAR STILL") AND (CFD OR "COMPUTATIONAL FLUID DYNAMIC*" OR RADIATION) AND ("SOLAR INTENSITY")	166
(DESALINATION OR "SOLAR STILL") AND (CFD OR "COMPUTATIONAL FLUID DYNAMIC*") AND (RADIATION)	24

In contrast, h-index values were taken from the *Scimago Journal and Country Rank (SJR)* website. VOSviewer software was used for network analysis of the Scopus data saved in a Microsoft excel file. The publications with only one participating country were called single country publications.

4. Results and Discussion

4.1. Document Types and Languages

A significant contribution of publications by document-type articles (1477, 76%) was trailed indistinctly by document-type conference papers (329, 17%). Other document types show significantly less contribution in this research field such as reviews (60), conference reviews (26), book chapters (21), notes (6), books (4), letters (3), retracted (3), business articles (2), and short surveys (1). The document-type article being dominant in these publications was used for most of the further analysis.

The documents were published in 11 languages, and English was used in 1844, contributing to more than 95% of total publications. Other languages contributed significantly less than Chinese (28). Four documents were published in each of the languages, French, German, and Russian, followed by two in Korean, Portuguese, and Spanish, and one in Italian, Japanese, and Turkish, respectively.

4.2. Publication Trend

Figure 1 shows that the research work in this area increased after 2000 and has grown rapidly since 2020. There were a total of 2482 publications in different document types, out of which 1909 were published in document-type articles. As shown in Figure 1, the number of publications increased from 1 in 1961 to 323 in 2021. In contrast, articles increased from 1 in 1961 to 245 in 2021. As the search operation was performed using the title, abstract, and keywords, an additional portion of such applications mentioned in the abstract could get searched. Thus, search in title only is required to understand the beginning and trend of research in the particular field. Search in title only showed an increment in publications from 1 document in 1969 to 13 in 2021. In contrast, the number of articles increased from 1 in 1969 to 10 in 2021. For search in title only, consistent publications were observed since 2008.

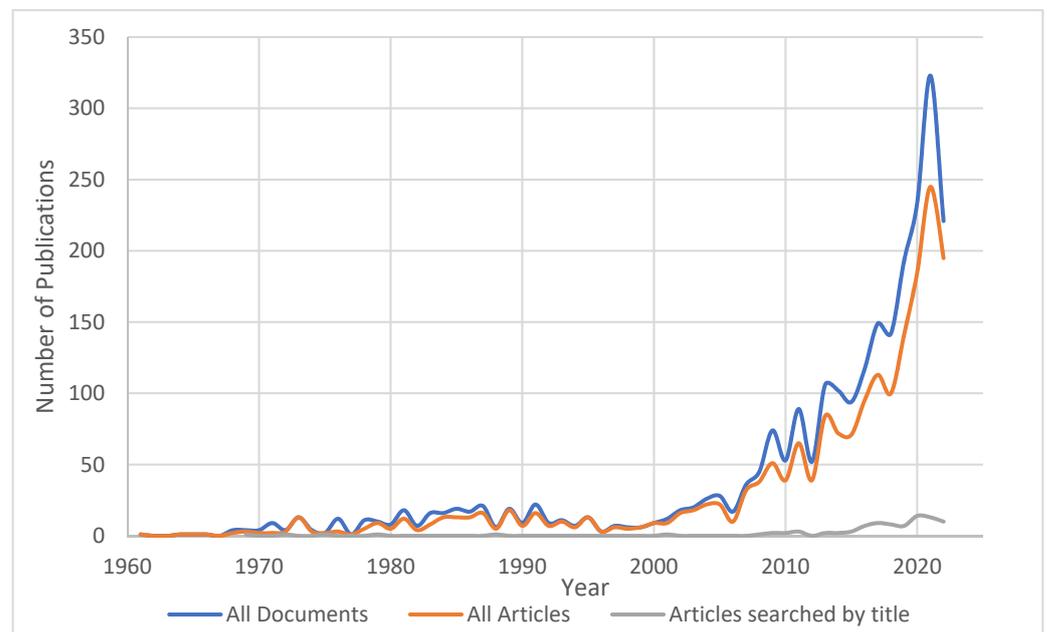


Figure 1. The number of documents published for keywords (desalination or “solar still”) and (CFD or “computational fluid dynamic*” or radiation) or “Solar Intensity”.

