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A REVIEW OF THE HALAL STATUS OF CERAMIDE IN COSMETICS: A STRATEGIC APPROACH TO HALAL POLICY AND CONSUMER AWARENESS IN INDONESIA

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Nazih Basuki[1], Rista Yulianti[1], Oman Fathurrohman SW[2], Nina Salamah[3]*
[1]Faculty of Pharmacy, Universitas Ahmad Dahlan, Yogyakarta, Indonesia
[2]Faculty of Islamic Studies, Universitas Ahmad Dahlan, Yogyakarta, Indonesia
[3]Ahmad Dahlan Halal Center, Universitas Ahmad Dahlan, Yogyakarta
*Corresponding author: nina.salamah@pharm.uad.ac.id

ABSTRACT

In cosmetics, ceramide plays a significant role in maintaining healthy skin. However, ensuring its halal status remains challenging because ceramide can be sourced from animals, plants, microbial fermentation, or chemical synthesis, each presenting its own halal-critical points. With the growing demand for halal cosmetics in Indonesia and mandatory halal certification for raw materials and finished products, special attention is required to maintain consumer trust. This study employed a literature review by analyzing registration data of ceramide-based cosmetic products from the Indonesian Food and Drug Authority (BPOM) and halal certification data from the Halal Product Assurance Organizing Agency (BPJPH). The review aimed to identify compliance gaps, examine halal policies, and understand the critical halal points in ceramide production. The analysis shows 74.52% of ceramide-based cosmetic products registered with BPOM do not have halal certification. Regulatory factors, consumer awareness, and halal raw material supply chain constraints influence this shortfall. Ceramide derived from animal sources poses the greatest challenge, whereas microbial fermentation and chemical synthesis offer greater potential for halal compliance if properly supervised. Collaboration among BPJPH, BPOM, and the Ministry of Trade is crucial to ensure compliance. Moreover, mandatory halal requirements on raw materials before the final product stage are essential to guarantee comprehensive halal assurance. Institutional synergy, public education, and improved access to halal raw materials are strategic measures to support Indonesia's halal cosmetics industry. This study provides strategic guidance for regulators and industry players in addressing challenges related to halal regulations for ceramide-based cosmetics.

Keywords: Ceramide, Halal Cosmetics, Halal Mandatory, Halal Certification, Halal Critical Point

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INTRODUCTION

Cosmetics have become an important element in the daily lives of modern society, not only to enhance appearance but also to maintain skin health and self-confidence. According to Indonesian Minister of Health Regulation No. 445 of 1998, cosmetics are preparations or combinations of ingredients that are ready for use on the outer parts of the body (epidermis, hair, nails, lips, and external genital organs), teeth, and oral cavity to clean, enhance attractiveness, alter appearance, protect to maintain good condition, and improve body odour, but are not intended to treat or cure a disease. In Indonesia, the cosmetics industry continues to show significant growth, in line with increasing public awareness of the importance of skin care, technological innovations in product formulation, and the influence of global trends. Law No. 33 of 2014 on Halal Product Guarantees mandates that every product, including cosmetics, obtain halal certification before being distributed

on the market. This certification assures Muslim consumers that the product is free from prohibited or questionable ingredients, while also promoting responsible business practices.

Over the past five years, the halal cosmetics market has shown promising prospects both globally and nationally. According to a report cited by Koswara and Herlina (2025), the global halal cosmetics market is estimated to reach USD 47.76 billion in 2024 and is projected to increase to USD 115.03 billion in 2032, with an average annual growth rate (CAGR) of 11.67% (Fortune Business Insights, 2024). This figure reflects a surge in demand for certified halal products and consumer expansion beyond Muslim-majority countries. Interest in halal cosmetics is not only growing in Muslim countries such as Indonesia, Malaysia, and the United Arab Emirates, but also significantly in non-Muslim regions such as Japan, South Korea, and Slovakia (Koswara & Herlina, 2025). This growth is not solely driven by religious factors, but also by increasing consumer preference for ethical products—cruelty-free, environmentally friendly, and responsibly produced (Ahmed, 2024). Therefore, this trend opens up great opportunities while also requiring industry players to maintain comprehensive halal standards, including for active ingredients such as ceramides, which are now widely used in modern cosmetic formulations.

