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Navigating the Halal Food Ingredients Industry: Exploring the Present Landscape

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Abstract

Due to their religious obligations, Muslims strongly believe that halal food ingredients are crucial to protecting their health and faith. As a result, the halal food ingredient industry is growing very rapidly. This review focuses on the latest trends and advancements involving halal food ingredients. In this review, halal certification and the standards governing the production of halal ingredients are discussed. The latest technological developments for authenticating and tracking halal components are also brought up in this review. It addresses the impact of halal ingredient manufacturing on the environment, promotes social responsibility, and places emphasis on procuring ingredients sustainably and ethically. It also examines customer awareness and preferences and the marketing of halal food ingredient brands. In conclusion, this study analyses the current condition of halal food ingredients and emphasises the importance of continuous improvement and adaptation to fulfil the requirements set out by the customers. By navigating the market for halal food ingredients, those involved should ensure that Muslim customers everywhere have access to items that are authentic and in compliance with relevant standards.

1. Introduction

Halal food ingredients are the components and substances used in producing food products that are considered permissible and in accordance with Islamic dietary laws. The term 'halal' originates from Arabic, which means 'lawful' or 'permissible'. It encompasses a set of guidelines derived from the teachings of the *Qur'an* and the *Hadith*. While halal primarily pertains to the consumption and preparation of meat, its scope extends beyond the absence of pork in food products. It also applies to various food ingredients and additives (Nazaruddin *et al.*, 2023). The significance of halal food ingredients lies in their adherence to Islamic dietary laws, which hold great importance in Muslims' religious and cultural practices. For Muslims, halal food is not just about physical nourishment but also a spiritual practice (Suleman *et al.*, 2021). It is seen as an act of obedience and submission to the commands of Allah as outlined in the *Qur'an* and the *Hadith*.

The halal industry is experiencing rapid global expansion, extending beyond its traditional consumer base of 1.8 billion Muslims (Akram, 2022). It has become a market of interest for non-Muslims as well. Various countries such as China, Thailand, Indonesia, Singapore, Korea, the Philippines, and Australia have recognized the potential of this market and have made significant progress in tapping into it, even in non-Muslim-majority countries. Brazil, Australia, New Zealand, Italy, India, and Germany are among the top ten in the Global

Islamic Economy Indicator (GIEI) score for different halal sectors (Azam & Abdullah, 2020). The global demand for halal food products has steadily increased due to the growing Muslim population, globalization, and the rising awareness and preference for halal-certified products among Muslims and non-Muslims. In 2022, the halal food industry experienced remarkable growth, with the global market size reaching US\$2,221.3 billion. The IMARC Group predicts continued expansion, with the market expected to reach an impressive US\$4,177.3 billion by 2028. This projection signifies a compound annual growth rate (CAGR) of 10.8% from 2023 to 2028, highlighting the positive trajectory of the halal food industry (imarcgroup.com, 2022).

Ensuring Muslim consumers have access to food choices that align with their dietary requirements is crucial, and halal certification plays an important role. It is a reliable confirmation that the food meets the criteria outlined in Islamic law, including ingredients sourcing, preparation and processing methods, and the absence of prohibited substances or additives. Aside from religious obligations, halal food must adhere to safety standards such as Hazard Analysis Critical Control Points (HACCP) and Good Manufacturing Practices (GMP). To ensure effective halal certification, the certifying body must possess technical competence and expertise to verify compliance with religious requirements and food safety standards (Abdallah *et al.*, 2021). Such measures ensure that halal food products are safe, hygienic and free from harmful entities or contaminants. By integrating food safety practices

into the certification process, halal certification reinforces the idea that halal is not just about religious compliance but also about maintaining high-quality and safe food products. This article provides a detailed overview of the halal food ingredients industry, presenting a broad understanding of its present condition. It is a valuable reference for industry experts and researchers who wish to remain informed about the latest advancements and emerging patterns within this thriving field. The information for this review is obtained primarily from secondary sources, including journals, books and electronic media such as Google Scholar, ResearchGate, and other related official websites.

2. Halal certification and regulatory framework in Malaysia

The issue of halal certification is currently a global concern. Halal has been incorporated into governmental regulations in both nations with a majority Muslim population and nations with a small Muslim population. This is due to the fact that halal concerns both religious teachings and people's freedom to practice their religion. Consuming halal food, beverages, medicines, cosmetics, and other products is required for Muslim consumers as it is a religious principle that must be upheld (Kohilavani *et al.*, 2021). However, the world of halal is not only limited to consumable items like toiletries, food, pharmaceuticals, cosmetics, and financial services, but it is also crucial in ensuring the status of halal from the beginning of origin and throughout the supply chain process, encompassing logistics activities (Majid *et al.*, 2019).

Halal certification has been a valuable tool for Muslim consumers by providing them with the information they need to make an informed decision, giving industries a marketing tool, establishing the supply and sale of more halal-certified products, stimulating the growth of more halal enterprises, and providing regulatory bodies with a means of enforcing the law. Halal certification ensures Muslims can consume the products per the *Shari'ah* law (Al-Teinaz *et al.*, 2020; Sulaiman *et al.*, 2019). The Malaysian Halal Certification Programme is separated into nine schemes, and manufacturers or businesses can select the plan they want to utilise based on the kind of product or service they have. Food and drink, cosmetics, pharmaceuticals, restaurants or hotels, consumer products, logistics, slaughterhouses, OEM (original equipment manufacturer), and medical devices are among the schemes. As a result, businesses related to the schemes mentioned can seek halal certification for their products or services (Saiman & Yusma, 2022). According to Mokti *et al.* (2022); Saiman & Yusma (2022); and Sulaiman *et al.* (2019), the halal certification procedure typically starts when applicants submit their applications to the Halal Certification Body. Before going through the halal inspection process, the halal Certification Body will evaluate and confirm the application. The application will then be presented to the halal certification panels during a specific meeting, along with all the compliance proof acquired during the halal inspection. The application's approval or rejection status is determined at the halal inspection phase. Afterwards, the relevant applicant receives a halal Certificate and logo after meeting all conditions and having the application for halal certification approved by the halal certification panels. The authority will supervise the holder of the halal certificate during the final stage of certification to ensure they abide by the certification guidelines. The Manual Procedure for Malaysia Halal Certification (MPPHM) (Domestic) 2020 outlines particular regulations that must be followed by all parties participating in the Malaysia halal certification system and provide a description of the halal certification system's

procedure. Figure 1 summarises the Malaysia Halal Certification Process flow according to MPPHM (Domestic) 2020. Muslim consumers can be confident that whatever products and services they consume are in line with their religious principles according to the halal certification procedure. It entails a thorough analysis of the procedures, components, and manufacturing processes used by businesses. By becoming certified, businesses may access the expanding Muslim market, win over customers, and support the worldwide halal economy.

Malaysia is acknowledged as a world pioneer in fostering the halal industry. The scheme acknowledges emerging opportunities for halal in a number of different sectors, including logistics and supply chain management, food and restaurant management, tourism, banking, textiles, medical devices, and finance. Malaysia has established JAKIM (Jabatan Agama Kemajuan Islam, Malaysia) and the Halal Development Corporation (HDC) in order to promote the expansion of the halal trade (Majid *et al.*, 2019). The halal certification system is strictly regulated and influenced by the Malaysian government. However, multiple halal authorities at the federal and state levels oversee and issue the halal certification. The Halal Certification Body, an Islamic organisation tasked with regulating halal certification in the country, carries out the certification procedure. The Department of Islamic Development Malaysia, or Jabatan Kemajuan Islam Malaysia (JAKIM), regulates halal certification on a federal level. The State Islamic Religious Department (JAIN) and the State Islamic Religious Council (MAIN) are responsible for managing the system at the state level (Sulaiman *et al.*, 2019). The government authorizes them under the Trade Description Act of 1983. To protect, oversee, and uphold Islamic matters in accordance with state constitutions, each state and the federal territories possess their Islamic religious authority. The Sultanates are associated with anything related to Islam throughout the nation, and the states have authority over how the religion is regulated. As a result, the states under Sultan's rule oversee the halal certification system (Sulaiman *et al.*, 2019).