4.3. Distribution of Articles in Subject Areas and Source Journals

The publication data is categorized into 23 different subject areas. Out of these, 15 considerable top productive subject areas are shown in Table 2 for the period of 1960–2021. Where “TA” indicates the total number of articles published in a respective subject area and “%” indicates the percentage share of published articles. The subject areas consisting of more than 400 articles were Engineering (810, 54%), Environmental Science (742, 50%), Materials Science (500, 33%), Chemical Engineering (484, 32%), Energy (462, 31%), and Chemistry (427, 28%). Figure 2 shows the year-wise research growth trend of the top six productive subject areas since 2000. The growth trend of research shows that the highest number of articles published were observed during 2020 for the subject area of Engineering (78), followed by Energy (72) and Environmental Science (67).

Table 2. The 15 most productive subject areas and published articles.

Scopus Subject Areas	TA	%
Engineering	810	54.8
Environmental Science	742	50.2
Materials Science	500	33.9
Chemical Engineering	484	32.8
Energy	462	31.3
Chemistry	427	28.9
Physics and astronomy	99	6.7
Biochemistry, genetics, and molecular biology	68	4.6
Computer science	33	2.2
Earth and planetary science	29	2.0
Mathematics	27	1.8
Agricultural and biological sciences	26	1.8
Multidisciplinary	17	1.2
Business, management, and accounting	14	0.9
Social sciences	14	0.9

TA: number of articles published; %: the percentage share of total articles published.

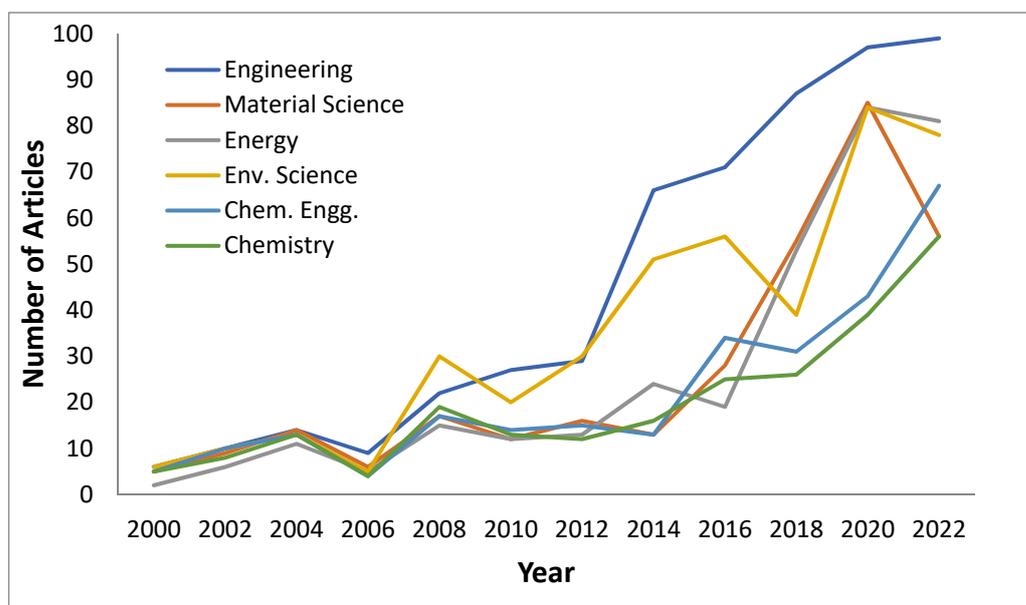


Figure 2. Comparison of research growth trend of the top six productive subject areas.

Table 3 shows the top 12 most productive journals and their number of articles published in the searched topic. The details of journals: impact factor, h-index, CiteScore, Scopus source categories, and CiteScore Rank. *Desalination* was the most productive journal with 298 articles, contributing about 20% of the published articles, followed by *Desalination And Water Treatment* (196, 13%). On the other hand, *Applied Energy* and *Energy Conversion And Management* were observed as journals with relatively higher impact factors.

Table 3. The 12 most productive journals, their contribution in total publications, and journal details.