Ceramide is a lipid component that plays an important role as a permeability barrier, strengthening the skin's protective layer. (Nojiri *et al*., 2018). Ceramides are widely used in skincare products such as moisturisers, serums, and anti-ageing creams due to their ability to lock in moisture and prevent skin damage (Lueangarun et al., 2019: Jinchang et al., 2024). However, the critical point in the context of ceramide's halal status lies in its source and production process. Ceramide can be obtained from animal sources such as pigs or cows, as well as from plant-based materials such as soybeans (Amalia & Tsai, 2023). This creates challenges in ensuring that ceramides used in halal cosmetics do not originate from prohibited (haram) or questionable (syubhat) ingredients. The halal status of ingredients such as ceramides is not only a regulatory requirement but also reflects the moral responsibility of businesses towards Muslim consumers. In this context, evaluating the commitment of businesses in implementing halal policies is essential. This includes providing halal sources of ceramide raw materials and monitoring the production process. In addition, educating the public is also important to raise awareness of the importance of choosing halal cosmetic products that not only meet religious requirements but also safety and transparency standards.

In the implementation of halal policies, policy or regulatory risks play the most significant role in non-compliance with halal policies, followed by supply chain or raw material risks, market demand risks, production risks, and third-party service risks (Khan *et al*., 2022). This study discusses regulatory risks, raw material risks, and market demand risks in the implementation of halal cosmetics policies with highly critical ingredients such as ceramide. This study is expected to contribute to strengthening halal policies in Indonesia, particularly in the cosmetics industry. Through public education, this study aims to raise awareness of the importance of choosing halal ceramide-based products by understanding the critical points of halal certification. For businesses, this research offers strategic guidance to ensure product halal compliance through the selection of appropriate raw materials and halal certification processes. Additionally, this research provides recommendations to regulators to evaluate and strengthen the implementation of halal policies, thereby creating a more responsible, transparent, and Islamic-values-aligned cosmetics industry ecosystem.

METHODOLOGY

This study uses a literature review method to analyse the compliance gap among businesses regarding halal cosmetics policies for ceramide-based products, which are considered highly critical from a halal perspective. Data on cosmetic products with the keyword ceramide registered with the Indonesian Food and Drug Administration (BPOM) were compared with halal certification data from the Halal Product Guarantee Agency (BPJPH) to identify gaps between product registration and halal certification compliance. In addition, a literacy study was conducted to explore information on issues related to aspects that influence halal certification compliance for cosmetic products sourced from raw materials and the ceramide biosynthesis process, as well as data on ceramide raw materials that have been recognised as halal by BPJPH, the Foreign Halal Certification Agency (LSHLN), and the Indonesian Ulema Council (MUI). This study also includes an analysis of halal policies and regulations

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in Indonesia, including government regulations and MUI fatwas, to understand the legal basis and implementation of halal policies. This approach aims to provide a comprehensive overview of the challenges and opportunities in implementing halal policies for ceramide-based cosmetic products, as well as offering strategic recommendations for businesses and regulators.

RESULTS & DISCUSSIONS

Analysis of Halal Policies in Indonesia

Halal certification is a recognition of the halal status of a product issued by the National Halal Product Certification Agency (BPJPH) based on a written halal fatwa or a determination of the halal status of the product by the Indonesian Ulema Council (MUI), Provincial MUI, Regency/City MUI, Aceh Ulema Consultative Assembly, or the Halal Product Fatwa Committee. (PP No 42 of 2024). Policies related to halal product certification are regulated through legislation and government regulations to ensure that all products on the market meet halal standards in accordance with Islamic law. The legal basis for halal policy in Indonesia is as follows:

1. Law Number 33 of 2014 concerning Halal Product Guarantee
2. Government Regulation No. 42 of 2024 replacing Regulation No. 39 of 2021 concerning the Implementation of Halal Product Guarantee
3. Ministry of Religious Affairs Regulation No. 26 of 2019 concerning the Implementation of Halal Product Guarantee
4. Decree of the Minister of Religious Affairs (KMA) No. 982 of 2019 concerning Halal Certification Services

The halal certification process in Indonesia is carried out through the submission of applications by business operators via the Sihalal application, auditing and verification by BPJPH, and the issuance of halal certificates if the requirements are met. In the implementation of halal policy in Indonesia, cosmetics are a type of product that must be halal certified from 17 October 2021 to 17 October 2026. During the implementation period for products that are required to be halal certified, BPJPH guides businesses that produce products that are required to be halal certified, and BPJPH works with other stakeholders and the community to create conditions that encourage the improvement and development of the business climate in Indonesia (PP No 42 of 2024).

