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Bibliometric Analysis of Research on Cosmetic Products: Halal Cosmetics as an Emerging Research Area

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Abstract

The cosmetics industry is one of the most lucrative and high-growing industries that are driven by science and innovation. However, there is a lack of studies that analyze scholarly articles on cosmetic products. This study attempts to bridge this gap by reviewing the existing literature, with the specific purpose to explore the trends in the publications and themes related to research on cosmetic products. To achieve this purpose, a bibliometric analysis was conducted using the R application and R-based tools. The research retrieved 613 articles on the Scopus database that used the term 'cosmetic products' in their titles. The study reveals that the number of articles published on the topic of cosmetic products is increasing. Two main keywords, paraben, and high-performance liquid chromatography, are the most recurring themes. Halal cosmetics were identified as an emerging research area. In relation to this context, six major topics were identified, which are: regulations for halal certification of halal cosmetics, organization control, attributes of halal cosmetics, consumer purchase, and purchase intention. Overall, this bibliometric analysis provides essential information on the current trends and themes, and provides recommendations for future research on cosmetic products.

1. Introduction

Cosmetic products can be considered a necessity as their various daily uses are ubiquitous among many people. The term 'cosmetic products' refers to products used externally for cleaning or washing the face or body parts to make the user more comfortable; specific items include cleanser, shampoo, soap, and perfume. The technical definition is that cosmetic products include any substance or preparation used for cleansing, perfuming, enhancing the body's appearance, or correcting body odour. The term also refers to products applied to the body's outer layer, such as the face and lips, to keep them moisturized (Standard Malaysia, 2019). Cosmetic products such as lipstick, eyeliner, foundation, and eye concealer are used to beautify the human face. Likewise, products such as body wash, shampoo, and perfume are used to clean or perfume human body parts. The worldwide cosmetics market was projected to be valued at over USD 503 billion in 2021, making it one of the most lucrative industries in the world (Statista Research Department, 2022). It is predicted that by 2024, the cosmetics industry in Malaysia will generate a revenue, estimated at USD451 million (Statista, 2023).

Some people might associate the word 'cosmetics' with women, as most makeup and skincare cosmetics users are female. However, the term does not imply that a cosmetic product is aimed solely at female consumers as such products are used by everyone, regardless of gender. Deodorant and soap, which are used by everyone, are examples of products that fall into the category of cosmetics. Despite growing demand for cosmetic products in the market, too few studies have reviewed the literature specifically related to cosmetic products. The study attempted to bridge this gap by using R software to conduct a bibliometric analysis of the literature on cosmetic products. The specific purpose of the study was to explore the trends in the publications and themes related to research on cosmetic products.

2. Dataset and methods

To achieve the purpose of the study, the Scopus database was searched for articles relevant to cosmetic products. This database is recognized as a central search system that enables researchers to find articles related to a chosen research topic (Gusenbauer & Haddaway, 2020). The Scopus database is a comprehensive collection of scholarly literature from various sources, such as journals, conference proceedings, and books. It contains peer-reviewed literature and publications worldwide from various academic disciplines, including sciences, social sciences, engineering, medicine, and others, making it suitable as a source for conducting bibliometric analysis (Elsevier, 2023). The Scopus database is also available in BibTeX format, making it a helpful resource for analysing collaboration patterns and other analyses in bibliometric

evaluation (Elsevier, 2023). In this study, a bibliometric study was conducted to review the most recent publications of cosmetic products on the Scopus database using the R and R-based tools. R is a programming language used for statistical computing and graphics. It offers a wide range of statistical and graphical techniques and is highly customizable. For this bibliometric analysis, the specific R-based tools that were utilised include RStudio, Bibliometrix R Package, and Biblioshiny. RStudio serves as an integrated development environment (IDE) for R and acts as a tool that runs on R, while Bibliometrix R package software is the specific open-source software used to conduct bibliometric research. In addition, this study used Biblioshiny, an application that offers a user-friendly web interface for the Bibliometrix R package. It is capable of producing high-quality graphical statistics on article publications derived from the Scopus database (Ahmi, 2022; Aria & Cuccurullo, 2017; R Core Team, 2020).

Figure 1 shows an overview of the step-by-step Scopus search for publications on cosmetic products conducted in this study, adapted from Zakaria *et al.* (2020). The study utilized only the Scopus database, and not other databases due to authors' accessibility to the Scopus database and the availability of the BibTeX format dataset in Scopus. The BibTeX format in Scopus is different from that of other databases such as WOS. Currently, the software package utilized for the study (R, RStudio, Bibliometrix R package and Biblioshiny) is only able to analyse a dataset of a single format. Hence, the study utilised only the Scopus database.

The search focused on cosmetic products and utilised variations of the words in the article title search, including 'cosmetic product,' 'cosmetic products,' and 'cosmetics products'. Using these keywords adhered to the objective of obtaining appropriate articles whose main focus was cosmetic products. Using the advanced search function in Scopus, the scope of the search was narrowed to include only articles published in journals, and those written in English and include years from 1955 to 2021. The dataset was derived in September 2022; hence, the researchers excluded publications from the years 2022 to 2023. This search generated 613 scientific articles, which have cosmetic products in the title. The information on the 613 articles was then exported to BibTeX format. The raw data (in BibTeX format) were then imported into the Biblioshiny application to conduct bibliometric analysis (Aria & Cuccurullo, 2017).

3. Analysis and results

3.1 Descriptive analysis

3.1.1 Main information

Table 1 shows the main information regarding the dataset obtained from Scopus. In total, the documents examined are 613. Sources in this study are exclusively from journals. As shown in the table, within the 1955 to 2021 timeline, the publication growth rate was 6.2% annually.

3.1.2 Annual publication trends

Figure 2 shows the trend in the annual publications on cosmetic products from 1955 to 2021. Overall, the Scopus database search produced 613 scientific articles. The highest productivity was in 2021, with a total of 53 documents, while the lowest was between 1955 and 1977 when only one publication was produced each year. More recently, between 2018 and 2020, the average number of annual articles increased, with 43 to 45 publications each year. The number dropped slightly in 2017 when 29 articles were published. Overall, the number of articles published is increasing.