Journal Title	TA (%)	IF	H-Index	CiteScore	Scopus Source Categories	CiteScore Rank
<i>Desalination</i>	298 (20.2)	7.098	184	14.3	Mechanical Engineering	12/596
					Water Science and Technology	3/225
<i>Desalination And Water Treatment</i>	196 (13.3)	0.854	60	1.6	Ocean Engineering	54/96
					Pollution	88/132
					Water Science and Technology	139/225
<i>Solar Energy</i>	86 (5.8)	4.608	181	8.9	Renewable Energy, Sustainability and the Environment	32/195
<i>Renewable Energy</i>	56 (3.8)	6.274	191	10.8	Renewable Energy, Sustainability and the Environment	23/195
<i>Energy Conversion And Management</i>	51 (3.5)	8.208	192	15.9	Energy Engineering and Power Technology	6/224
					Fuel Technology	4/100
					Nuclear Energy and Engineering	2/66
					Renewable Energy, Sustainability and the Environment	11/195
<i>Energy</i>	39 (2.6)	6.082	193	11.5	Energy Engineering and Power Technology	10/224
					Fuel Technology	5/100
					Renewable Energy, Sustainability and the Environment	20/195
					Mechanical Engineering	22/596
					Pollution	8/132
					Modeling and Simulation	4/290
<i>Journal of Membrane Science</i>	34 (2.3)	7.183	249	13.5	Biochemistry	22/415
					Filtration and Separation	1/13
					Physical and Theoretical Chemistry	8/169
<i>Applied Thermal Engineering</i>	27 (1.8)	4.725	158	10.1	Energy Engineering and Power Technology	16/224
					Industrial and Manufacturing Engineering	17/336
<i>Applied Energy</i>	21 (1.4)	8.848	212	17.6	Building and Construction	1/185
					Mechanical Engineering	9/596
<i>Applied Solar Energy English Translation of Geliotekhnika</i>	16 (1.1)	1.2	15	2	Renewable Energy, Sustainability and the Environment	123/195
<i>International Journal Of Energy Research</i>	16 (1.1)	3.741	95	5	Energy Engineering and Power Technology	58/224
					Fuel Technology	32/100
					Nuclear Energy and Engineering	7/66
					Renewable Energy, Sustainability and the Environment	66/195
<i>Water Science And Technology Water Supply</i>	16 (1.1)	0.9	39	1.6	Water Science and Technology	135/225

TA (%): number of articles published and % share of total articles published; IF: Impact Factor.

4.4. Publications by Countries, Institutions, and Authors

The data shows the participation of 103 countries in the publications. The information on the 20 most productive countries is shown in Table 4 till year 2021. The table consists of the total number of publications, citations, and rank and percentage for total and single country publications. The highest number of publications was observed for China (393, 15%) followed by India (390, 12%), by the United States (250, 10.1%), Iran (189, 7.1%), and Egypt (180, 7.0%). The most contributed countries for single country publications were India (12.8%), China (9.1%), the United States (5.7%), Iran (5.7%), and Egypt (4%). Out of 103 countries, 42 countries have their contribution in one or two documents only. There are 77 countries responsible for single country publications, out of which 27 countries only contribute one or two documents.

Table 4. The 20 most productive countries and rank by number of publications.

Country/Territory	TP	Citations	TP Rank (%)	SCP Rank (%)
China	393	3598	1 (14.8)	2 (9.1)
India	390	4977	2 (12.1)	1 (12.8)
United States	250	3883	3 (10.1)	3 (5.7)
Iran	189	3135	4 (7.1)	3 (5.7)
Egypt	180	3403	5 (7.0)	5 (4.0)
Saudi Arabia	160	2395	6 (6.3)	6 (2.7)
United Kingdom	85	1709	7 (3.5)	10 (1.6)
Australia	79	1829	8 (3.2)	10 (1.6)
Algeria	64	875	9 (3.0)	15 (1.4)
Germany	62	1113	10 (2.8)	12 (1.5)
Japan	58	1590	11 (2.6)	7 (2.1)
Jordan	57	1567	12 (2.4)	9 (1.6)
United Arab Emirates	57	861	12 (2.4)	13 (1.4)
Italy	54	1035	14 (2.3)	13 (1.4)
South Korea	54	553	14 (2.3)	8 (1.7)
Malaysia	55	1585	16 (2.3)	25 (0.6)
Spain	53	1520	17 (2.2)	16 (1.2)
Turkey	47	927	18 (1.9)	20 (1.0)
Canada	46	770	19 (1.9)	23 (0.7)
Iraq	46	407	20 (1.8)	16 (1.2)

TP: number of documents published; TP Rank: rank of the country for total publications; SCP Rank: rank of the country for single country publications; (%): share of total publications.