In assessing the halal status of products, the criticality level of an ingredient is categorised into three levels: non-critical ingredients, critical ingredients, and highly critical ingredients (Decision of the Head of BPJPH No. 57 of 2021). Ceramides are classified as highly critical ingredients because they have the potential to originate from, contain, or be mixed with haram ingredients, while the highly critical category applies to ceramides derived from animals. In the implementation of the Halal Product Assurance System (SJPH), every product that uses critical or highly critical ingredients in its production process must have a halal certificate.

This study aims to identify the gap between the cosmetic product registration process and halal certification compliance. The identification was carried out by comparing data on cosmetic products with the keyword ‘ceramide’ registered on the BPOM registration page during the period from July 2023 to December 2023 with halal certification data on these products at the Halal Product Guarantee Agency (BPJPH). Based on this identification, it was found that 25.48% of cosmetic products containing ceramide had a halal certification number, while products without a halal certification number reached 74.52% (Table 1).

Table 1. Data on the Identification of Halal-Certified Ceramide Cosmetic Products

Data Source	Quantity
Ceramide Cosmetics with BPOM Certification	259
Ceramide cosmetics registered with BPJPH	66 (25,48%)
Ceramide Cosmetics not registered with BPJPH	193 (74,52%)

This data indicates that the halal status of most ceramide-based cosmetic products on the market is still questionable. Several risk factors affect the level of compliance in the implementation of halal policies on products, including regulatory risk, raw material risk, market risk, production risk, and third-

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party risk. Raw material risks often arise due to several factors, such as suppliers' failure to provide halal-certified raw materials, suppliers' inability to ensure that the raw material production process is fully compliant with halal principles, and the high cost of halal-certified raw materials (Khan *et al*., 2022). In addition, in the process of procuring raw materials, suppliers sometimes require a minimum purchase quantity to provide supporting documents, such as halal certificates for raw materials. This poses an additional challenge for businesses in ensuring compliance with policies.

Cosmetic and pharmaceutical raw materials are also a point of consideration in the implementation of halal policies in Indonesia. The mandatory halal policy for chemical raw materials is an urgent strategic step in supporting the development of halal products, particularly in the cosmetics sector. According to Government Regulation No. 42 of 2024, cosmetic raw materials are included in chemical products that are subject to mandatory halal certification from 17 October 2021 to 17 October 2026. Halal raw materials should be implemented first before the mandatory policy on end products is enforced. Without halal assurance on raw materials, the implementation of halal for cosmetic products becomes ineffective and risks damaging consumer confidence in halal certification. The alignment of the mandatory implementation of raw materials with halal cosmetic products in 2026 presents a major challenge for the industry to ensure comprehensive compliance, from supply chain to production, to meet integrated halal standards from upstream to downstream.

Based on data from the BPJH website, only three ceramide raw materials are listed as halal ingredients, a number that is vastly disproportionate to the increasing demand for ceramide in Indonesia. Meanwhile, information from LSHLN accessible via the internet shows that only nine ceramide raw materials have halal certification (Table 2). This situation is a serious concern in the application of halal certification for cosmetic products containing ceramide, as it can be a significant obstacle in the halal certification process, especially with the increasing market demand for halal cosmetic products.

The gap between the high number of ceramide-based products and the limited availability of halal raw materials reflects a serious supply crisis. Currently, there are only three ceramide raw materials certified as halal by the BPJPH and nine by the Foreign Halal Certification Agency (LSHLN), so local industry players face a major challenge in meeting certification requirements before the mandatory halal deadline in 2026. This situation has the potential to trigger a surge in production costs, delays in product launches to the market, and open opportunities for dominance by foreign manufacturers who have already established halal supply chains. To overcome this, the government needs to play an active role in promoting raw material substitution programmes through research and development (R&D) incentives, cross-border cooperation, and accelerated accreditation of imported materials based on a fast-track scheme.