Table 1: Main information of the documents

Description	Results
Main Information About Data	
Timespan	1955:2021
Sources (Journals)	293
Documents	613
Annual Growth Rate %	6.2
Document Average Age	13.1
Average citations per doc	17.99
References	15284
Document Contents	
Keywords Plus (ID)	4311
Author Keywords (DE)	1484
Authors	
Number of Authors	2081
Authors of single-authored docs	44
Authors Collaboration	
Single-authored docs	55
Co-Authors per Doc	4.15
International co-authorships %	12.72
Document Types	
Articles in Journals	**613**

3.1.3 Most productive authors

Table 2 shows the most productive authors of research on cosmetic products. They all published at least eight articles involving research on cosmetic products. Two authors, Gagliardi L. and Tonelli D., each published 19 articles. Referring to Table 2, the h-index values for both authors (11) were the joint-highest of all the authors. The two authors mentioned can be considered the most prominent in terms of researching cosmetic products. Chisvert A. and Salvador A. published 14 articles on topics related to cosmetic products, while Cavazzutti G. published 13 such articles. As can be seen, researchers from the Istituto Superiore Di Sanita dominated the field of cosmetic product research.

3.1.4 Most cited papers

Table 3 shows the ten most frequently cited papers on topics related to cosmetic products. Global citations refer to the number of citations of a paper, counted from all papers published in the Scopus database. Table 3 shows that the most-cited paper was published in the journal Regulatory Toxicology and Pharmacology, which is not included in the ten most

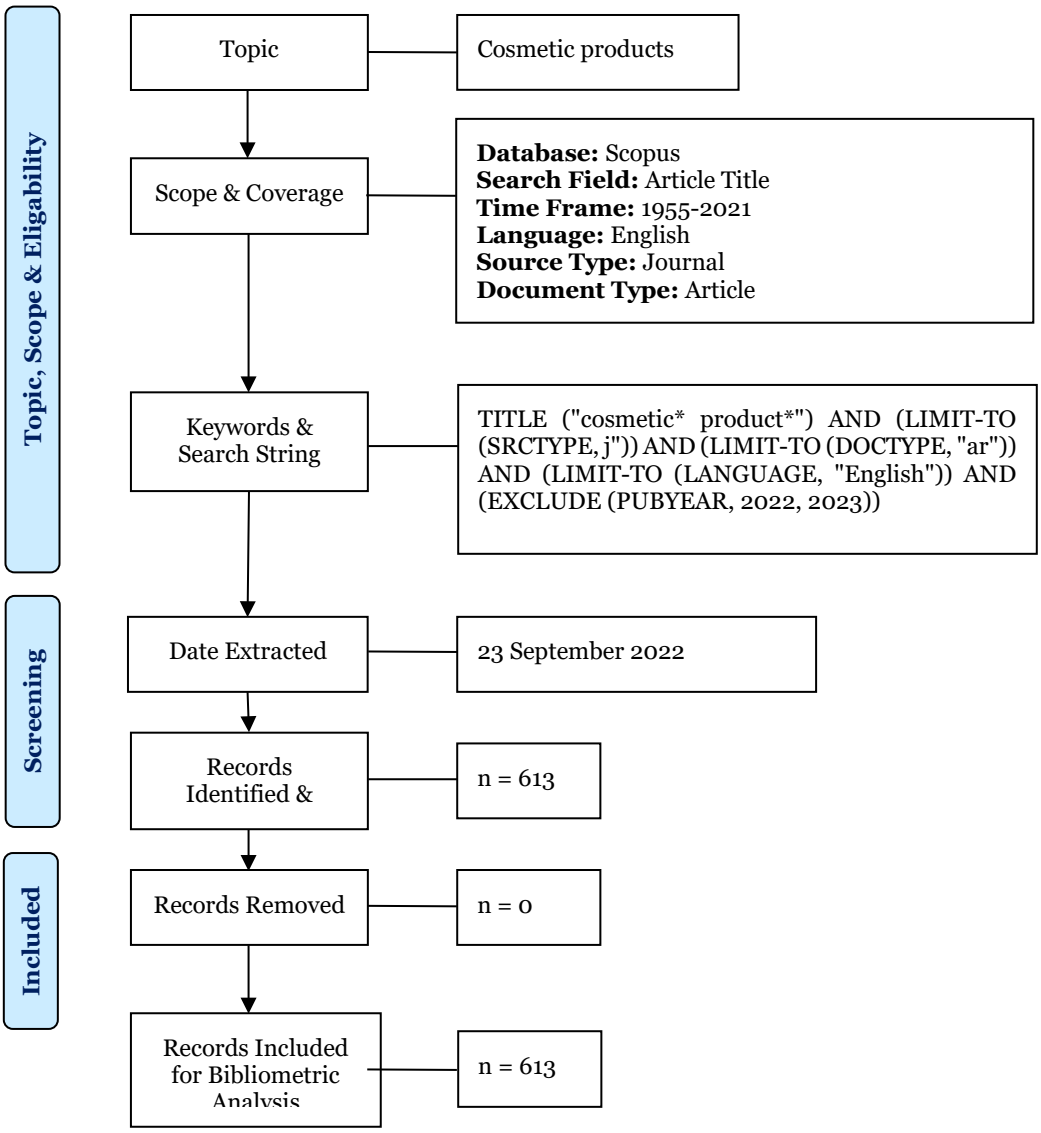

Figure 1: Step-by-step search of articles in Scopus for bibliometric analysis. Adapted from Zakaria *et al.* (2020).

