

## **A bibliometric analysis of materials research in Indonesian journal using VOSviewer**

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### **ABSTRACT**

This study aims to analyze the scope of research on materials using a bibliometric review and data mapping process. Research data on materials were obtained from databases from selected journals in Indonesia. The search is done using a search engine that contains data on all related journal articles. The search process is based on a topic area with titles, keywords, and abstracts in the study material. The mapping process is done using VOSviewer. A total of 60 relevant articles were found. The results showed that the most studied study material was in the 2016-2021 range. Meanwhile, in the field of chemistry, the "acid" term is the most widely discussed material. Among all contributing countries, Indonesia is the largest country with 43 articles. Indonesia also has the most links with other countries, namely 8 links. Through VOSviewer we analyze how many articles have been published about the material and its relation to the topic area. This review can certainly provide a reference point for further research related to materials.

**Key words:** Bibliometric, Material, VOSviewer, Mapping.

## INTRODUCTION

Material is a substance or mixture of substances that make up an object. Materials can be pure or impure materials. Material can also be living or non-living matter. Materials can be classified according to their physical and chemical properties. Materials can also be based on their geological origin and biological function. Material is a substance or mixture that can be processed in various ways to affect its properties. This can be done by purification, formation, or introduction of other materials. In the industrial world, materials are inputs for a manufacturing process that will produce more complex and useful products or materials. Lots of research that discusses the material. The materials that have been researched are in the fields of chemistry and education. Research on materials in the chemical field that has been carried out includes research on waste materials (Permatasari et al., 2016), organic materials (Nandiyanto et al., 2016; Nandiyanto et al., 2018; Nandiyanto et al., 2019), corrosion materials (Asmara & Kurniawan, 2018) and bio-battery materials (Maulida et al., 2021). There have been many studies on materials, but there is no research that discusses bibliometric analysis with the mapping process using VOSviewer. So that a comprehensive study is needed so that it can be used to help other researchers plan research related to materials. so that future researchers can research materials that are still rarely used.

This study aims to determine the development of research related to materials in Chemistry and Education research in terms of the distribution of bibliometric maps and research trends using VOSviewer software. VOSviewer software is used to map data (Al Husaeni & Nandiyanto, 2022). Bibliometric analysis is considered effective in providing datasets that can be used to improve the quality of research (Nandiyanto *et al.*, 2020). The bibliometric map has a distribution displayed consisting of the type of publication, the topic area studied,

the country of origin of the researcher, the journal where the publication was published and the language used (Hamidah et al., 2020). However, in this study, the bibliometric used is a distribution consisting of the type of publication, the research topic area, the country of origin of the researcher, and the journal where the publication is published.

### **MATERIALS AND METHOD**

All articles analyzed in this study were taken from a database of seven selected journals, namely the Indonesian Journal of Science and Technology (IJoST), ASEAN Journal of Science and Engineering (AJSE), ASEAN Journal of Science and Engineering Education (AJSEE), Indonesian Journal of Multidisciplinary Research. (IJoMR), Indonesian Journal of Community and Special Needs Education (IJCSNE), Indonesian Journal of Educational Research and Technology (IJERT), and Indonesian Journal of Teaching in Science (IJoTis). The research was conducted by collecting all publications in predetermined journals. After that, we proceed the data by creating a search engine to facilitate the analysis process. We enter the data article on the search engine that has been prepared.

We search the list of articles in the search engine that has been created. The search was carried out to filter articles with the keyword "Material" according to the title, keyword, and abstract (topic area) criteria. The articles used are articles published in the 2016-2021 range. The articles that have been collected and meet the requirements for analysis in this study are then entered into Microsoft Excel software and saved in comma separated values (\*.csv) format. Furthermore, VOSviewer is used to visualize and analyze trends in the form of bibliometric maps. Then, we do data mapping of articles from database sources.

VOSviewer is used to create publication maps, country maps, or journal maps based on a network (co-citation) or to build keyword maps based on networks or relationships between

existing items. At the time of making the bibliometric map, the keyword frequency is set as desired and the irrelevant or less relevant keywords are removed.