In facing the limited supply of halal ceramide raw materials, innovative breakthroughs are needed to address the challenge of availability while ensuring sharia compliance. One promising approach is the use of microbial fermentation technology. Compared to other sources of ceramide, microbial fermentation is the most promising option for meeting halal standards. This method allows for complete control over raw materials from the outset, including the selection of microorganisms and fermentation media that are free from impurities. In addition, the fermentation process is more adaptable to halal material engineering and can be optimized using cutting-edge biotechnology such as CRISPR and bioenzymatic synthesis (Jinchang *et al*., 2024: Zhang et al., 2025). With these advantages, development and investment in this production line is a strategic step to strengthen the halal cosmetics industry in Indonesia, especially in the face of increasingly stringent deadlines for active ingredient certification.

Although innovations such as microbial fermentation offer strategic solutions, the availability of halal raw materials in the industry remains highly dependent on regulatory systems and import policies. Without harmonized regulatory support, efforts to substitute halal materials at the production level will not be effective enough to meet the needs of the industry at large. The Minister of Trade, through Permendag No. 36 of 2023 concerning Import Policies and Regulations, has not yet included requirements for chemicals and pharmaceuticals circulating in Indonesia to attach halal certificates from recognized LSHLN, or the obligation to obtain halal certificates before these materials are distributed in Indonesia. This is an important input for enhancing synergy between the Ministry of Trade of the Republic of Indonesia, the Ministry of Religion, and the BPJH in implementing halal compliance

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from the source. With this synergy, domestic cosmetic companies will find it easier to select halal raw materials, thereby supporting compliance with halal policies in final products effectively and efficiently.

Ahead of the implementation of mandatory halal certification in 2026, the national cosmetics industry still faces various readiness challenges. The majority of businesses, especially small and medium-sized enterprises, do not yet have adequate access to technical information related to critical active ingredients such as ceramides, as well as halal certification procedures and mechanisms. KNEKS data (2023) shows that more than 60% of cosmetics manufacturers have not yet started the active ingredient certification process, reflecting a real gap between the regulations set and the capacity for implementation in the field. To anticipate delays and potential mass non-compliance, accelerated measures are needed in the form of technical assistance, standardized training, and digitization of the audit process and certification application.

The implementation of active ingredient-based halal policies cannot run optimally without solid institutional synergy between stakeholders. BPJPH, as the main halal certification authority, plays an important role in setting standards and issuing certificates. On the other hand, LPPOM MUI and LSHLN play a role in the technical verification and auditing of the processes and ingredients used. The Ministry of Trade is responsible for regulating the flow of imported raw materials, while the Ministry of Industry and the Ministry of Research and Technology have a role in promoting raw material independence through incentive policies and technological innovation. Industry players, especially MSMEs, are at the forefront and are most affected by the effectiveness of this coordination. Unfortunately, no integrated mechanism ensures comprehensive harmonisation of work between these institutions. Therefore, the formation of a cross-ministerial task force and halal industry association is essential to accelerate policy harmonisation, streamline certification procedures, and expedite the adoption of strategic halal raw materials such as ceramides. The delay of cosmetic industry players in fulfilling their halal certification obligations by the deadline of 17 October 2026 risks causing serious economic and social impacts. Legally, products without halal certification will not be allowed to circulate in the domestic market, as stipulated in Law No. 33 of 2014 concerning Halal Product Guarantee. The consequences include product recalls, distribution stoppages, and administrative sanctions that directly disrupt business continuity and reduce revenue. From the consumer side, increasing halal literacy, especially among the younger Muslim generation, has made the halal label a major consideration in purchasing decisions. Products without certification risk losing market trust, even in countries with a Muslim majority such as Indonesia. This situation also opens opportunities for imported products from countries that are better prepared in terms of halal certification systems and halal raw material supply, such as Malaysia and South Korea. Global Data (2023) reports that cosmetics manufacturers in the Middle East who failed to adapt to halal policies experienced a margin decline of up to 30% in the first two years since the regulation was implemented. Therefore, compliance with halal certification is not only normative but also an important prerequisite for business sustainability and the competitiveness of the national cosmetics industry.