Regulatory bodies and certifying bodies crucially support the reliability and integrity of halal certifications. Developing standards, supervising the certification procedure, performing audits, confirming the ingredients, dispensing training, granting certifications, and enforcing legal frameworks are all part of their responsibilities. These organisations work to increase consumer trust in halal goods and services while promoting the expansion and development of the global halal market.

Food products are manufactured and imported all across the world. The integrity of halal food products must be managed and monitored to satisfy customers with genuine halal products because they travel a considerable distance and experience several handlings along the supply chain before reaching the consumers (Mohamed *et al.*, 2022). For organisations and regulatory authorities engaged in the halal industry, upholding halal integrity and authenticity is essential since they count as a benchmark for assessing the potential for sustainable business growth (Majid *et al.*, 2019). But upholding consistent adherence to halal standards while preventing fraud or deception presents a number of challenges. Muslim consumers heavily depend on the halal certifications or logos that HCBs provide to determine whether food is halal. However, unregulated Halal Certification Bodies (HCB) frequently follow distinct operating methods, and some of these organisations' level of knowledge has frequently been

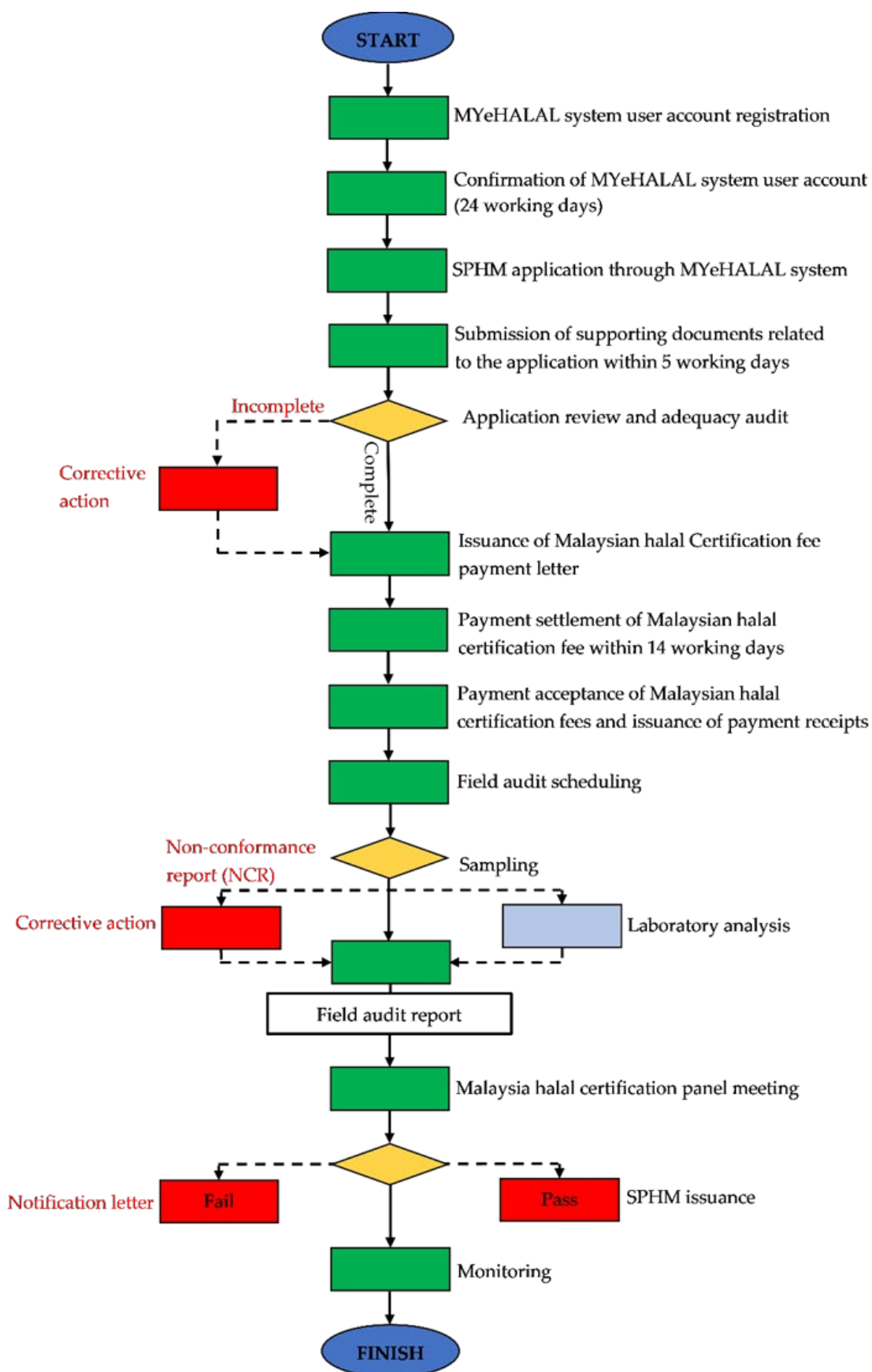


Figure 1: Malaysia Halal Certification process flow chart - MPPHM (Domestic) 2020.
(Source: MPPHM (Domestic) 2020)

questioned. Insufficient technical knowledge has prevented some halal-certified establishments from being properly monitored and scrutinised when halal products are cross-contaminated over the course of the supply chain, such as handling halal products alongside non-halal products (Ab Rashid & Bojei, 2020; Masood & Rahim, 2021) halal certification organisations, regulatory authorities, and evaluation systems are susceptible to sabotage and commercially motivated adulteration because to these vulnerabilities. Contamination, tampering, counterfeiting, artificial enhancement, use of undeclared, prohibited, or restricted products, misrepresentation of nutritional content, false claims on labelling, and removal of genuine ingredients are all examples of food fraud (Masood & Rahim, 2021; Tola, 2018).

Managing halal supply chains has become more difficult, especially worldwide. It is crucial to monitor product flows, distribute precise data and information across stakeholders, and integrate a wide range of products to ensure the integrity of the halal supply chain. Integrating blockchain technology with RFID/NFC technologies can reduce supply chain complexity. In order to recognise and monitor tags connected to things that contain microchips and crucial data that include lot numbers, manufacturing dates, and validity dates, radio-frequency identification (RFID) employs electromagnetic fields. Data can be transmitted between devices using Near Field Communication (NFC) technology, a contactless method based on a radio frequency field. NFC technology offers a secure connection to information regarding the place of origin, product certificates, and the supply chain's path. Integrating these two technologies with Blockchain Technology solutions can result in improved security, automation of administrative processes through smart contracts, and increased transparency that is advantageous to all stakeholders, from suppliers to customers (Masood & Rahim, 2021; Tan *et al.*, 2022).

Insufficient awareness may result from a lack of knowledge and comprehension of halal criteria and principles, significantly impacting how customers demand authenticity in halal products (Ali & Ahmad, 2023; Ruslan *et al.*, 2018). Aware consumers are more likely to buy and consume halal items, enabling Muslims and non-Muslims to develop halal goods. Halal awareness for businesses refers to using a halal process in manufacturing products. Entrepreneurs must secure the cooperation and contribution of many stakeholders in the product supply chain to highlight halal as a crucial component. Making decisions as a client requires knowledge. After learning new information and recalling various facts, an individual's level of knowledge might indicate how well they comprehend a subject. One's awareness of halal issues can be increased by understanding halal topics (Akın & Okumuş, 2020; Ali & Ahmad, 2023; Amarul *et al.*, 2019).