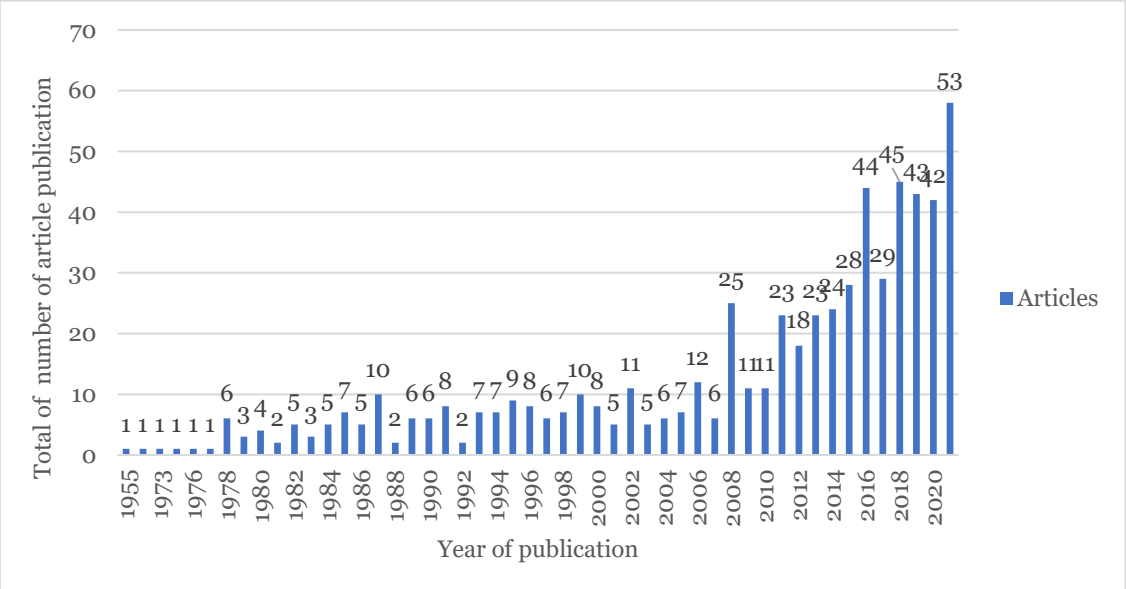

Figure 2: Trend in the annual publications on cosmetic products.

Table 2: Most productive authors of research on cosmetic products

Author	Number of Publications	Affiliation	Country	*h*-index	g-index	m-index	Total Citations	Publication Year*start
Gagliardi L.	19	Istituto Superiore Di Sanita	Italy	11	18	0.282	326	1984
Tonelli D.	19	Alma Mater Studiorum Università di Bologna	Italy	11	17	0.282	304	1984
Chisvert A.	14	Universitat de València	Spain	9	13	0.6	171	1984
Salvador A.	14	Universitat de València	Spain	9	13	0.6	171	2008
Cavazzutti G.	13	Istituto Superiore Di Sanita	Italy	8	13	0.205	204	2008
Ficheux A. S.	10	Université de Brest	France	7	10	0.778	172	1984
Roudot A. C.	10	Université de Brest	France	7	10	0.778	172	1995
Amato A.	9	Istituto Superiore Di Sanita	Italy	7	9	0.179	146	2014
De Orsi D.	9	Università degli Studi di Siena	Italy	7	9	0.25	149	2014
Rastogi S. C.	8	Nationalt center for miljø og energi	Denmark	7	8	0.2	357	1988

Table 3: List of top 10 cited cosmetic products articles in the Scopus database

No.	Author/Year	Journal	Title	Global Citations	Total Citation Per Year
1.	Safford *et al.* (2015)	Regulatory Toxicology and Pharmacology	Use of an aggregate exposure model to estimate consumer exposure to fragrance ingredients in personal care and cosmetic product	961	120.13
2.	Buschmann & Schollmeyer (2002)	Journal of Cosmetic Science	Applications of cyclodextrins in cosmetic product: A review	243	11.57
3.	Lopez-Galindo *et al.* (2007)	Applied Clay Science	Compositional, technical and safety specifications of clays to be used as pharmaceutical and cosmetic product	236	14.75
4.	Handjani-Vila *et al.* (1979)	International Journal of Cosmetic Science	Dispersions of lamellar phases of non-ionic lipids in cosmetic product	209	4.75
5.	Rastogi *et al.* (1995)	Contact Dermatitis	Contents of methyl-, ethyl-, propyl-, butyl- and benzylparaben in cosmetic product	174	6.21
6.	Shen *et al.* (2007)	Journal of Separation Science	Simultaneous determination of seven phthalates and four parabens in cosmetic products using HPLC-DAD and GC-MS methods	145	9.06
7.	Wang *et al.* (2009)	Environment International	Low molecular weight cyclic volatile methylsiloxanes in cosmetic product sold in Canada: Implication for dermal exposure	144	10.29
8.	Loretz *et al.* (2005)	Food and Chemical Toxicology	Exposure data for cosmetic products: Lipstick, body lotion, and face cream	138	7.67
9.	Abd Rahman *et al.* (2015)	Journal of Islamic Marketing	Consumers and Halal cosmetic product: knowledge, religiosity, attitude and intention.	131	16.38
10.	Lei *et al.* (2017)	Regulatory Toxicology and Pharmacology	Microplastics releasing from personal care and cosmetic products in China.	120	20

productive journals. In the paper with the most citations (961), Safford *et al.* (2015) used a probabilistic model to evaluate the aggregate exposure of consumers to fragrance ingredients in all forms of personal care products. They discovered the Creme FIRM model risk assessment to be superior to the conservative method. In the paper with the second highest number of citations, 243, Buschmann and Schollmeyer (2002) gave an overview of the application of cyclodextrins in cosmetic products. They emphasized the advantages of using cyclodextrins in these products, such as the derivatives of cyclodextrins not being nutrient mediums for bacteria. Cyclodextrins can also reduce the number of preservatives used in a final product and they are an inert material. While the article by Safford *et al.* (2015) had the most citations per year, 120.13, Abd Rahman *et al.* (2015) produced the work with the second-highest number of annual citations, 16.38, despite the article itself being cited 131 times. This shows that the article gained the attention of other researchers.

3.1.5 Most productive countries

Figure 3 shows the most productive countries in terms of publishing articles on topics related to cosmetic products. The the most productive country was Italy, which produced 20% (123) articles. The articles from Italy were contributed by five of the ten most productive authors, such as Gagliardi L., Tonelli D., Cavazzutti G., Roudot A. C., and Amato A., all of whom belonged to the same institution. The second-most productive country was the USA, which produced 18% (112) articles about cosmetic products. This aligned with the fact that the USA was listed among the three leading cosmetic product manufacturers worldwide in 2020 (GlobalData, 2020). Third, 17% (102) of cosmetic product articles were published by authors in France. Other than that, authors in China published 15% (89) articles on cosmetic products, while authors in Malaysia published 8% (52) such articles.

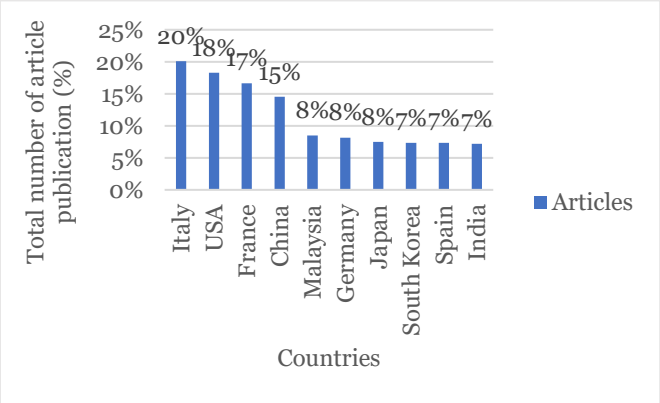

Figure 3: Most productive countries that publish articles on cosmetic products.