Table 2. List of Halal-Certified Ceramide Raw Materials

Product Name	Manufacture	Halal Certification Body
Ceramide	Shaanxi Youbio Technology Co., Ltd.	BPJPH
Ceramide	Hangzhou Xinfu Science & Technology Co.,Ltd.	BPJPH
CERAPLEX Series	Sunjin Beauty Science Co.,Ltd.	BPJPH
CERACARE AC45	Biochempro	CICOT
Actosome InoCeramide C06	Biochempro	CICOT
CERACARE H30S	Biochempro	CICOT
Ceramide	Pure Chemical	CICOT
Ceramide	Nextech	CICOT
Ceramide	MB Chem Co., Ltd	CICOT
Ceramide E	Spec Chem	CICOT
Ceramide III	XL-life	CICOT

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CeraSkin C3Br	Jebsen & Jessen Ingredients	CICOT

Halal Status of Ceramide Raw Materials

Ceramides are complex lipid molecules composed of fatty acids and sphingosine, naturally found in the human skin, particularly in the stratum corneum (Amalia & Tsai, 2023). This molecule plays an important role in maintaining the skin's protective function (skin barrier), retaining moisture, and protecting the skin from damage caused by environmental exposure (Jinchang *et al*., 2024). As an essential component in skin care, ceramides are often used in cosmetic products to repair dry skin (Moore & Rawlings, 2017), reduces signs of ageing and improves skin elasticity and moisture levels (Kono *et al*., 2021)**.**

Ceramides can be produced through various methods, including natural extraction from animal and plant sources, chemical synthesis, and microbial fermentation. Each method has its own advantages and challenges, particularly in ensuring the halal status of the final product. Therefore, it is important to understand the production process of each source and identify critical halal points as part of the evaluation in implementing halal product policies.

1. Animal Ceramide

   Animal-derived ceramides can be obtained from pig skin, cow brains, and eggs (Jinchang *et al*., 2024). In addition, ceramides can also be produced from animal fats, such as beef and sheep. The part that is utilized is animal fat that is rich in lipids, such as oleic acid, palmitic acid, and stearic acid. This fat then undergoes a purification process to separate complex lipids from other components, such as triglycerides and free fatty acids, thereby producing ceramides with a high level of purity (Zhu *et al*., 2023). Critical points regarding the halal status of animal-derived ceramide raw materials include the use of pigs as raw materials and the method of slaughtering animals, which must comply with Islamic law to ensure halal status.
2. Plant-derived Ceramide

   Plant-derived ceramides can be extracted from plants such as soybeans, rice, apples, and wheat using solvents such as isopropanol, n-hexane, and water. The initial extraction process involves combining the solvent with dried plant material, which is then separated to produce a lipid extract containing glucosylceramide (Reisberg *et al*., 2017). Ceramide extraction from plants can also be carried out by soaking plant parts in a 95% ethanol solution with a volume five times the weight of the material. The extraction process is carried out using an ultrasonic device at a frequency of 40 kHz, a power of 360 W, and a temperature of around 50 °C. The resulting extraction solution is filtered and concentrated using a rotary evaporator, then separated using petroleum ether. Finally, the extract is dried in a vacuum drying box at a temperature of 60–70 °C until ceramide is obtained. (Gambar II) (Wang et al., 2022: Yamashita et al., 2021). The critical point of halal compliance in this process lies in the solvent used. The use of ethanol in solvents must be ensured not to originate from the alcohol industry, and as far as possible, there should be no residual ethanol in the raw materials produced. According to the Indonesian Ulema Council's Fatwa No. 11 of 2018, the use of alcohol or ethanol in cosmetic products is permitted without any restrictions on the amount, provided that the ethanol does not originate from the alcohol industry, whether through chemical synthesis from petrochemicals or non-alcoholic fermentation, and does not cause any harmful medical effects.
3. Microbial Fermented Ceramide