Businesses, governing organisations, and customers must work together to maintain halal integrity and authenticity. The continuing development and credibility of the halal business depend on overcoming obstacles relating to ingredient verification, cross-contamination hazards, monitoring compliance, combating fraud, standardisation, consumer awareness, and certification capabilities. Stakeholders can guarantee the constant delivery of authentic halal products and services by addressing these issues, boosting consumer confidence and promoting the growth of the global halal market.

3. Current status of halal food ingredients

Consumer health and wellness consciousness is driving the halal food and beverage industry. Functional food and beverages, which provide health advantages beyond nutrition, are popular. People are growing more health-conscious and seeking goods to improve their diets. The market's future looks promising, supported by the increasing demand for health supplements and dietary products derived from halal sources. Because halal products only utilize natural ingredients, many believe they are healthier.

According to Laluddin *et al.* (2019), the Muslim community in Malaysia confronts obstacles when it comes to following the sunnah of the Holy Prophet (PBUH) and recognizing the health benefits of food consumption. Consequently, the market has witnessed an increase in the production of sunnah food products. Entrepreneurs have capitalized on this opportunity to market these products, utilizing Islamic characteristics to attract Muslim consumers. In the study by Osman *et al.* (2020), these characteristics allow producers to charge higher prices for their products.

3.1 Commonly used halal food ingredients

Muhammad *et al.* (2019) and Mutmainah (2018) underline the need for customer awareness and familiarity with food security, halal certification, and food quality. The advent of contemporary science and technology has enabled food production to combine a variety of substances, some of which may be permissible (halal) or prohibited (haram). However, gelatine has grown contentious, as about 95% of gelatine on the market is obtained from animals prohibited for Muslim consumption, as underlined by (Sin & Sin 2019; Zin *et al.*, 2021). Muslim communities are concerned about consuming food products contaminated with porcine-derived gelatine. Nonetheless, there are alternatives, such as gelatine derived from halal sources such as fish, cattle, chicken, and turkey, as proposed by Rakhmanova *et al.* (2018); Uddin *et al.* (2021); and Zin *et al.* (2021). Adherence to halal guidelines is critical from an Islamic perspective, as even minor deviations might affect the overall halal status of consumed food. There are now processed foods and items that violate Islamic standards, such as the usage of pork oil, khamr-derived substances in cakes, and even brushes made from pork fur for food spreading. Furthermore, Fatmi *et al.* (2020) and Habibie & Donna (2020) discovered that ingredients substantially influenced consumers' views toward halal products. Manufacturers and customers express concern about product ingredients, as they play a significant role in consumer decision-making processes.

3.2 Key considerations in sourcing halal ingredients

The lack of standardization in the halal ingredient industry has sparked concern among consumers pursuing better-quality products. Consumers are preoccupied with safety and quality. Haleem *et al.* (2018) highlighted that government regulations on the standardization of halal ingredients have presented obstacles and impeded business expansion, as noncompliance can result in substantial losses. These standardization requirements have disproportionately impacted the cosmetics, fragrances, and pharmaceutical industries. In addition, the costs of halal ingredients are frequently increased due to increased demand and the specialized preparation techniques required (Ahmed *et al.*, 2019). Due to their one-of-a-kind production processes, these goods are deemed exclusive. Complying with strict safety and standardization regulations is also challenging for the pharmaceutical industry (Hole *et al.*,

2021). Extra procedures necessitated by the need for transparent labelling and uncompromised quality result in marginally higher costs.

3.3 Halal labelling and packaging requirements

According to Zhao *et al.* (2021), labelling is crucial in helping consumers differentiate between similar products and influencing their purchase decisions. Labelling policies can address market inefficiencies and bridge the information gap between firms and consumers by providing relevant information. The use of labels such as 'HALAL,' 'CERTIFIED HALAL,' or similar statements signifies that the product has undergone strict testing and certification, assuring Muslims that it is permissible for consumption, manufacturing, preparation, and sale (Khan & Haleem, 2018; Zin *et al.*, 2021). Halal certification provides a sense of security for Muslim consumers, ensuring that the product meets their dietary requirements. The certification instils confidence in consumers who may have hesitated to consume a product, as it signifies that it has been approved by a halal-certifying institution (Mutmainah, 2018). In Malaysia, the halal label is not required for all products consumed by the public, including ready-to-eat items (Azizah, 2022). On the other hand, businesses can obtain halal certification and label their products accordingly to cater to Muslim clients and ensure that the items follow halal regulations.

Sungit *et al.* (2020) discussed the Halal Product Guarantees In-Law Number 33 of 2014, which explains that halal products have been deemed halal by Islamic law. According to Government Regulation Number 69 of 1999, food labels are any information about food in pictures, texts, or a combination of both. Other forms attached to food, inserted into, fastened to, or part of food packaging are now called labels in government regulations. Meanwhile, according to Halal Product Guarantee Law Number 33 of 2014, a halal label signifies that a product is halal (Badriyah *et al.*, 2021). The following are the indicators of halal labelling, according to Government Regulation Number 69 of 1999 (Millatina *et al.*, 2022):

1. Image: is the result of imitation in shapes or patterns (animals, people, plants) made with writing utensils.
2. Writing: is the result of writing which is expected to be read.
3. Combination of Images and Writings: a combination of the results of images and writings made into one part.
4. Sticking to the packaging can be interpreted as something attached (intentionally or unintentionally) to the packaging (protecting a product).

Producers and customers in the halal market must fully understand how halal works based on Islamic *Shari'ah* law. Determining if food is halal is difficult because you can't just go by how it smells, feels, or tastes. Because of this, certification and labelling are very important for helping Muslim customers determine if food products follow halal rules (Ahmed *et al.*, 2019; Zainalabidin *et al.*, 2019). Concerns about contamination, improper slaughter, and the need to verify food products mean that fast screening methods for halal food must be improved immediately (Rakhmanova *et al.*, 2018). These improvements should make real-time, on-site tracking more sensitive, accurate, portable, and cheap. Muslim and non-Muslim customers can ensure their food is safe using cutting-edge technologies and verification methods (Ng *et al.*, 2022).

Traditional methods like physical approaches and electrophoresis have been used to determine what's in food, but they aren't good for screening and finding things in large quantities. Halal packaging ensures product labelling. Food additives, enzymes, emulsifiers, and flavours must be labelled. Traceability also certifies halal compliance and shows consumers the food's origin and composition (Masudin *et al.*, 2022). The certifying authority must label all goods and containers with the correct information, halal label, and logo (Osman *et al.*, 2020; Ruslan *et al.*, 2018). Halal meat should be shipped with a certificate from the certifying organisation. The Muslim supervisor controls halal logos, stamps, and seals.