3.1.6 Most productive affiliations

Figure 4 shows the most productive institutions in terms of publishing articles on cosmetic products-related topics. Research on cosmetic products was usually conducted by institutions or research divisions commissioned by cosmetic manufacturers. The Istituto Superiore di Sanita and the Food and Drugs Administration each published 22 articles. In terms of their affiliation, the most productive authors, such as Gagliardi L., Cavazzutti G., and Amato A., were affiliated with the Istituto Superiore di Sanita (the Italian National Institute of Health). Alma Mater Studiorum Università di Bologna published 19 articles. The University of Valencia published 14 articles, while companies also published articles, with L'oreal S.A., for instance, publishing ten. The Faculté des Sciences et Techniques of the Université de Brest (UBO) published nine articles. Three institutions and companies published eight articles each, including the University of Brest (UBO), the University of Ferrara, Procter and Gamble, and Unilever.

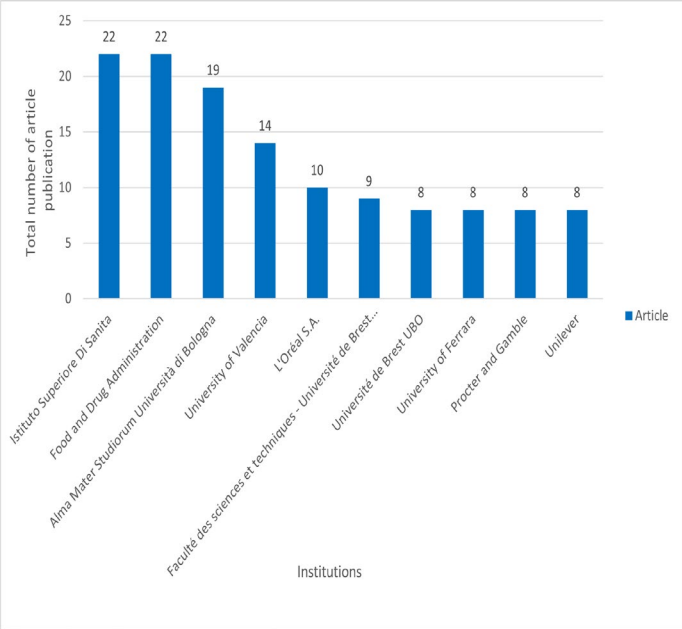

Figure 4: Most productive institutions that publish articles on cosmetic products topics.

3.1.7 Most frequent journals

Figure 5 shows the journals that published articles on cosmetic products-related topics most frequently. It shows that 37 articles were published in the International Journal of Cosmetic Science, while the Journal of Chromatography A had 35 articles. Contact Dermatitis published 26 articles, and Food and Chemical Toxicology published 18. Although the International Journal of Cosmetics Science published the most articles, the journal's cite score was 4.5, lower than that of Talanta, which was 10.6.

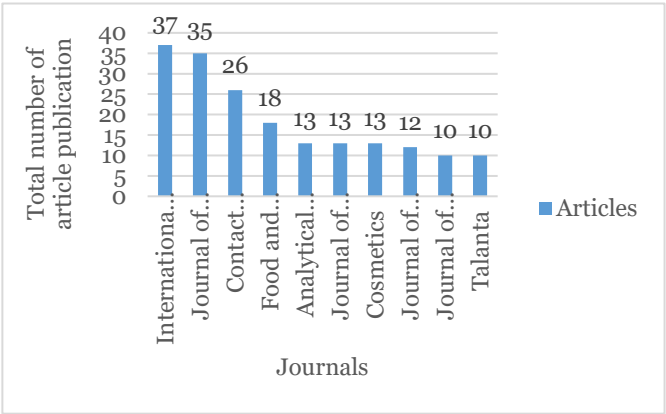

Figure 5: Most frequent journals of cosmetic products topics.

3.1.8 Most frequent keywords

Figure 6, a word cloud based on the authors' keywords, shows the most frequently used keywords in the articles on cosmetic products. There are two types of keywords, which are author

keywords and Keyword Plus. Author Keywords are listed by authors when their papers are published, and generally, they are more specific than Keyword Plus. Word cloud analysis shows that the most frequently used author keywords were 'cosmetics, preservatives, paraben, allergic contact dermatitis, HPLC (high-performance liquid chromatography), and liquid chromatography,' which are considered natural science terms. As the word cloud illustrates, some of the keywords commonly used in the social science articles included 'purchase intention, halal cosmetics, attitude, and consumption.'

Figure 6**:** Most frequent author keywords in cosmetic products articles.

3.2 Network analysis

3.2.1 Collaboration analysis

Figure 7 displays the patterns of inter-country collaboration on cosmetic products-related topics. This analysis of collaboration between countries is initiated based on author affiliation. The countries appeared in four main clusters, as the figure shows. The collaboration links between France and the USA, Italy, and Germany were quite strong, as can be seen through the publication of more articles from these countries than from other countries. In the dataset, an example of the collaboration of authors from different countries is the article written by Ribet, Nobile, and Rossi (2019). The level of thickness of the collaboration link for Germany, Portugal, and Sweden is fairly substantial compared to other collaboration links.

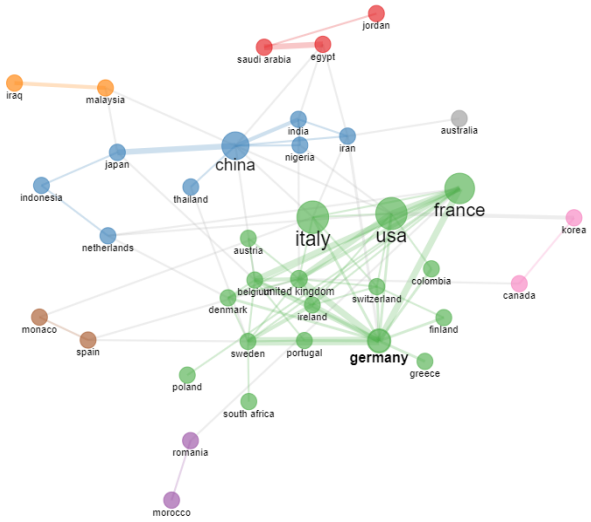

Figure 7: The collaboration analysis between countries.