   Ceramides can also be produced using microbial fermentation processes. The process of producing ceramides through microbiological fermentation begins with the use of L-serine and carbon sources as raw materials. Microorganisms such as yeast are used to produce the basic compounds of ceramides, namely Long Chain Bases (LCBs) and Fatty Acids (FAs), through fermentation and genetic engineering optimization. The fermentation product is then further processed with an enzyme catalyst to form ceramide as the final product ready for use. (Jinchang et al., 2024)

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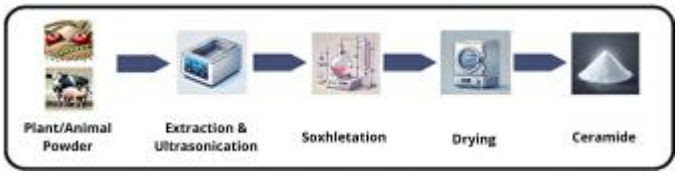
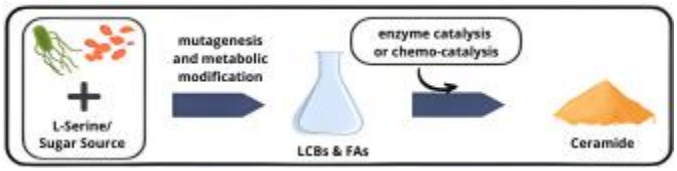
Ceramides produced through microbial fermentation, particularly by *Wickerhamomyces ciferrii*, have several advantages. This process is environmentally friendly, sustainable, and suitable for large-scale production because these microbes naturally produce tetraacetyl phytosphingosine (TAPS), an important precursor to ceramide. In addition to avoiding the complicated extraction process from plants, this method also produces more stable and higher-quality ceramide. However, the production of ceramide through fermentation requires genetic engineering, fermentation process optimization, and further purification stages (Zhang et al., 2025).

In the ceramide production process (Figure 1), the main critical points lie in the type of microbial media, genetic engineering, and enzymes used. Microbial media and genetic engineering must be ensured to contain no non-halal ingredients, such as blood, human body parts, or non-halal animal body parts (Kurniati & Hafsan, 2022: Jumiono et al., 2024). Meanwhile, the source of the enzymes used must also be verified to ensure that they do not originate from animals that do not meet halal standards. The types of enzymes that can be used can be derived from plants such as papain, bromelain, amylase, and ficin.

a) Production Process of Plant-derived/Animal Ceramide



b) Production Process of Microbial Fermented Ceramide



c) Production Process of Chemical Synthesis Ceramide

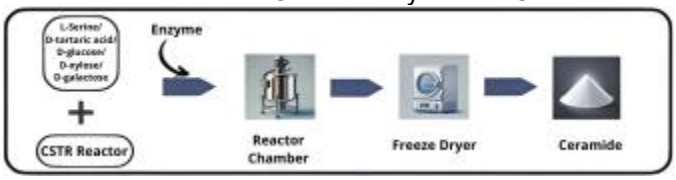


Figure 1. Ceramide Production Process

4. Ceramides from Chemical Synthesis

The production process of ceramide through chemical synthesis uses raw materials such as L-serine, D-glucose, D-xylose, and D-galactose. These materials are processed using two methods, namely a one-step and a two-step method. In the single-stage method, the raw materials are directly converted into ceramide through a reactor and/or enzymatic catalysis. Meanwhile, in the two-stage method, the raw materials are first converted into Long Chain Bases (LCBs) and Fatty Acids (FAs), then reacted using enzymes to form ceramide (Jinchang *et al*., 2024). The critical points in the production process of ceramide using chemical synthesis are the enzyme source and the reactor used in the manufacturing process.

In addition, ceramide can also be produced from L-threonine through an amidation reaction with fatty acids using EDC and HOBt reagents. The hydroxyl group on L-threonine is modified, then the reaction product is purified by chromatography and characterized using NMR and LC-MS to confirm the structure of the compound. produced from L-threonine through an amidation reaction with fatty acids using EDC and HOBt reagents. The hydroxyl group on L-threonine is modified, then the reaction product is purified by chromatography and characterized using NMR and LC-MS to confirm the structure of the compound. In general, the production of ceramides through synthetic pathways has the advantage of being able to

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modify molecular structures with precision, enabling the development of various ceramide analogues according to functional requirements. This process is also independent of microorganisms or enzymes, making it more flexible in terms of reaction control and suitable for bioactive molecular research. However, this pathway has several disadvantages. The process consists of multiple reaction steps (multistep), requiring special chemical reagents and potentially hazardous organic solvents. Additionally, the reaction often produces by-products, necessitating intensive purification methods such as chromatography. Its conversion efficiency is low, and it generates significant chemical waste, making it less environmentally friendly and less ideal for large-scale production compared to microbial fermentation methods (Liu et al., 2019).