The growth trend of research for six top productive countries is shown in Figure 3. Since 2008, publications of all six countries have shown significant progress. The highest number of publications was observed for countries China (52 in 2020 and 79 in 2021), followed by India (35 in 2020 and 44 in 2021), Iran (25 in 2020 and 27 in 2021), Egypt (19 in 2020 and 18 in 2021), and Saudi Arabia (19 in 2020 and 16 in 2021), and for the USA (26 in 2020 and 25 in 2021). Though India showed the highest publication and good research development in the last decade, publications in China have risen sharply after 2018 and crossed the Indian publication.

The top 15 research institutes or universities contributing the highest number of articles to this research topic are listed in Table 5. Ranks of institutes are given as per their contribution to articles and total documents published. The University of Tanta has the highest contribution in this research field with 60 publications including 56 articles. Four institutes were from Saudi Arabia, followed by three from China, two from India, Egypt, and Iran, and one from Jordan and Japan, respectively, also contributing very quickly since 2018.

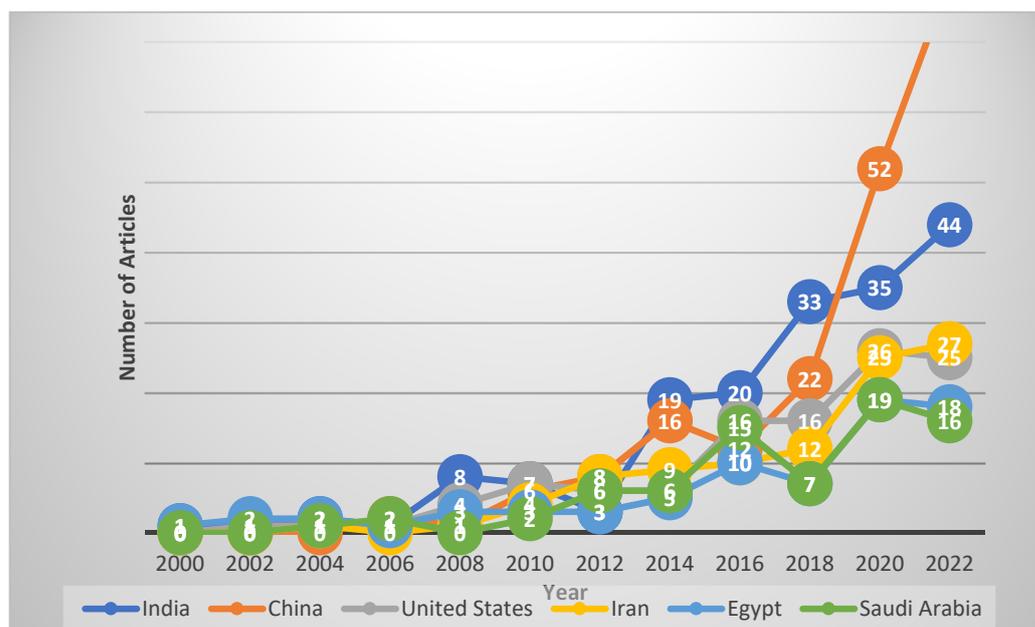


Figure 3. Comparison of the research growth trend in top producing countries.

Table 5. The 15 most productive institutions and rank by number of publications.

Institutes	TA	TA Rank (%)
University of Tanta, Egypt	60	1 (4.4)
Ministry of Education China, China	55	2 (4.2)
Indian Institute of Technology Delhi, India	43	3 (3.6)
King Saud University, Saudi Arabia	30	4 (2.6)
Jordan University of Science and Technology, Jordan	29	5 (2.5)
Alexandria University, Egypt	28	6 (2.4)
King Abdullah University of Science and Technology, Saudi Arabia	25	7 (2.2)
Anna University, India	24	8 (2.1)
Chinese Academy of Sciences, China	23	9 (2.0)
National Institute of Technology, Kurume College, Japan	21	10 (1.8)
King Abdulaziz University, Saudi Arabia	17	11 (1.4)
Ferdowsi University of Mashhad, Iran	15	12 (1.1)
King Fahd University of Petroleum and Minerals, Saudi Arabia	15	12 (1.1)
Sharif University of Technology, Iran	15	12 (1.1)
Harbin Institute of Technology, China	13	15 (0.9)

TA: number of articles published; TA Rank (%): rank and percentage of total articles.