4. Technological advances in halal ingredients analysis

Technological advancements have been made to meet the increasing demand for halal food ingredients. These technological developments aim to enhance the evaluation procedure's precision, productivity, and transparency, thereby facilitating consumers' and regulatory agencies' effective identification and authentication of halal constituents. Several techniques for halal authentication have been introduced to analyse processed and unprocessed food ingredients. Examples of these techniques include High-Performance Liquid Chromatography (HPLC), Enzyme-Linked Immunosorbent Assays (ELISA), Fourier Transform Infrared Spectroscopy (FTIR), Electronic Nose coupled with Gas Chromatography-Mass Spectrometry (GC-MS), Polymerase Chain Reaction (PCR) assays and Radio Immunoassays (RIA). These methods provide insights into the chemical composition and molecular profiles of the ingredients, helping to determine their halal status accurately. Furthermore, the amalgamation of artificial intelligence (AI), chemometrics, and the Internet of Things (IoT) with these advanced methods can augment the precision, velocity, and potential of multiplexed analyte detection (Ng *et al.*, 2022). For instance, a study by Islam *et al.* (2021) focuses on the fundamental methods of constructing an intelligent fluorescence spectroscopy apparatus coupled with a straightforward DNA extraction protocol crucial in detecting pork contamination in food and beverage samples. The spectroscopy was utilised to observe various material combinations, including those with and without pork, and subsequently measure their respective light spectra using RSpec software. Upon analysing the spectral patterns of various combinations, it has been proven that the suggested system can recognise the difference between uncontaminated pork, pork blends, and non-pork samples. The commonly employed techniques in the halal food ingredients analysis are discussed below.

Infrared spectroscopy is a technique that analyses the materials that comprise a sample using infrared, allowing for qualitative identification of sample components. When the bonds of the material's atoms vibrate, the frequency of vibrations is recorded as absorption peaks, which form the sample's infrared spectrum. This spectrum is considered the 'fingerprint' of the sample because no two compounds may have the same spectrum due to differences in atom combinations from one compound to the other (Lubis *et al.*, 2016). It has been employed to analyse the molecular composition of food ingredients and identify non-halal components. In 2018, Rahayu *et al.* (2018) showed that combining FTIR spectroscopy with multivariate data analysis can accurately identify and quantify dog meat in beef meatballs. Other than that, a combination of Fourier Transform Infrared Spectroscopy (FTIR) and Attenuated Total Reflectance (ATR)

successfully identified the porcine-based source in 13 types of capsules (Mustafa, 2014).

Other than that, Electronic Nose coupled with Gas Chromatography-Mass Spectrometry (GC-MS) is also commonly applied in detection analysis. The E-nose is a detection system or device that emulates the human olfactory system (Di Rosa *et al.*, 2017; Kadafi & Putra, 2021). It uses semi-selective sensors that undergo a physical change when volatile compounds adsorb on their surface. E-nose is suitable for identifying adulterants, and its ability is significantly enhanced when integrated with Mass Spectroscopy. The advantages of E-nose include its low cost; rapid and accurate qualitative detection, high sensitivity (requires only a small amount of sample), environmental friendliness; simple sample pre-treatment process and the ability to integrate it with other instruments, such as a mass spectrometer (Ng *et al.*, 2022b). A study was carried out to examine seven categories of meat, each made up of a different combination of beef and pork. The optimised support vector machine achieved a 98.10% accuracy in the classification test for detecting beef and pork. This research exemplifies the efficacy of E-nose technology in detecting pork adulteration in beef for halal authentication (Sarno *et al.*, 2020). In another research by Kadafi & Putra (2021), the results demonstrated that the e-nose system developed can efficiently identify food samples containing lard fat across various types of samples based on the output values of its six sensors.

Additionally, PCR analysis is also frequently utilised, particularly for meat products. A specific DNA sequence of the animal species is amplified using species-specific primers during species-specific PCR DNA amplification. The PCR results are then analysed using agarose gel electrophoresis to determine species distinction. The benefits of PCR analysis include its sensitivity, ability to analyse large quantities of samples, and potential to save time and money. Using various PCR analytical techniques, porcine DNA has been detected in raw and processed food. A study by Cahyadi *et al.* (2020) showed that multiplex-PCR with 12S rRNA gene primers uniquely and accurately detect bovine, dog, pig, and rat species on beef meatballs in one reaction. Besides that, the detection limit of the PCR technique for identifying swine and poultry species in meat products under different processing conditions was investigated (Felk *et al.*, 2017). From the results, it can be concluded that PCR is an effective tool that is sufficiently specific and sensitive for identifying animal species in processed meat products.

Other than the absence of pork, halal foods must also be alcohol-free. Alcohol, particularly ethyl alcohol or ethanol, is frequently used in the production of foods or as a by-product of food processing. Therefore, it is equally important to have porcine detection technology as its analytical detection method for alcohol in food products. Alcohol detection in complicated food samples has not been established or developed yet. The ethanol detector formerly only utilised ethanol solution, vapours, or alcoholic beverages like beer. However, these detectors give us useful starting points for creating alcohol biosensors that can be incorporated into food mixtures in the future. Determining whether alcohol is present in food and drink as a result of a natural occurrence or an intentional addition during manufacturing may also be important. Since no tests have yet been able to differentiate between the two, future research in the field of halal analysis could focus on this.

Regardless of the approaches used, a significant improvement has been made in the sensitivity and specificity of analytical

procedures for halal ingredient detection. It is important to note that each technique has a unique benefit and application that depends on the needs and complements the others.

5. Sustainability and ethical sourcing of halal ingredients

The importance of sustainable and ethical ingredient sourcing in today's society cannot be emphasized enough. As consumers become more aware of the consequences of their purchasing decisions, there is a rising trend of making thoughtful food choices that consider environmental impact, social values, and economic factors (Chevallier-Chantepie & Batt, 2021). This growing consciousness among both businesses and consumers has led to an increased demand for products that adhere to principles of sustainability and ethic. The shift in perspective has put ingredient-sourcing practices under scrutiny, emphasizing the need for responsible approaches that prioritize the well-being of our planet and its inhabitants. We can uncover its diverse benefits by exploring the importance of sustainable and ethical ingredient sourcing. From preserving ecosystems and ensuring fair treatment of workers to promoting animal welfare and building consumer trust, embracing these practices is an important step towards shaping a more sustainable and ethical future.

Sustainable ingredient sourcing is critical in protecting the environment and its delicate ecosystems (Ojo *et al.*, 2018). Businesses can play a vital role in preserving biodiversity, maintaining soil quality, and conserving water resources by adopting methods that minimize negative impacts. For example, embracing organic farming practices can significantly reduce the use of synthetic chemicals, thus minimizing pollution and soil degradation (Chandini *et al.*, 2019). Similarly, responsible fishing techniques combined with a scientific approach can support marine ecosystems' long-term health and resilience. Bolin *et al.* (2021) reported on the prediction metrics of body condition and nutritional quality in commercially valuable wild-caught fish. This gives insight into the overall health of fish populations, guides sustainable fishing practices, supports conservation efforts, and ensures the availability of nutritious seafood for human consumption. Additionally, companies can mitigate climate change, an urgent global concern, by reducing their carbon footprint through sustainable sourcing practices (Qian *et al.*, 2022; Skärin *et al.*, 2022; Yuan *et al.*, 2022). These efforts are essential for safeguarding the environment and promoting a more sustainable future.

On the other hand, ethical practices strongly focus on social responsibility, ensuring that farmers, labourers, and suppliers involved in the supply chain are treated fairly and provided with safe working conditions. In recent years, a notable shift in consumer behaviour has shifted towards being more informed and conscientious about their shopping habits. Consumers are dedicating more time and effort to understanding the origins and manufacturing processes behind their products, seeking to align their purchases with their values and contribute to a more sustainable and equitable world. Ethical sourcing also extends to animal welfare, recognizing the inherent value of animals and emphasizing the need for compassionate treatment by those who benefit from their existence. The issue of safeguarding the welfare of farmed animals has gained significant traction in public policy across a growing number of countries. Robust regulations, both from the public and private sectors, have been implemented to govern the treatment and well-being of animals in our care. However, it is worth noting that several countries, including some of the largest animal-

producing nations such as Brazil, India, and China, still lack of comprehensive formal legislation dedicated to animal welfare (Buller *et al.*, 2018). From the Islamic perspective, integrating religious adherence with a commitment to sustainability and ethicality in the sourcing process allows the production of halal ingredients to embody responsible and conscientious business practices. This approach meets Muslim consumers' religious requirements and contributes to broader societal and environmental objectives. It reflects the industry's dedication to delivering high-quality products while upholding environmental and ethical standards, positively impacting the Muslim community and society.