3.2.2 Co-word analysis

Figure 8 shows the co-word analysis of the author keywords. A co-word analysis is a structure in which words clump to each other once they are understood to refer to the most critical and up-to-date issues; this is described as a research frontier. A co-word analysis of author keywords might help to identify topics that will potentially evolve in the future. For this study, the co-word analysis involved words that occurred together in the articles on cosmetic products (Aria & Cuccurullo, 2017; Callon *et al.*, 1991). The different colours represent different categories of keywords that were strongly linked to each other. For example, 'cosmetics' was mentioned with several keywords, including 'paraben, preservative, risk assessment, personal care products, and sunscreen agents.' The link between cosmetics and paraben is quite thick, so the frequency with which the keywords were mentioned together was quite high, compared to links between other keywords. The size of the circle of each keyword (for example, safety testing), as shown in Figure 8, indicates the frequency the keyword is used by authors.

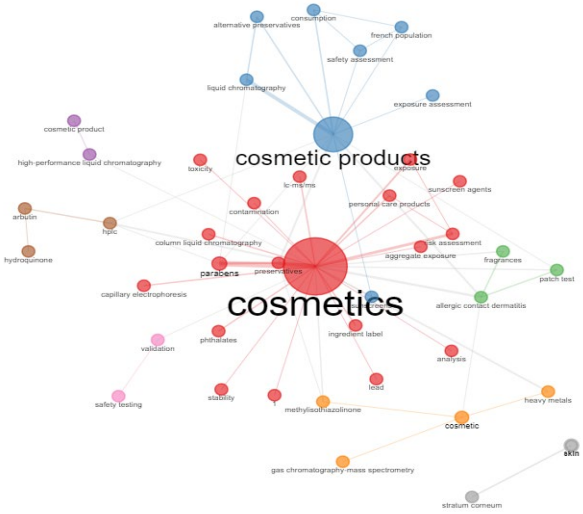

Figure 8: The co-word analysis of author keywords.

Figure 9 shows the trend in cosmetic products-related topics, based on the author's keywords. The topics leading the research trends included 'health risks, heavy metals, stability, cadmium, halal cosmetics, liquid chromatography, toxicity, and attitude.' These topics became popular among researchers in 2020. Topics such as hydroquinone were not prominent after 2018, while topics such as cosmetic and purchase intention were not prominent after 2019. The topics that became popular among researchers can be divided based on discussions from different perspectives: natural science and social science. The topics of halal cosmetics and attitude were examined from a social science perspective, while other topics came under natural science. Meanwhile, several topics were discussed between the 1980s and 2020. In the 1980s, stratum corneum and skin became cosmetic products-related trends in terms of author discussions, which lasted until 2013. In the 1990s, topics such as cosmetic products, high-performance liquid chromatography, and column liquid chromatography became widespread in discussions among researchers. In the 2000s, studies on parabens, preservatives, eye irritation, patch test, allergic contact dermatitis, and HPLC were some of the central topics of discussion among researchers. In the 2010s, popular topics included 'risk assessments, sunscreen, cosmetics, toxicity, halal

cosmetics, exposure, hydroquinone, liquid chromatography, purchase intention, attitude, personal care products, stability, health risk, heavy metals, and cadmium.' These observations show that especially in the social sciences, cosmetic products-related research on topics such as halal cosmetics, purchase intention, and attitude increased between 2014 and 2021. In the natural sciences, studies on cosmetic products have evolved from the 1980s until now, and they have become a reliable resource for future researchers.

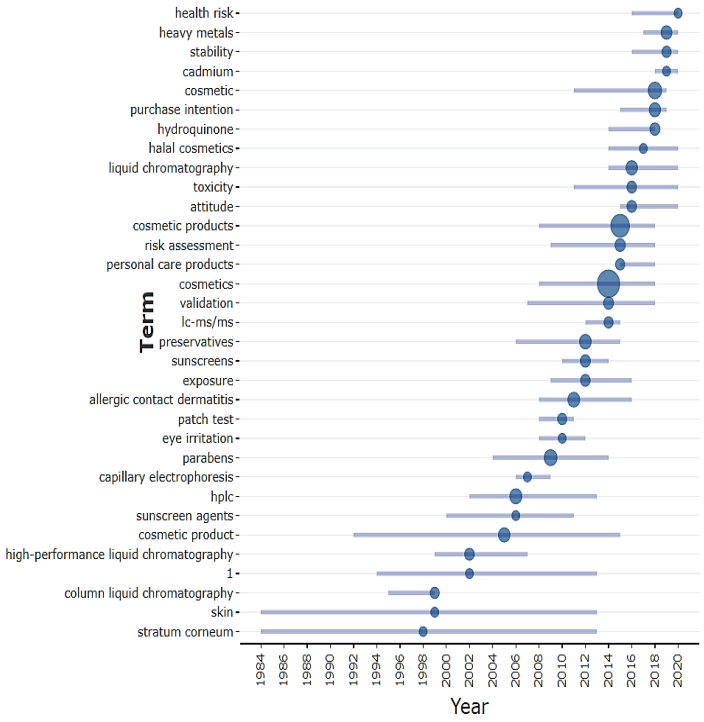

Figure 9: The trend topics of author keywords.

Figure 10 displays a thematic map of the articles on cosmetic products, based on the author's keywords. Thematic maps have four quadrants, with two different indicators that determine the character of each quadrant (Callon *et al.*, 1991; Della Corte *et al.*, 2019). In Figure 10, the coloured boxes contain the author's keywords; the red arrow shows the degree of relevance, and the blue arrow shows the degree of development. First, the motor theme can be considered to have high degrees of development and relevance, indicating that the keywords are significant and represent excellent development in research on cosmetic product topics. An example of a pink box is halal cosmetics, inside the upper-right quadrant of the thematic map. The term halal cosmetics is one of the most frequently mentioned by authors, but not the most frequent keyword. This relationship indicates that the degree of development of the halal cosmetics topic was lower than that of other terms (such as *HPLC*). The degree of development refers to a topic's level of maturity, while the degree of relevance refers to its level of significance to the body of knowledge. There is a high potential for halal cosmetics to be developed further as a body of knowledge in the future because the current development of halal cosmetics literature was found to be low.