The authors’ significant contributions in the relevant field are listed in Table 6. The table is arranged as per the highest number of published articles. It consists of information about their share in total articles, the number of their all documents published, share in total publications, and total citations of all documents. Kabeel, A.E holds the top position in this list, contributing 38 articles, about 2.3% of the total published articles. Wang Y., Tiwari, G.N., Wang X, and Tanaka, H. also show significant work in this field, publishing more than 1.2% of total articles. Other researchers Alazba, A.A. (15), Mashaly, A.F. (14), Sathyamurthy, R. (12), Ahsan, A. (11), El-Nashar, A.M. (11), Rahbar, N. (11), and Fath, H.E.S. (10) have also given valuable contribution in the relevant research area.

Table 6. The 10 most contributing authors.

Author Name	TA (%)	TP (%)	CT
Kabeel, A.E.	38 (2.3)	29 (1.5)	1319
Wang Y	32 (2.0)	32	1123
Tiwari, G.N.	31 (1.9)	34 (1.76)	1241
Wang X	28 (1.5)	28	783
Tanaka, H.	24 (1.2)	24 (1.24)	1144
Alazba, A.A.	15 (1.02)	15 (0.78)	198
Mashaly, A.F.	14 (0.95)	14 (0.72)	196
Sathyamurthy, R.	12 (0.81)	12 (0.62)	138
Ahsan, A.	11 (0.74)	11 (0.57)	448
El-Nashar, A.M.	11 (0.74)	12 (0.62)	237
Rahbar, N.	11 (0.74)	11 (0.57)	692
Fath, H.E.S.	10 (0.68)	12 (0.62)	197

TA (%): number of articles published and % share in total articles; TP (%): number of documents published and % share in total publications; CT: total citations of all documents published.

4.5. Network Analysis by Keywords and Author’s Collaboration

The Scopus data was further used for network analysis using VOSviewer version 1.6.18 software, released on January 2022 by Centre for Science and Technologies Studies (CWTS), Leiden University, Netherland. Firstly, the network analysis was completed for co-occurrences of indexed keywords, as shown in Figure 4. The indexed keywords considered synonyms, plurals, and different spellings while analyzing the data. Keywords exhibiting more occurrences were indicated by bigger size on the network analysis graph. The minimum number of occurrences was restricted to five, which allowed 956 keywords to be plotted out of 8899 total keywords. The highest occurrence was observed for the keyword “desalination” and impacted other keywords of different clusters shown by different colors. “Computational fluid dynamics” has significant occurrence and was found to be linked with other considerably occurring keywords “desalination”, “solar still”, “solar energy”, “solar heating”, “water treatment”, “distillation”, and “solar intensity”.

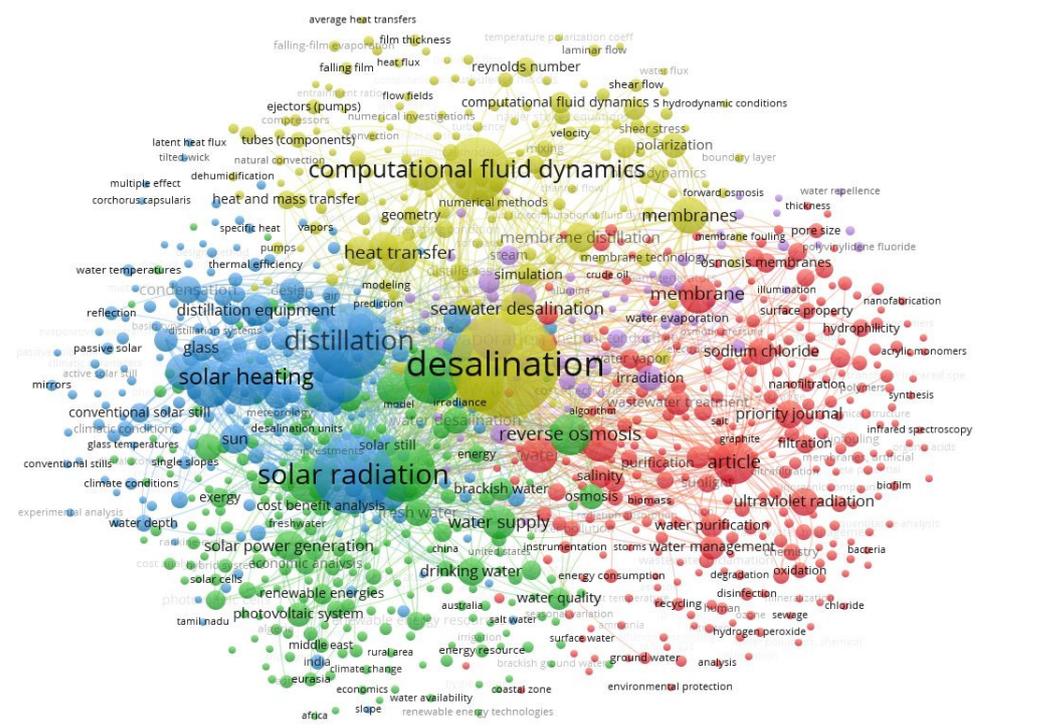


Figure 4. Network analysis diagram based on indexed keywords.