5.1 Impact of halal ingredient production on the environment

Recently, the demand for halal products has been rising, driven by the growing Muslim population globally. What was once a market primarily confined to Muslim-majority countries has also expanded to non-Muslim countries. In these non-Muslim countries, halal food represents a new benchmark for ensuring safe, clean, and hygienic food consumption practices (Rahman, 2021). Halal production and processing of products can indeed contribute to addressing sustainability issues in various processes and procedures. The core principle of producing halal products centres around eliminating substances that can harm human health and the environment (Mabkhot, 2023). Like any other sector, the halal industry prioritises responsible sourcing practices that consider the environmental impact of ingredients. By doing so, it can contribute to sustainable development and help address global environmental challenges. According to the *Qur'an*, environmental conservation is a religious and social obligation. It is considered a matter of necessity rather than choice. The *Qur'an* emphasises the responsibility of protecting and preserving natural resources while emphasizing the direct connection between sustainable resource use and our accountability for their maintenance. This important message is captured in verse translated as "And do no mischief on the earth after it has been set in order: that will be best for you if ye have Faith" (*Qur'an* 7:85). The environmental impact of halal ingredient production is not exclusive to the halal industry. Similar considerations apply to the wider food industry as a whole. Adopting sustainable and environmentally friendly practices throughout the supply chain can minimise the impact, contributing to a more sustainable and responsible approach to halal ingredient production (Figure 2).

Halal principles encourage the humane treatment of animals and emphasize their well-being (Khan *et al.*, 2018). This includes the responsible sourcing of ingredients from suppliers that prioritize animal welfare. Emphasizing animal welfare within halal principles can also positively affect the environment. By prioritizing the humane treatment of animals, halal practices contribute to the overall well-being of the ecosystem. The treatment, rearing, and fattening of livestock are given utmost consideration to protect animal health and ensure compliance with halal guidelines. By adhering to these principles, halal supply chains aim to safeguard animal welfare while meeting consumers' nutritional and organic requirements (Azhar & Tu, 2021).

Halal principles promote organic and sustainable agricultural practices that reduce reliance on synthetic fertilizers, pesticides, and genetically modified organisms (GMOs). These practices aim to prevent environmental pollution and maintain soil health. According to halal principles, the use of pesticides is acceptable when applied in appropriate dosages and carefully

IMPACT OF HALAL INGREDIENT PRODUCTION ON THE ENVIRONMENT



Figure 2: Environmental implications of halal ingredient production.

selected. However, the use of pesticides that cause significant harm to crops, the environment, or human life is considered non-halal (Alzeer *et al.*, 2020). In line with the concept of *Tayyib*, any food contaminated with pathogenic microbes or potentially toxic ingredients that endanger human health is categorized as non-*toyyib*. Consequently, such food is deemed non-halal and should not be consumed (Kurniadi & Frediansyah, 2016). The principle of *toyyib* emphasizes the importance of ensuring food safety and purity, aligning with the core values of halal consumption (Yahaya & Ruzulan, 2020).

It is important to note that the positive impact of halal ingredient production on the environment is not solely determined by halal requirements alone. The environmental benefits depend on adopting sustainable practices, responsible sourcing, and implementing eco-friendly approaches at every stage of the production chain. While halal requirements can have positive implications for animal welfare and farming practices, addressing broader environmental goals necessitates a comprehensive and holistic approach that encompasses sustainable practices throughout the production process.

5.2 Social Responsibility and fair-trade practices in the halal food industry

Social responsibility and fair-trade practices are essential in the halal food industry, just as in any other sector. Social responsibility is important to the halal industry as it encompasses the entire supply chain, from carefully selecting raw materials to producing the final product. It is important for everyone in society, particularly Muslim consumers, to take part in the efforts to acquire halal-certified food. This responsibility extends to non-government organizations, the private sector, entrepreneurs, suppliers, and consumers (Figure 3).

According to Mohd Riza *et al.* (2022), the government must establish a law concerning halal food that benefits all parties, including the industry and consumers. This law should emphasize the importance of stakeholders recognizing their responsibilities and contributions to the country rather than

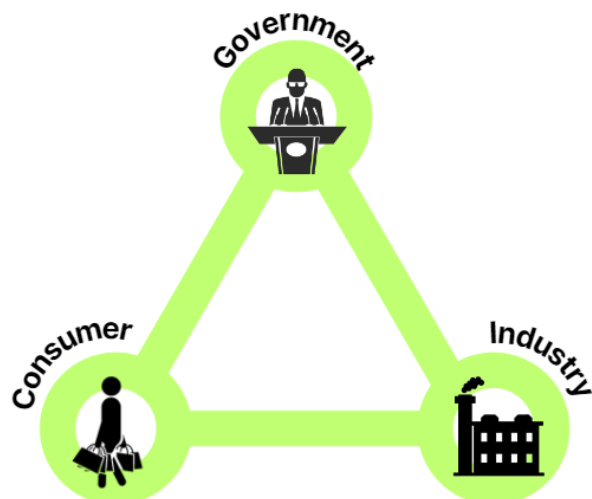


Figure 3: Fostering social responsibility through government, consumers, and industry collaboration.
(Adapted from Mohd Riza *et al.*, 2022)

prioritising profit maximization. Social responsibility in guaranteeing halal food can be viewed from various perspectives, where the focus extends beyond profit-making activities. It encompasses efforts to protect the environment, ensure the well-being of employees, engage in ethical trading practices, and other similar considerations.

Halal and fair trade are closely tied because both concepts promote ethical practices, social justice, and sustainable development (Mustun, 2021). While halal certification ensures that products meet the religious requirements of Muslims, fair trade certification ensures that the products are produced under fair and equitable conditions. Fair-trade practices in the halal food industry involve adopting ethical and transparent business approaches that promote fairness and social responsibility across the entire supply chain of halal food products. Embracing and implementing halal practices can offer several advantages for companies regarding sustainability and corporate social responsibility (CSR). Firstly, companies can enhance their CSR profiles and programs by adhering to the principles of good deeds embedded in halal, such as transparency, fairness, and community. Secondly, by positioning halal as a health and wellness initiative, firms can avoid being perceived solely as a Muslim-exclusive company by global consumers. These efforts allow halal products to attract a broader audience, including non-Muslims, similar to how some non-Jewish consumers embrace kosher items as pure and ethical alternatives (Izberk-Bilgin & Nakata, 2016). Integrating fair-trade practices in the halal food industry aligns with halal principles and helps promote a more sustainable and socially responsible business environment.

6. Market and consumer's purchase intention

The halal ingredients market size was valued at USD 325.2 Billion in 2021 and is projected to reach USD 435.5 Billion by 2030, growing at a CAGR of 3.2% from 2023 to 2030 (Verified Market Research, 2023). The expansion of the halal ingredients market has been driven by the increasing demand for halal food and ingredients, which can be attributed to the growing Muslim population. In addition to its religious connotations, halal has acquired considerable importance in commercial and economic spheres. The advocacy pertains to providing food

products that are healthy, safe, and fresh to consumers, thereby representing cleanliness, superior quality, and food safety (Alzeer *et al.*, 2018). The halal ingredients market is anticipated to experience significant expansion due to the contemporary consumer's increasing inclination towards halal ingredients. Assessing the purchase intention of halal foods would help better understand consumers' needs, expectations and perceptions (Shaari & Arifin, 2009). Thus, it is necessary to analyse and understand the motivating factor influencing Muslim consumers' purchase of halal food products (Khan *et al.*, 2020).