## RESULTS AND DISCUSSION

Based on the search results from a database of several journals that have been determined (IJoST, AJSE, AJSEE, IJOMR, IJCSNE, IJERT, IJOTIS) obtained 60 data articles that meet the research criteria. The article data is divided into two categories, namely non-educational chemical materials and educational materials. Non-educational chemistry materials consist of 32 articles and 28 articles of Educational materials. Articles in 2016 were 3 articles, 2017 were 4 articles, 2018 were 4 articles, 2019 were 4 articles, 2020 were 6 articles and the rest are in 2021, which are 39 articles. Table 1 shows the data of the articles used in this study.

**Table 1** Article Data with The Material in The Field of Chemistry

No	Cite	Topic	Journal
1	Permatasari et al. (2016)	Analysis of silica sources from agricultural waste (rice husk, rice straw, corn cobs, and bagasse) and discusses the method of isolating silica from agricultural waste and its application as a catalyst.	IJoST
2	Kurniawan et al. (2016)	Overview of the high-temperature oxidation of Fe-Cr steel under steam	IJoST
3	Nandiyanto et al. (2016)	This study investigates the photodecomposition of organic matter during partial solar motion and its correlation with the amount of photocatalyst	IJoST
4	Awan et al. (2017a)	Effective utilization of pure acid oxidized carbon nanofibers for strengthening of high-performance cementitious materials.	IJoST
5	Awan et al. (2017b)	use of carbon nanofibers in cementitious mortar materials with the microstructural investigation	IJoST
6	Bhullar & Putra (2017)	research on the design and modeling of the production process of butyl cellosolve acetate and EO-3 Phosphate ester	IJoST
7	Bilad (2017)	Module-scale simulation of the osmosis module-part B using the modified spiral-Wound method	IJoST

No	Cite	Topic	Journal
8	Asmara & Kurniawan (2018)	Literature review on prediction of corrosion rate of carbon steel in oil and gas environment	IJoST
9	Putra (2018)	Literature review on the treatment of lignocellulosic biomass in biorefinery	IJoST
10	Nandiyanto et al. (2018)	Analysis of ball-milling process in conditions working volume, milling time, and material load on the material properties, product yield, and electricity consumption was investigated.	IJoST
11	Kumalasari et al. (2018)	Review the development phase change materials incorporation of PCM in asphalt pavement	IJoST
12	Awan et al. (2019)	Reinforcement of nanocarbon fiber in concrete so that it can improve the flexural attributes, impact resistance, and abrasion of concrete.	IJoST
13	Nandiyanto et al. (2019)	This research was conducted to find out how to read and interpret the FTIR spectroscopy of organic matter	IJoST
14	Sumarji et al. (2019)	The topic of this research about the effect of particle dispersion on variations in mixing speed	IJoST
15	Nandiyanto (2019)	development synthesis of Metal-organic framework (MOF) materials	IJoST
16	Priyand et al. (2020)	Evaluating nanoparticles on zinc oxide (ZnO) materials	IJoST
17	Saripudin et al. (2020)	The development of the Information Technology Open CourseWare (OCW) movement and new opportunities in Asia to support the education process	IJoST
18	Al Abbad & Alakhras (2020)	The use of chitosan-iso-vanillin sorbent material for removal of dye acid red 1.	IJoST
19	Budiman et al. (2020)	Predicting the life of an inflatable rubber dam taking into account deep hole damage	IJoST
20	Kurniawan et al. (2020)	Utilization of Stem Bark and Leaves of Artocarpus Altilis Park materials as an Anti-Mosquito Repellent	IJoST
21	Haristiani & Rifa'i (2020).	Combined chatbot and social media for improved personal learning environment (PLE)	IJoST
22	Errich et al. (2021)	removal of toxic heavy metals using hydroxyapatite and hydroxyethylcellulose material with Gum Arabic	IJoST
23	Fitriyana et al. (2021)	Investigation hypocholesterolemic activity of Parkia roxburghii	IJoST