Figure 5 represents the network of various authors and their collaborations with co-authors. The minimum number of documents of the author was restricted to five. It allowed 195 authors to be plotted in the graph out of 5562 authors. The most contributing authors, Tiwari, Kabeel, Wang X, Wang Y, and Tanaka, were connected to the graph's major network. In contrast, some authors were found to be working independently.

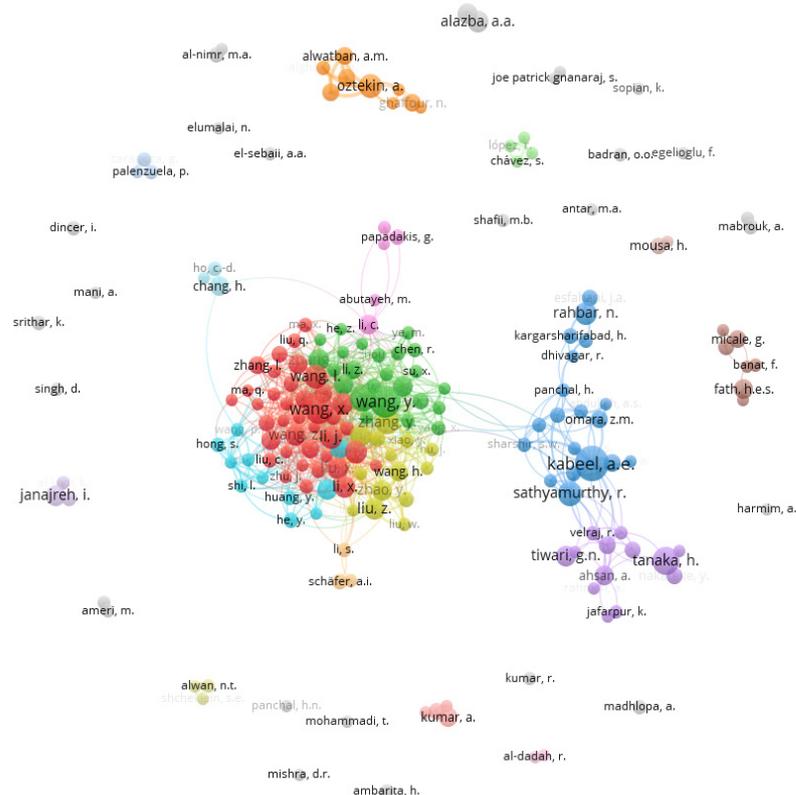


Figure 5. Network analysis diagram based on authors' collaboration.

5. Conclusions

The bibliometric study showed the increasing growth of research work for investigating solar desalination. The research work analysis conducted in the current study was focused on computational fluid dynamics and solar radiation consideration to the inquiry. The following points are concluded from present work:

- The maximum number of document types belongs to articles with about 76% of total publications. It illuminates the quality of work and research tendencies related to the topic under consideration.
- The search by title helped to understand the research work carried out on solar desalination systems. Additionally, many researchers have worked on solar desalination systems to enhance the distillate output.
- Engineering and Environmental Science were witnessed as the most relevant subject areas with more than 50% of total publications. The significance of most contributing journals was inferred from their impact factor, h-index, and CiteScore.
- Journals such as *Desalination* and *Desalination And Water Treatment* were on the top among most publishing sources, sharing about 20% and 13% of total publications.
- Analyzing geographically, India's top rank was achieved by China and the United States for both the two factors as total publications and single country publications. Indian Institute of Technology Delhi, India, was the highest contributing institute in this field.
- The authors Tiwari, G.N., Kabeel, A.E., and Tanaka, H. have contributed the highest number of articles, publications, and citations in this research area.

- Network analysis of keywords helped to understand the trend of various terms used in relevant research works.
- CFD analysis ensures its implementation for the parametric study of desalination systems also. The overall survey clears the increasing trend of CFD and solar radiation for analyzing solar desalination systems.

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