Three main approaches in the ceramide production process, distinguished based on the source of materials and methods used, namely from plant/animal materials, through microbial fermentation, and using chemical synthesis, are presented in Figure 1.

Market Aspects of Halal Products

Public knowledge about halal products still varies. A small portion of the public considers halal certification important, but the majority considers it non-essential. This shows a low level of awareness regarding the importance of halal certification. Many Muslim consumers rely more on their personal perception of a product's halal status than on formal evidence such as halal certification, so that certification is often considered merely an added value rather than a primary requirement (Anas *et al*., 2023).

According to research conducted by Yanti and Darwanto, halal labelling on cosmetic products has no significant effect on the purchasing interest of Muslim female students at Diponegoro University. Respondents generally do not consider halal labelling to be a major factor in choosing cosmetic products, mainly due to the difficulty of accessing halal-labelled products. As a result, the presence of halal labelling on cosmetics does not influence their purchasing decisions (Dewi Yanti, 2021).

Indonesia, as a country with a Muslim majority (87%) and a female population of 134.27 million, has great potential as a market for halal products. However, although the concept of halal often attracts consumer attention, its application is more effective in food and beverages than in cosmetics. Consumers pay more attention to halal labels on food because they are considered to have a direct impact on the body, while halal-labelled cosmetics are less of a priority because the quality and safety of non-halal products are considered equivalent or better (Dewi Yanti, 2021).

This study is consistent with previous studies. Intansari (2019) found that respondents only considered halal cosmetics if there were promotions or discounts, but did not make them their first choice. Consumers place more importance on the halal status of food than cosmetics, because food has a more significant direct impact on the body than cosmetics. This reflects consumers' low awareness of the importance of halal labelling on cosmetic products (Abd Rahman *et al*., 2015).

The low level of public understanding of the importance of halal products, especially cosmetics, has resulted in minimal market demand for halal-certified products. This situation has also contributed to the low level of compliance among cosmetics businesses in implementing halal certification, due to a lack of consumer demand to prioritise halal products. The government needs to respond to these findings by increasing public education and understanding through creative, engaging, and efficient outreach. This can be done through digital campaigns, cross-sector collaboration, and the provision of easily accessible information. In this way, it is hoped that consumer awareness will increase, market demand for halal products will grow, and businesses will be more motivated to comply with halal certification standards.

In an increasingly competitive global cosmetics industry landscape, halal labelling is now seen not only as a form of compliance with religious principles, but has also become a strategic added value in marketing (Mutafarida *et al*., 2019). For Muslim consumers, halal certification provides assurance and encourages brand loyalty (Anggraini & Suryoko, 2018). Meanwhile, some non-Muslim consumers associate halal labels with hygienic, safe, and environmentally friendly product standards (Purwanto *et al*., 2020). Dewi Yanti's (2021) findings show that more than a third of non-Muslim consumers in

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Europe are interested in using halal cosmetics for ethical reasons and perceptions of quality. This indicates that the halal market reaches a wider audience, not limited to Muslim consumers, but also includes those who care about sustainability and social responsibility.

On the other hand, digital transformation has also strengthened awareness and preference for halal products, especially among the younger generation. Muslim Gen-Zers in Southeast Asia show an increasing tendency to choose beauty products that are not only effective but also in line with values such as halal, sustainability, and social justice. According to a Nielsen study (2023), 65% of Muslim consumers aged 18–29 years old trust halal products promoted through educational and authentic digital campaigns. The presence of Muslim beauty influencers, halal cosmetics review content on social media, and halal product search applications also influences purchasing behaviour (Bisri, 2022). Therefore, value-based marketing strategies are an important element in strengthening brand positioning and expanding the market reach of halal cosmetics in the digital age.