Secondly, basic themes with a high degree of relevance are significant, indicating that the keywords are essential in research concerning cosmetic products. These keywords included 'paraben and high-performance liquid chromatography.' However, the development of these keywords for cosmetic products had not fully matured. Meanwhile, niche themes have a high degree of relevance and a low degree of development, suggesting that these keywords were relevant to cosmetic products but low on centrality, indicating that on the whole, keywords such as 'antioxidant activity, green purchase behaviour, and contamination' are not important in the cosmetic products field. Moreover, those keywords did not appear in the list of the most frequently used keywords. Lastly, emerging or declining themes, which have low degrees of relevance and development, refer to keywords that were not well developed in articles on cosmetic products or used to be relevant to the topic but might be starting to decline because authors began to focus on other keywords. One example, 'purchase intention,' is mentioned in the thematic map. Research on purchase intention may be declining because authors are focusing more on consumers' actual behaviour.

3.2.3 Three-field plots

A three-field plot shows relationships between countries, journals, and author keywords. Figure 11 shows the three-field plot between the authors, countries, and author keywords for this study. Authors from the most productive countries, including the USA, Italy, China, South Korea, France, Germany, the United Kingdom, Spain, Iran, and Japan, published articles in the International Journal of Cosmetics Science. This also indicates that the authors from these countries used keywords such as cosmetics or cosmetic products in the articles published in this journal. The link between France and the International Journal of Cosmetic Science is fairly thick, possibly indicating that more articles from France were published in this journal. The sizes of the boxes placed after the countries may indicate the number of article publications. Compared to India, the size of the box for Malaysia is quite small, possibly because the country published fewer articles in the journals shown in Figure 11. The single link to the Cosmetics journal indicated that Malaysia published an article only in that journal but in none of the others mentioned in Figure 11.

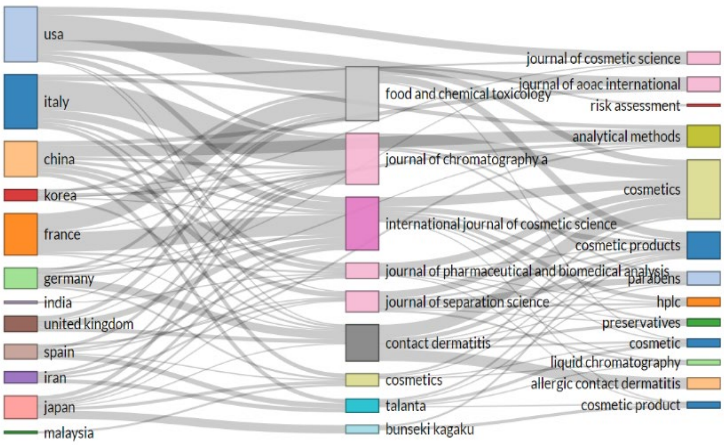

Figure 11: The three-field plots between countries, journals, and author keywords.

3.2.4 Historiography

Figure 12 shows the historiography of the articles on cosmetic products. A histography shows the direct historical citations of a paper. Seven coloured clusters of direct historical citations are illustrated, based on biblioshiny. Starting with the blue cluster, Wang *et al.* (2006) were cited by Miralles P. *et al.* (2018) and Miralles P. *et al.* (2019). Both cited this paper because Wang *et al.* (2006) used the liquid chromatography

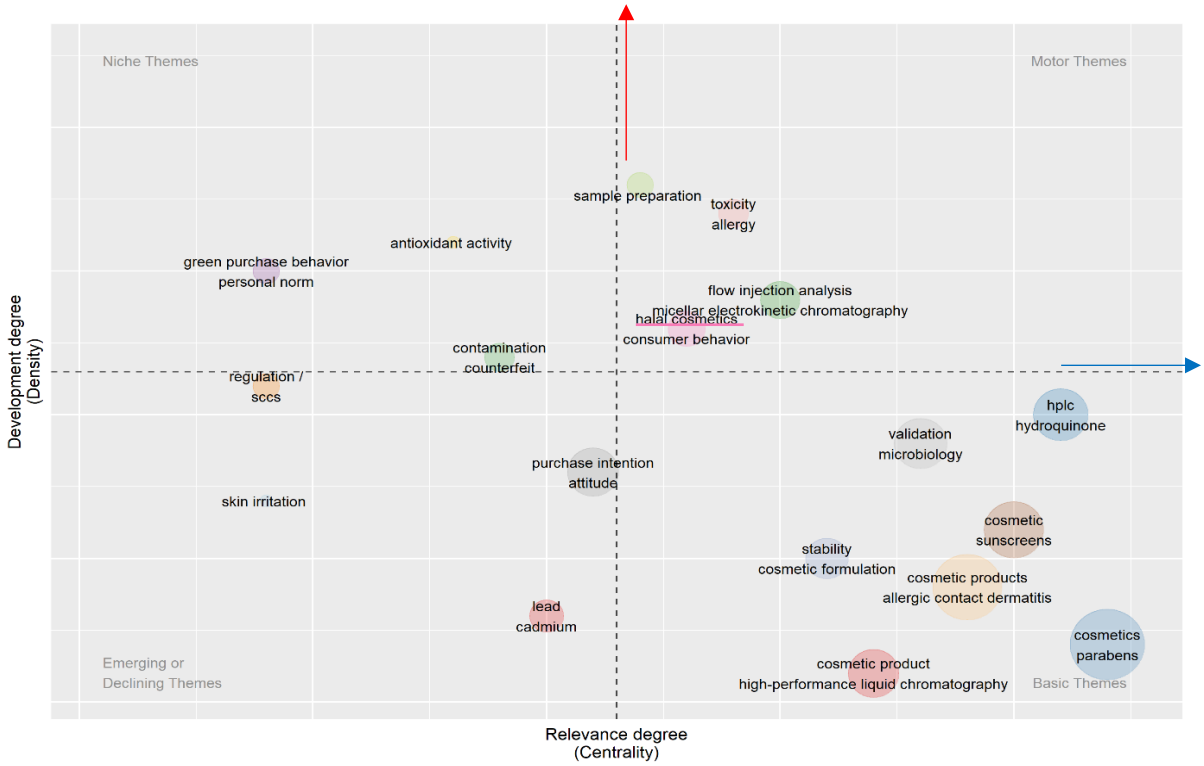

Figure 10: Thematic maps of cosmetic product articles.