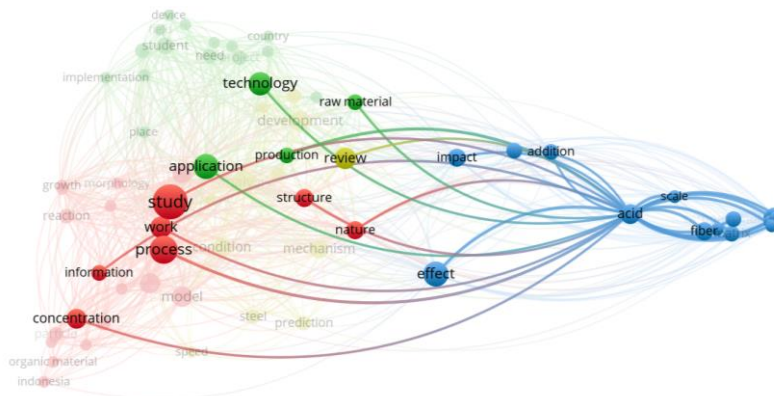
No	Cite	Topic	Journal
24	Castiblanco et al. (2021)	The application of smart materials in Robotic Hand Systems	IJoST
25	Setiyo et al. (2021)	Literature review and bibliometric analysis of the latest reports on the advantages and disadvantages of pure biodiesel materials on engine performance	IJoST
26	Syahputa et al. (2021)	Development of the optimum combination of the oxy-acetylene gas cutting process on 1045 AISI steel material	AJSE
27	Swamy & Zebenay (2020).	Design and Development of Landing Gear on the elephant leg analogy	AJSE
28	Elia et al. (2021)	Techno-Economic Evaluation to determine the feasibility of the Hyaluronic Acid manufacturing process by Yellowfin Tuna Eyeball Extraction	AJSE
29	Obielodan et al. (2021)	The Design and Construction Expert Appraisal of 220 volts inverter at a frequency of 50H	AJSE
30	Valensia et al. (2021)	Creating alternative energy by utilizing biomass materials	IJOMR
31	Amri & Pagarsukma (2021)	Calculation of runway, taxiway, and apron volume requirements for airplane development planning	IJOMR
32	Mukti et al. (2021)	finding solutions to get around the energy crisis with vegetable waste material	IJOMR

The minimum number of relationships between terms in VOSviewer is set by 2 terms. after that, the data were analyzed using VOSviewer and the results were divided into 6 clusters:i) Cluster 1 is depicted in Red, ii) Cluster 2 is depicted in Green, iii) Cluster 3 is depicted in Blue, iv) Cluster 4 is depicted in Yellow, v) Cluster 5 is depicted in purple, and vi) Cluster 6 is depicted in Cyan. Each cluster shows the relationship between one term with another term. VOSviewer can display bibliometric mappings in three different visualizations; network visualization (Figure 1), overlay visualization (Figure 2), and density visualization (Figure 3). keywords are labeled with colored circles. The size of the circle is positively correlated with the occurrence of keywords in the title and abstract. Therefore, the size of letters and circles is determined by the frequency with which they occur. the more often the keyword appears, the larger the size of the letters and circles.