Halal Raw Material Independence Strategy

The independence of the halal cosmetics industry is not solely determined by regulatory readiness and market preferences, but also depends heavily on strategic measures such as innovation capacity in the development of safe and verified halal active ingredients as a means of import substitution (Gunawan *et al*., 2022). Ceramide is a clear example of this challenge. To date, most ceramides on the global market are still produced by countries with advanced biotechnology capabilities, and many of them do not yet have halal certification or production systems that comply with sharia principles. This dependence poses a significant obstacle, particularly for domestic industry players and MSMEs, in obtaining consistent and affordable halal active ingredients.

To overcome these obstacles, structured and sustainable research and technological innovation are needed, such as the biosynthesis of ceramides using halal microorganisms, such as Saccharomyces cerevisiae and Lactobacillus plantarum, chemical synthesis, and phytoceramides, while still paying attention to the critical points of each ceramide production process. Modern fermentation technology allows for strict monitoring of raw materials, culture media, and enzymes used, thereby ensuring halal compliance from the outset. The application of techniques such as CRISPR and bioenzymatic synthesis is are crucial factor in improving the efficiency of high-quality halal ceramide production (Jinchang et al., 2024: Zhang et al., 2025). Furthermore, strengthening the research ecosystem also requires close collaboration between research institutions, academics, and industry. One strategy that can be implemented is the establishment of an integrated halal innovation centre that not only functions as an incubator for active ingredient technology but also as a coordination hub with certification authorities, regulators, and upstream and downstream industry players. Similar practices have been successfully implemented in South Korea and Malaysia through institutions such as the Halal Industry Development Corporation (HDC) and the Korea Halal Authority (KHA), which actively facilitate collaborative research based on halal ingredients. Indonesia can apply a similar model through synergy between BRIN, BPJPH, KNEKS, as well as the private sector and state-owned biotechnology companies.

Going forward, the potential for developing halal active ingredients is not limited to ceramides. Other ingredients, such as niacinamide, hyaluronic acid, alpha hydroxy acid (AHA), and peptides, also have great potential for local development. Therefore, a downstream-based and import substitution national strategy needs to prioritize the halal active ingredients industry in its applied research agenda. Support in the form of fiscal incentives, research funding, and accelerated accreditation for local innovations will be the main drivers for increasing the competitiveness of halal products in both domestic and global markets. Strengthening innovation will not only address the challenges ahead of the implementation of mandatory halal certification in 2026 but also lay the foundation for the long-term sovereignty of Indonesia's halal cosmetics industry.

CONCLUSIONS

The implementation of halal certification policies in the cosmetics industry, particularly for critical active ingredients such as ceramides, requires genuine synergy between the government, businesses, and the public. The main challenges lie in the lack of harmonisation between regulations across

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agencies and the limited availability of accredited halal raw materials. Therefore, the certification of raw materials should be the main focus before the final product, so that the verification process is more structured and efficient. In this regard, coordination between the BPJPH, BPOM, and the Ministry of Trade is crucial to harmonise aspects of certification, distribution, and supervision of imported and local ingredients. For industry players, understanding the critical points of ceramide halal certification must be a priority. The source of ingredients, production methods, and supply chains determine a valid halal status. On the other hand, consumers also play an important role in encouraging industry compliance by increasing literacy and preference for halal products. Public education—especially among the younger generation—must be strengthened so that halal labelling is not only seen as an added value, but as an integral part of religious awareness and ethical consumption. To address the challenge of raw material supply, technological innovation is key. The development of halal ceramides based on microbial fermentation and biotechnology, such as CRISPR, is a strategic solution that needs to be facilitated through applied research, cross-sector collaboration, and policy incentives. In addition, the establishment of halal innovation centres and the acceleration of local active ingredient accreditation will strengthen the independence of the national industry. Overall, halal policy is not only about regulation and administrative compliance, but also touches on aspects of the industrial ecosystem, market awareness, and technological sovereignty. If these three elements can be harmoniously integrated, Indonesia has a great opportunity to become a major player in the global halal cosmetics industry, while also meeting the 2026 deadline with comprehensive readiness from upstream to downstream.

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