Knowledge of halal, halal logo and labelling, economic factors, food safety concerns, and religiosity of customers (Figure 4) are among the factors that affect the purchase intention of halal food ingredients (Khan *et al.*, 2020; Shaari *et al.*, 2021; Shaari & Arifin, 2009).

The level of religious knowledge is vital in determining the extent of engagement in halal consumption. Insufficient education and understanding of halal rules and guidelines can result in a lack of awareness among individuals. This can be addressed by implementing educational programs and initiatives to enhance knowledge and familiarity with halal practices. Without marketing or branding efforts for halal items, awareness and information about halal products would not reach the broader consumer base.



Figure 4: Factors affecting customers' purchase intention of halal food ingredients.

Besides that, the halal logo and labelling also impact the purchasing intention of buyers. It is generally agreed that the halal logo is the most important and influential component of halal products and services. According to Ismail *et al.* (2016), the halal Malaysia logo is the most prevalent graphic presentation, and it indicates that the product or service in question has been approved by JAKIM (Figure 5). When a product or service bears the halal logo or label, the relevant government agency has determined that it complies with the principles of Islamic values. halal logo itself is perceived as an important factor because consumers consider that if a product has halal labelling, it means that the product is safe and hygienic.

Economic factors have the potential to influence consumers' purchasing intention, particularly concerning the accessibility and affordability of halal products. The limited availability and comparatively higher cost of halal products may present

obstacles for adherents of halal dietary restrictions to sustain a halal-compliant diet and remain informed of the range of halal offerings on the market. Muslim consumers might not consider a product's prices because they already understand that the prices can be higher due to many factors, but the economic reason might affect the purchase intention of non-Muslim buyers (Syukur & Nimsai, 2018).



Figure 5: Halal logo by JAKIM.

People's perception of food safety has noticed a noticeable shift in the past few years. In recent years, consumers have increasingly regarded food hazards as significant (Ali & Ahmad, 2023). Several incidents associated with consumers' increasing lack of confidence regarding food safety matters have been reported. The concerns above are primarily associated with the increased utilization of chemical inputs in conjunction with food production and processing. Halal food ingredients' safety and health benefit significantly impact health-conscious consumers' preferences (Rani *et al.*, 2016).

Religiosity refers to recognising, respecting and dedicating one's religious beliefs, practices, values, and symbols influenced by spiritual forces (Mutmainah, 2018). This dedication will be evident in their attitudes and behaviour. The level of religiosity exhibited by an individual can affect their consumer behaviour. Consumers tend to purchase or utilise products that align with their philosophies and beliefs (Ali & Ahmad, 2023). The role of religiosity is to control customer behaviour on purchase intention of halal food. This indicates that if a person is more obedient to religion, the halal food ingredients purchase intention is higher. Thus, this is also an important factor influencing the customers' purchasing intention.

7. Conclusion

Muslims firmly believe that halal food ingredients are crucial for preserving their health and faith, driving the increasing demand for these ingredients. The halal food industry is experiencing significant growth, providing numerous opportunities for businesses and consumers. This growth is influenced by factors such as the rising demand for halal products, the expanding Muslim population, and the globalization of halal standards. Understanding the industry's current status is crucial due to the growing demand for diverse and high-quality halal products, both locally and globally. To seize market opportunities and remain competitive, businesses must stay updated on emerging trends, consumer preferences, and new ingredient offerings. Technological advancements in halal ingredient analysis are transforming the industry by offering more efficient and accurate testing methods and verifying halal compliance. Leveraging these advancements can enhance ingredient analysis processes, improve product quality, and meet consumer expectations for transparency and authenticity. Additionally, sustainability and ethical sourcing play a significant role in the industry. Prioritizing responsible

sourcing practices, promoting sustainable agriculture, and ensuring ethical treatment throughout the supply chain is essential to meet the demands of socially conscious consumers. Understanding the market and consumer purchasing intentions is crucial for navigating the halal food industry. Conducting market research and gaining consumer insights provide valuable information about preferences, buying behaviour, and emerging trends. This knowledge enables businesses to develop targeted marketing strategies, innovate product offerings, and build strong brand loyalty among their target audience. By addressing these key aspects, businesses can effectively navigate the halal food industry, tap into the growing market, build consumer trust, contribute to a sustainable and ethical industry, and position themselves for long-term success.

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References

- Ab Rashid, N., & Bojei, J. (2020). The relationship between halal traceability system adoption and environmental factors on halal food supply chain integrity in Malaysia. *Journal of Islamic Marketing*, 11(1), 117–142. <https://doi.org/10.1108/JIMA-01-2018-0016>
- Ab Talib, M. S., Bakar, A. H. A., Zulfakar, M. H., & Jeeva, A. S. (2014). halal logistics PEST Analysis: The Malaysia perspectives. *Asian Social Science*, 10(14), 119–131. <https://doi.org/10.5539/ass.v10n14p119>
- Abdallah, A., Rahem, M. A., & Pasqualone, A. (2021). The multiplicity of halal standards: a case study of application to slaughterhouses. *Journal of Ethnic Foods*, 8(1). <https://doi.org/10.1186/s42779-021-00084-6>
- Ahmed, W., Najmi, A., Faizan, H. M., & Ahmed, S. (2019). Consumer behaviour towards willingness to pay for halal products: An assessment of demand for halal certification in a Muslim country. *British Food Journal*, 121(2), 492–504. <https://doi.org/10.1108/BFJ-02-2018-0085>
- Akın, M. S., & Okumuş, A. (2020). Shaping the consumers' attitudes towards halal food products in Turkey. *Journal of Islamic Marketing*, 12(6), 1081–1096. <https://doi.org/10.1108/JIMA-08-2019-0167>
- Ali, M. Q., & Ahmad, N. (2023). The Factors that affect halal Food and Food Products Awareness and Different Challenges: an overview. *Journal of Agribusiness Marketing*, 10(1). <https://doi.org/10.56527/fama.jabm.10.1.6>
- Al-Teinaz, Y. R., Spear, S., & Abd El-Rahim, I. H. A. (2020). *The halal food handbook*.
- Alzeer, J., Rieder, U., & Hadeed, K. A. (2018). Rational and practical aspects of halal and Tayyib in the context of food safety. *Trends in Food Science and Technology*, 71, 264–267. <https://doi.org/10.1016/j.tifs.2017.10.020>
- Alzeer, J., Rieder, U., & Hadeed, K. A. (2020). Good agricultural practices and its compatibility with halal standards. *Trends in Food Science and Technology*, 102, 237–241. <https://doi.org/10.1016/j.tifs.2020.02.025>