**Figure 5** Network Visualization of Acid Material Relationship with Other Terms

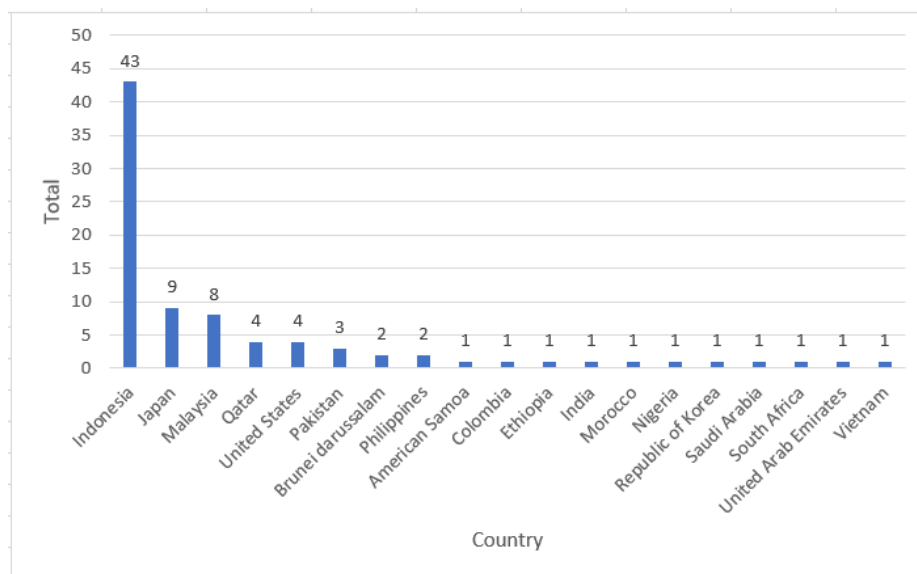
The density visualization shown in Figure 3 means that the darker the yellow color and the larger the diameter of the circle, the denser the keywords, meaning that the more frequent the research on this subject is increasing. If the color fades, blends with the green background, the number of studies will decrease (Al Husaeni & Nandiyanto, 2021). Figure 3 shows that materials in education have the most increasing number of researches, such as the keywords study, research, student, learning, application, and process.

The keywords that often appear are study, research, student, application, process, and learning. From this data, we can look for research on new materials. For example, research related to pure materials in the field of chemistry is still rarely done or published in a database of 7 journals that are used as references for data collection. In addition to the bibliometric analysis of the topic area, we analyze the country of the research study. Specifically for the study country, the bibliometric analysis is shown in Figure 6. In this study, 86 countries were involved. Indonesia contributed the largest research to publications published by 7 journals (IJoST, AJSE, AJSEE, IJOMR, IJCSNE, IJERT, and IJOTIS) which we are currently researching, namely 43 articles. Relations between countries are shown in Figure 7.

Figure 7 shows the relationship between countries when conducting research. From the 19 countries collected, there are only 11 countries that have connectedness, namely i) Cluster 1

contains American Samoa, Pakistan, and United States, ii) Cluster 2 contains Indonesia, South Africa, and the United State, iii) Cluster 3 contains Brunei Darussalam and Qatar, iv) Cluster 4 contains Japan and Vietnam, and v) Cluster 5 is Malaysia.

From the 11 countries that are involved and interconnected, Indonesia has the most relationship links, which is about 8 links connected to the United States, Malaysia, South Africa, Japan, Vietnam, and Qatar. Malaysia has 1 link, which is connected to Indonesia, Japan has 2 links with Indonesia and Vietnam, South Africa has 1 link only with Indonesia, the United States is connected to Indonesia and Pakistan, Qatar is connected to Brunei Darussalam and Indonesia and vice versa Brunei Darussalam is connected to Qatar. and Indonesia. This shows that the articles related to the materials published in the journals that we study are international in scale and have connections between one country and another.



**Figure 6** Total Countries Participating in Research Materials



**Figure 7** Network Visualization of Country Research.

## CONCLUSION

This research was conducted to analyze the bibliometric articles about the material. In this study, the materials were divided into two categories, namely chemistry materials and educational materials. The search process uses the keyword “material” which is based on a topic area with titles, keywords, and abstracts. After the search process was carried out, 60 relevant articles were obtained. After that, the mapping process is carried out using VOSviewer. The search results found 60 relevant articles. Based on the results of analysis and mapping with VOSviewer, it was found that material research with term study was the most studied in the 2016-2021 range. Meanwhile, in the field of material chemistry, the term acid is the most studied. We also analyzed the countries involved in the process of publishing articles on material from seven selected journals. Indonesia contributed by donating 43 articles. In writing articles, Indonesia cooperates with 8 other countries, namely the United States, Malaysia, South Africa, Japan, Vietnam, and Qatar. The biometric approach is used in identifying key themes in each research that has been done so far and is useful for determining novelty in conducting further research.

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