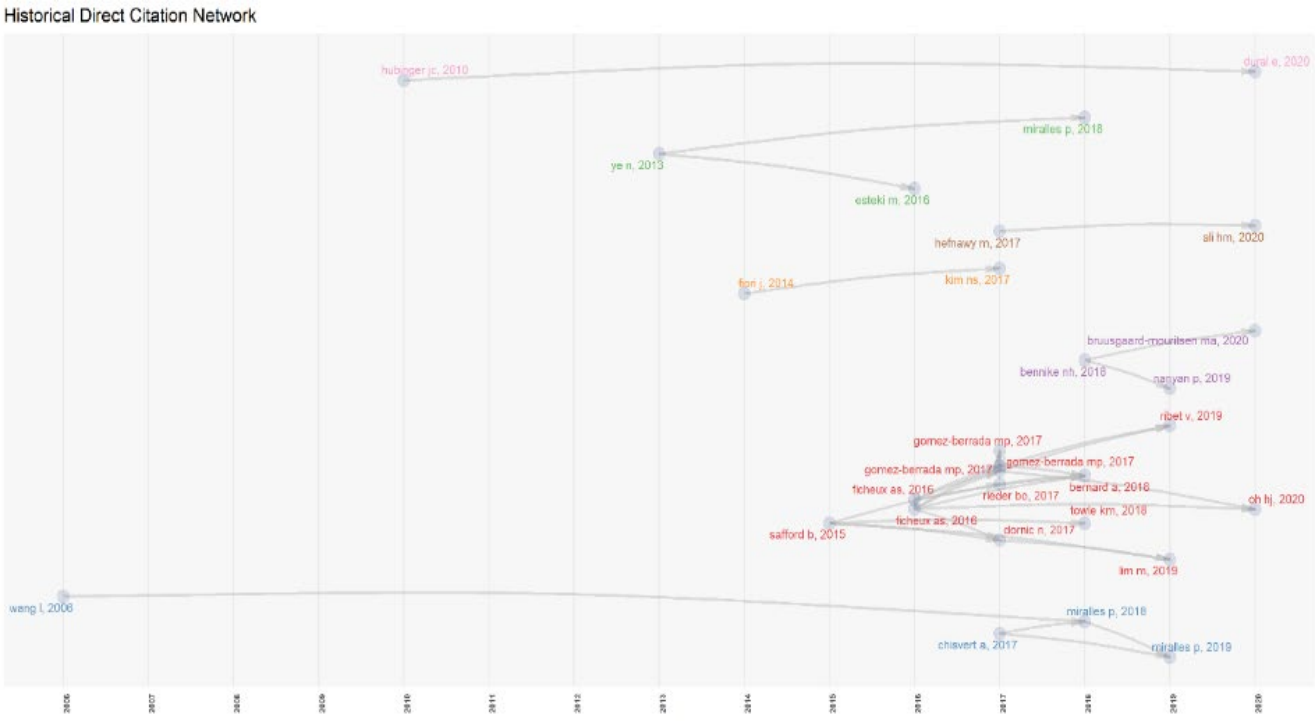

Figure 12: The historiography of cosmetic products articles.

the technique when examining cosmetic products. For the red cluster, Safford *et al.* (2015) are cited in an article that used the former work as a main reference when examining consumer exposure to cosmetic products. For the green cluster, Ye *et al.* (2013) developed a method to extract paraben from cosmetic products. For the brown cluster, Hefnawy *et al.* (2017) developed a liquid chromatography technique to extract preservatives such as salicylic acid and parabens. For the pink cluster, Hubinger (2010) surveyed cosmetic products with five phthalate esters. For the purple cluster, Bennike *et al.* (2018) investigated the fragrance contact allergen in 5,588 cosmetic products, identifying the allergen using a novel smartphone application. Bruusgard *et al.* (2020) and Nanyan (2019) cited the paper as a reference for fragrance contact allergens. For the orange cluster, Fiori and Andrisano (2014) investigated the simultaneous determination of glucosteroids in counterfeit cosmetic products and pharmaceutical formulations using the LC-MS method. Kim *et al.* (2017) cited the paper to record how consumers were unaware of the side effects because the latter were unlabeled on cosmetic product packaging.

4. Emergence of halal cosmetics as research focus

Halal cosmetics is a major theme that emerged from the study's findings. Halal cosmetics refers to products made in conformity with Islamic law, for instance, should its ingredients are sourced from animal origins, the animals must be slaughtered according to Islamic law (Azmi, Noor & Elgharbawy, 2021). The significance of halal cosmetics as an emerging trend can be seen from two aspects: first, halal cosmetics is an emergent topic in the thematic maps and second, it is one of the trend topics that emerged from 2014 until 2021. The finding that emerged from thematic maps indicates that the term halal cosmetics is located in the quadrant of motor themes, which means the halal cosmetics keyword is significant to the research related to cosmetic products. The position of halal cosmetics in the low side of the quadrant indicates the term halal cosmetics is included as one of the most frequent keywords used by authors, although not the most frequent keyword used by authors (see Figure 6). This finding can be interpreted that the current development of halal cosmetics in the cosmetic products field is low, but it has a high potential to develop further. Secondly, the trend topics show that research on cosmetic products related to halal cosmetics increased consistently from 2014 to 2021. It shows there is a high potential for halal cosmetics to be developed further as a body of knowledge in the future.

Within the analysed dataset of 613 articles, 13 articles included 'halal cosmetics' in the title. Of these 13 articles, 11 articles are from the social sciences, with eight from the marketing perspective and three from the management perspective respectively, and two articles are on natural sciences. The eight articles on marketing focused on the topic of consumer behaviour, with attributes of halal cosmetics, consumer purchase, and purchase intention as the major themes. On the theme of attributes, Daud *et al.* (2012) proposed specific attributes regarding halal cosmetics, which include religious compliance, safety, purity, and quality. On the theme of consumer purchase, the research conducted by Shahid *et al.* (2018) suggested that trust, halal awareness, and attitude towards the products are the key factors that determine the behaviour of consumers when purchasing halal cosmetic products. Six articles focused on consumer purchase intention, highlighting several factors that influence the purchase intention of halal cosmetic products purchase: religiosity (Abd Rahman *et al.*, 2015), attitude (Briliana & Mursito; Haque *et al.*, 2018), awareness and trust of halal cosmetic products (Handriana *et al.*, 2020), the halal logo of the product and ingredients (Khan *et al.*, 2021). Arbak *et al.* (2019) claimed that sexism in halal cosmetics advertising leads to ethical violations and negatively impacts consumer purchase intention.