- Amarul, A., Sukirno, S., & Kurnia, D. (2019). Understanding the Awareness of the Importance of Halal Labels to Business Actors Based on Range of Long Business Variations. *Business and Management Research*, 8(1), 17. <https://doi.org/10.5430/bmr.v8n1p17>
- Azam, M. S. E., & Abdullah, M. A. (2020). Global halal Industry: Realities and Opportunities. *International Journal of Islamic Business Ethics*, 5(1), 47. <https://doi.org/10.30659/ijibe.5.1.47-59>
- Azhar, A., & Tu, Y. T. (2021). The investigation of key factors for successful implementation of sustainable. *Food Research*, 5, 221–228.
- Bolin, J. A., Schoeman, D. S., Evans, K. J., Cummins, S. F., & Scales, K. L. (2021). Achieving sustainable and climate-resilient fisheries requires marine ecosystem forecasts to include fish condition. *Fish and Fisheries*, 22(5), 1067–1084. <https://doi.org/10.1111/faf.12569>
- Buller, H., Blokhuis, H., Jensen, P., & Keeling, L. (2018). Towards farm animal welfare and sustainability. *Animals*, 8(6), 1–13. <https://doi.org/10.3390/ani8060081>
- Cahyadi, M., Wibowo, T., Pramono, A., & Abdurrahman, Z. H. (2020). A Novel Multiplex-PCR Assay to Detect Three Non-halal Meats Contained in Meatball using Mitochondrial 12S rRNA Gene. *Food Science of Animal Resources*, 40(4), 628. <https://doi.org/10.5851/KOSFA.2020.E40>
- Chandini, Kumar, R., Kumar, R., & Prakash, O. (2019). The Impact of Chemical Fertilizers on our Environment and Ecosystem. *Research Trends in Environmental Science*, 4, 69–86.
- Chevallier-Chantepie, A., & Batt, P. J. (2021). Sustainable Purchasing of Fresh Food by Restaurants and Cafes in France. *Agronomy*, 11(11), 1–13. <https://doi.org/10.3390/agronomy11112357>
- Di Rosa, A. R., Leone, F., Cheli, F., & Chiofalo, V. (2017). Fusion of electronic nose, electronic tongue and computer vision for animal source food authentication and quality assessment – A review. *Journal of Food Engineering*, 210, 62–75. <https://doi.org/10.1016/J.JFOODENG.2017.04.024>
- Dusuki, A. W., & Abdullah, N. I. (2007). Maqasid al-Shari'ah, Maslahah, and Corporate Social Responsibility. *The American Journal of Islamic Social Sciences*, 24(1).
- Fatmi, F. O., Ahmad, A. N., & Kartika, B. (2020). Determinants affecting purchase intention of halal products: an article review. *Journal of Halal Product and Research*, 3(2), 63. <https://doi.org/10.20473/jhpr.vol.3-issue.2.63-79>
- Felk, G. S., Marinho, R. S., Montanhini, M. T. M., Rodrigues, S. A., & Bittencourt, J. V. (2017). Detection limit of polymerase chain reaction technique for species authentication in meat products. *International Food Research Journal*, 24(3), 1353–1356.
- Habibie, H. M. H., & Donna, D. R. (2020). Factors that Influence the Intention to Purchase Halal Food Products (Case Study of Universitas Gadjah Mada Students). *BENEFIT Jurnal Manajemen Dan Bisnis*, 5(1), 83–95.
- Haleem, D. A., Khan, M. M. I., Khan, M. S., & Ngah, D. A. H. (2018). Assessing Barriers to Adopting and Implementing Halal Practices in Logistics Operations. *IOP Conference Series: Materials Science and Engineering*, 404(1). <https://doi.org/10.1088/1757-899X/404/1/012012>
- imarcgroup.com. (2022). halal Food Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2023-2028. <https://www.imarcgroup.com/halal-food-market>
- Islam, K. Z., Ahasan, Md. A. Al, Hossain, Md. S., Rahman, M. H., Mousumi, U. S., Asaduzzaman, Md., Islam, K. Z., Ahasan, Md. A. Al, Hossain, Md. S., Rahman, M. H., Mousumi, U. S., & Asaduzzaman, Md. (2021). A Smart Fluorescent Light Spectroscope to Identify the Pork Adulteration for halal authentication. *Food and Nutrition Sciences*, 12(1), 73–89. <https://doi.org/10.4236/FNS.2021.121007>
- Ismail, W. R. B. W., Othman, M., Rahman, R. A., Kamarulzaman, N. H., & Rahman, S. Ab. (2016). Halal Malaysia Logo or Brand: The Hidden Gap. *Procedia Economics and Finance*, 37(16), 254–261. [https://doi.org/10.1016/s2212-5671\(16\)30122-8](https://doi.org/10.1016/s2212-5671(16)30122-8)
- Izberk-Bilgin, E., & Nakata, C. C. (2016). A new look at faith-based marketing: The global halal market. *Business Horizons*, 59(3), 285–292. <https://doi.org/10.1016/j.bushor.2016.01.005>
- Kadafi, M., & Putra, R. A. (2021). Electronic Nose (E-Nose) Design for Arduino Nano-Based Halal Haram Identification. *Jurnal Neutrino*, 13(1), 8–12. <https://doi.org/10.18860/neu.v13i1.8903>
- Khan, M. I., & Haleem, A. (n.d.). Saudi Journal of Business and Management Studies Understanding “halal” and “halal Certification & Accreditation System”-A Brief Review. *Saudi J. Bus. Manag. Stud*, 1(1), 32–42. <http://scholarsmepub.com/>
- Khan, R., Guo, H., Raza, S. H. A., Rahman, A., Ayaz, M., & Linsen, Z. (2018). Halal slaughtering, welfare, and empathy in farm animals: a review. *Tropical Animal Health and Production*, 50(8), 1733–1738. <https://doi.org/10.1007/s11250-018-1644-1>
- Khan, W., Akhtar, A., Ansari, S. A., & Dhamija, A. (2020). Enablers of halal food purchase among Muslim consumers in an emerging economy: an interpretive structural modelling approach. *British Food Journal*, 122(7), 2273–2287. <https://doi.org/10.1108/BFJ-08-2018-0528>
- Kohilavani, Wan Abdullah, W. N., Yang, T. A., Sifat, S. A. din, & Zzaman, W. (2021). Development of Safe Halal Food Management System (SHFMS). *Food Control*, 127. <https://doi.org/10.1016/j.foodcont.2021.108137>
- Kurniadi, M., & Frediansyah, A. (2016). Perspektif halal Produk Pangan Berbasis Bioproses Mikrobial. *Jurnal Universitas Dipenogoro*, 16(3), 147–160.
- Laluddin, H., Sikandar, S., Haneef, S., Saad, N. M., & Khalid, H. (2019). The Scope, Opportunities and Challenges of Halal Industry: Some Reflections. In *International Journal of Economics* (Vol. 27, Issue 2).
- Lubis, H. N., Mohd-Naim, N. F., Alizul, N. N., & Ahmed, M. U. (2016). From market to food plate: Current trusted technology and innovations in halal food analysis. *Trends in Food Science*