From the management perspective, the authors of the relevant three articles discussed the organization's context concerning halal cosmetics. Widjaja and Sijabat (2021) studied the halal certification of halal cosmetic products that complied with the law and regulations set by the government of Indonesia. The other two articles studied the statistical process control implemented in halal cosmetics companies (Husain, 2015; Husain *et al.*, 2019). According to these two articles, management's commitment has an impact on the implementation of statistical control processes, which in turn will benefit the company.

Two studies on halal cosmetics from the natural science perspective include articles by Kim *et al.* (2018) and Salae *et al.* (2018). These studies focused on testing methods to examine the ingredients used in the production of halal cosmetic products.

Figure 13 shows the nine journals that published halal cosmetics articles. Most authors publish their articles in the Journal of Islamic Marketing with four articles. It indicates that most authors publish their halal cosmetics articles in a journal with specialized Islamic focus. Malaysian Journal of Consumer and Family Economics published two articles, whereas other journals, namely Asia Pacific Management Review, Management Science Letters, Humanities and Social Sciences Reviews, Journal of Applied Sciences Research, International Journal of Applied Business and Economic Research, and Journal of Legal, Ethical and Regulatory Issues and Applied Biological Chemistry respectively publish one article each that related to halal cosmetics.

Overall, existing literature regarding halal cosmetics focused mostly on consumer purchase intention, which is from the marketing perspective. Given the current development of halal cosmetic products literature from a natural science perspective is low, there is a potential for more exploration of natural science perspective related to testing methods of halal cosmetics, such as the method to determine the halal (or haram) ingredients in finished cosmetic products. Such testing methods, which can be used for verifying the halal-ness of ingredients, help manufacturers address potential issues of fraudulent practices among their suppliers.

5. Conclusion and implications

The study was conducted to explore the trends in the publications and themes related to research on cosmetic products. Halal cosmetics have been identified as an emerging area for future research as there is increasing academic interest in the development of the body of knowledge. Six major topics related to halal cosmetics were attributes of halal cosmetics, consumer purchase, purchase intention, regulations for halal certification of halal cosmetics, organization control and testing method. Most articles related to halal cosmetics were published in the Journal of Islamic Marketing, which is a specialized Islamic-theme journal. The published articles related to halal cosmetics are mostly within realm of the social science, while articles from the natural sciences are lacking. On reflection, there is a need and considerable potential to further explore halal cosmetics from the natural science perspective such as articles by Kim *et al.* (2018) and Salae *et al.* (2018).

Most research concerning cosmetic products has been conducted in European countries, but many Muslim consumers, particularly in Asia, use readily-made cosmetics produced by both Muslim and non-Muslim manufacturers. The

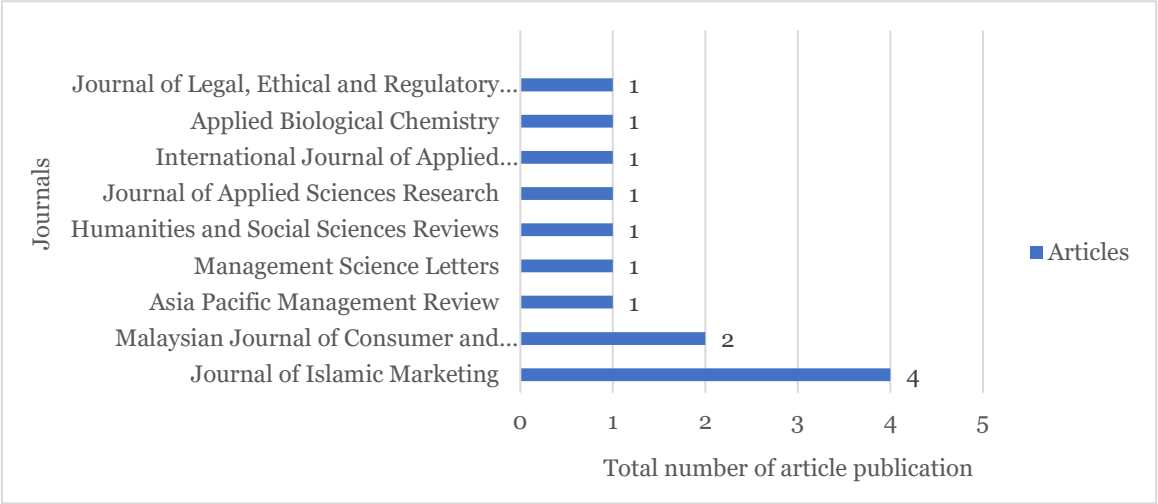

Figure 13: Halal cosmetics articles published in journals (from 613 articles on cosmetic products).

size of the halal cosmetics market increases exponentially year on year. Researchers, particularly Muslim researchers need to conduct more research on halal cosmetics and publish in reputable journals so that the knowledge about halal cosmetics can be rapidly disseminated globally. Such knowledge serves as the foundation for the effective development of halal industry practices that serves the needs and concerns of Muslims. This knowledge is essential given that Muslims' needs and requirements regarding cosmetics generally differ from those of non-Muslims, for instance, in terms of the requirements of the ingredients that can be used, processing methods, packaging, transportation, and delivery to consumers, all which must follow the Islamic law.

The findings of this study contribute toward enriching the body of knowledge on cosmetic products by reporting the publication trends of published articles and highlighting the main themes in cosmetic products research over time. This understanding provides avenues through which to identify specific research gaps that could guide future research. To date, most cosmetic product research has come from a natural science perspective, focusing on sample preparation, toxicity of raw materials, and flow injection analysis. Based on the findings of this bibliometric analysis, research on cosmetic products from the social science perspective can be said as less developed. Collaboration between natural science and social science researchers is highly recommended as their research and perspectives could complement each other. In particular, future researchers should focus on providing new knowledge to mitigate issues with existing cosmetic products, among others, products that could be dangerous or harmful for human consumption. For this purpose, halal cosmetics, which concept addresses issues of prohibition of harmful and non-clean ingredients (as per halal requirements), as well as hygiene and processing aspects, would be an excellent area for future research and exploration.

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