- and Technology, 58, 55–68. <https://doi.org/10.1016/j.tifs.2016.10.024>
- Mabkhot, H. (2023). Factors Affecting the Sustainability of Halal Product Performance: Malaysian Evidence. *Sustainability (Switzerland)*, 15(3). <https://doi.org/10.3390/su15031850>
- Majid, Z. A., Kamarulzaman, N. H., Rahman, A. A., Suzana Jaafar, H., Rahman, A. A., & Mohammad, M. F. (2019). Halal Integrity from Logistics Service Provider Perspective. In *Int. J Sup. Chain. Mgt (Vol. 8, Issue 5)*. <http://excelingtech.co.uk/>
- Masood, A., & Rahim, A. A. (2021). 3rd International halal Management Conference (3rd IHMC 2021).
- Mohamed, Y. H., Binti Ma'aram, A., Rahman, A., Rahim, A., Abdullah, A. S., Abbas, M. S., Adis, A.-A. A., & Ismail, M. (2022). The Moderating Effect of halal Assurance System on the Relationship between halal Food Supply Chain Management and halal Integrity Assurance. In *International Journal of Mechanical Engineering (Vol. 7)*.
- Mohd Riza, N. S., Md Ariffin, M. F., Hamdan, M. N., & Ramli, N. (2022). halal food: a social responsibility on cartel meat issue in Malaysia. *Food Research*, 6(3), 92–100. [https://doi.org/10.26656/fr.2017.6\(3\).277](https://doi.org/10.26656/fr.2017.6(3).277)
- Mokti, H. A., Kamri, N. 'Azzah, & Mohd Balwi, M. A. W. F. (2022). Halal Food Quality: An Analysis of Relevant Guidelines And Regulations In Malaysia. *Journal of Fatwa Management and Research*, 27(2-SE), 37–55. <https://doi.org/10.33102/jfatwa.vol27no2-se.482>
- Mustafa, R. R. (2014). Identification of Porcine-Based Source in Capsule by Using FTIR-ATR and Awareness of Muslim Consumers about Halal Authentication. *Universiti Teknologi Malaysia*.
- Mustun, Z. K. (2021). Halal food certification and business excellence: A conceptual paper. *Journal of Emerging Economies and Islamic Research*, 9(3), 98. <https://doi.org/10.24191/jeeir.v9i3.13987>
- Mutmainah, L. (2018). The Role of Religiosity, halal Awareness, halal Certification, and Food Ingredients on Purchase Intention of halal Food. *Ihtifaz: Journal of Islamic Economics, Finance, and Banking*, 1(1), 33. <https://doi.org/10.12928/ijiefb.v1i1.284>
- Ng, P. C., Ahmad Ruslan, N. A. S., Chin, L. X., Ahmad, M., Abu Hanifah, S., Abdullah, Z., & Khor, S. M. (2022). Recent advances in halal food authentication: Challenges and strategies. *Journal of Food Science*, 87(1), 8–35. <https://doi.org/10.1111/1750-3841.15998>
- Ojo, O. O., Shah, S., & Coutroubis, A. D. (2018). An overview of sustainable practices in food processing supply chain environments. *IEEE International Conference on Industrial Engineering and Engineering Management*, 2017-Decem, 1792–1796. <https://doi.org/10.1109/IEEM.2017.8290200>
- Osman, S., Ab. Rahman, S., & Jalil, A. (2020). Issues in halal food product labelling: A conceptual paper. *Food Research*, 4, 214–219. [https://doi.org/10.26656/fr.2017.4\(S1\).S15](https://doi.org/10.26656/fr.2017.4(S1).S15)
- Qian, D., Dargusch, P., & Hill, G. (2022). Carbon Management behind the Ambitious Pledge of Net Zero Carbon Emission—A Case Study of PepsiCo. *Sustainability (Switzerland)*, 14(4). <https://doi.org/10.3390/su14042171>
- Rahayu, W. S., Rohman, A., Martono, S., & Sudjadi. (2018). Application of FTIR spectroscopy and chemometrics for halal authentication of beef meatball adulterated with dog meat. *Indonesian Journal of Chemistry*, 18(2), 376–381. <https://doi.org/10.22146/IJC.27159>
- Rani, M. D. M., Umar, N. S., Ramli, S., Rahman, Z. A., Abdullah, M. Y., & Salleh, N. M. (2016). Knowledge of Prophetic Food Consumption in Malaysia: halal, Health Benefits and Practices. In *Contemporary Issues and Development in the Global Halal Industry (pp. 3–12)*. Springer Singapore. https://doi.org/10.1007/978-981-10-1452-9_1
- Ruslan, A. A. A., Kamarulzaman, N. H., & Sanny, M. (2018). Muslim consumers' awareness and perception of halal food fraud. In *International Food Research Journal (Vol. 25)*.
- Saiman, M. Z., & Yusma, N. S. (2022). Issues And Challenges of Promotion Halal Certification for Muslim Entrepreneurs in Malaysia. *Al-Qanatr: International Journal of Islamic Studies*, 28(2), 116–128.
- Sarno, R., Triyana, K., Sabilla, S. I., Wijaya, D. R., Sunaryono, D., & Fatchah, C. (2020). Detecting Pork Adulteration in Beef for Halal Authentication using an Optimized Electronic Nose System. *IEEE Access*, 8, 25–30. <https://doi.org/10.1109/ACCESS.2020.3043394>
- Shaari, J. A. N. Bin, Khalique, M., & Ottot, H. Bin. (2021). halal logo and the Confidence Level of Malaysian Customers on Indonesian halal Certified Products. *Academy of Entrepreneurship Journal*, 27(5), 1–8.
- Shaari, J. A. N., & Arifin, N. (2009). Dimension of Halal Purchase Intention: A Preliminary Study.
- Sin, K. Y., & Sin, M. C. (2019). Distinguished identification of halal and non-halal animal-fat gelatin using microwave dielectric sensing system. *Cogent Engineering*, 6(1). <https://doi.org/10.1080/23311916.2019.1599149>
- Skärin, F., Rösiö, C., & Andersen, A. L. (2022). An Explorative Study of Circularity Practices in Swedish Manufacturing Companies. *Sustainability (Switzerland)*, 14(12). <https://doi.org/10.3390/su14127246>
- Sulaiman, M. Z. M., Noordin, N., Noor, N. L. M., Suhaimi, A. I. H., & Isa, W. A. R. W. M. (2019). A comparison of halal inspection process between federal and state halal certification body in Malaysia. *International Journal of Digital Enterprise Technology*, 1(4), 349. <https://doi.org/10.1504/ijdet.2019.103359>
- Suleman, S., Sibghatullah, A., & Azam, M. (2021). Religiosity, halal food consumption, and physical well-being: An extension of the TPB. *Cogent Business and Management*, 8(1). <https://doi.org/10.1080/23311975.2020.1860385>
- Sungit, F., Isa Mohd Deni, M., Abdullah, M., Abd Ghani, N., & Syahwahid, F. (n.d.). Concepts And Practices Of Halalan Tayyiban In The Islamic Manufacturing Practice (Imp): An Analysis From Syariah Perspective. www.muslimconsumer.org.my

Syukur, M., & Nimsai, S. (2018). Factors influencing the purchase intention of halal packaged food in Thailand. *International Journal of Supply Chain Management*, 7(4), 1–6.

Tan, A., Gligor, D., & Ngah, A. (2022). Applying Blockchain for halal food traceability. *International Journal of Logistics Research and Applications*, 25(6), 947–964. <https://doi.org/10.1080/13675567.2020.1825653>

Tola, A. (2018). Global Food Fraud Trends and Their Mitigation Strategies: The Case of Some Dairy Products: A Review. 77. www.iiste.org
Verified Market Research. (2023). halal Ingredients Market Size, Share, Opportunities, Trends & Forecast.

Yahaya, A. M., & Ruzulan, Z. (2020). Quranic Concept of Halalan Tayyiban and its Application in Food and Beverages of Hospitality Sector in Malaysia. *Journal of Contemporary Islamic Studies*, 6(1), 61–76. <https://doi.org/10.24191/jcis.v6i1.4>

Yuan, Y., Zhang, B., Wang, L., & Wang, L. (2022). Low-Carbon Strategies Considering Corporate Environmental Responsibility: Based on Carbon Trading and Carbon Reduction Technology Investment. *Sustainability (Switzerland)*, 14(11). <https://doi.org/10.3390/su14116683>

Zhao, H., Yao, X., Liu, Z., & Yang, Q. (2021). Impact of Pricing and Product Information on Consumer Buying Behavior With Customer Satisfaction in a Mediating Role. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.720151>

Zin, Z. M., Sarbon, N. M., Zainol, M. K., Nur', S., Jaafar, A., Shukri, M. M., Hj, A., & Rahman, A. (2021). Halal and Non-halal Gelatine as a Potential Animal By-Products in Food Systems: Prospects and Challenges for Muslim Community. *Proceedings of the First International Conference on Science, Technology, Engineering and Industrial Revolution (ICSTEIR 2020)*, 536(Icsteir 2020), 530–540. <https://doi.org/10.2991/assehr.k.210312.086>