

HALALAN THAYYIBAN CHEMISTRY: THE TOPICS OF CHEMISTRY METHODS IN FOOD SAFETY PERSPECTIVE

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Abstract

Halalan Thayyiban concept is the universal benefits of good that can be offered from halal food. The concept is related to food safety and had the potential to support the sustainability of all efforts to develop food quality for humanity in the future. The application of knowledge and technology will push the concept into a trend of food service and food industry in the future. In this case, Chemistry occupies a special position. The main purpose of this research is to study the interrelationships between *Halalan Thayyiban* concept and Safety Food that has generated by the food service practice and Chemistry methods in food analysis. Another important objective of this research is to analyze the topics of chemistry methods that can be offered in the training of human resources who will be responsible to the Halal assurance of food products as an important part of food safety. The Systematic literature review method approach was used to determine the development of knowledge and research of *Halalan Thayyiban* of food products, especially in the scope of food analysis as part of food safety. Search strategy and identification of scientific articles and others literature sources used electronic databases. The data base search was conducted using Various keywords such as Halal Food, *Halalan Thayyiban*, issues in halal food, and food safety. The review critically appraise, evaluate, and identify limitations and strengths of studies related to *Halalan Thayyiban* of food products as a part of food safety, and role of analytical chemistry in this area. The strength of studies about chemistry methods was offered in food products halal assurance training as a part of food safety. In conclusion, There is a close interrelationships between *Halalan Thayyiban* concept and Food Safety. *Halalan Thayyiban* concept has become important due to its clean and wholesome requirements, and has encourage Food Safety development in food service practice and food industry. The concept has trigger the development of various chemistry methods in Food Analysis for the benefit of food safety. Some topics of chemistry methods that can be offered in the training of human resources who will be responsible to the Halal assurance of food products as an important part of food safety. These topics include: *Halalan Thayyiban* principle, chemical analysis in analysis of *Halalan Thayyiban* of food products (biochemical technique, chromatography techniques, mass spectrometry techniques, electrophoresis techniques, spectroscopic techniques), *Chemometric* Method in analysis of *Halalan Thayyiban* of food products, and Laboratory Safety in food analysis of *Halalan Thayyiban* of food products.

Key Words: *Halalan Thayyiban*, Chemistry Methods, Food Safety, Food Analysis

INTRODUCTION

Halal is an Arabic phrase refer to Islamic law and principles of lawful and permissible. Halal foods are foods that do not contain any components that Muslims are prohibited from consuming [4]. Halal products are the main requirement for country with mostly Muslims population [14].

The need for halal food products is increasing due to the impact of awareness in two important groups. The first group are consumers that aware on the importance of halal as a benefit that ensures the quality, safety and purity of food products. The second group are entrepreneurs that aware on food production according to the halal concept that can meet the needs of consumers. The interesting thing is demand for halal products has been increasing globally, not only from Muslim consumers but also from non-Muslims [3].

At present, the term *Halal Thayyiban* is more used when talking about halal food products. *Halalan Thayyiban* is how to obtain the halal sustenance and the good according to Qur'an. Islam

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strongly emphasises the aspect of *Halalan Thayyiban* of food consumption among its followers [17,14].

Halalan Thayyiban concept is very closely related to the universal benefits of good that can be offered from halal food. This has the potential to support the sustainability of all efforts to develop food quality for humanity in the future, because this concept is closely related to foodsafety. The application of knowledge and technology will push this concept into a trend mark of service and food industry in the future. In this case, Chemistry occupies a special position. The main purpose of this research is to study the interrelationships between *Halalan Thayyiban* concept and Safety Food that has generated by the food service practice and Chemistry methods in food analysis. The main purpose can be synthesized into 2 most important objectives, i.e: (i) to conduct a critical review of the impact of Halalan Thayyiban concept to Food Safety development in food service practice and food industry; (ii) to investigate the impact of the Halalan Thayyiban concept to development of Chemistry methods in Food Analysis for the benefit of food safety. Another important objective of this research is to analyze the topics of chemistry methods that can be offered in the training of human resources who will be responsible to the Halal assurance of food products as an important part of food safety.

METHOD

The study was conducted using a literature review to answer the research objectives based on the results of other studies that have been published. Systematic literature review method approach was used to determine the development of knowledge and research of *Halalan Thayyiban* of food products, especially in the scope of food analysis as part of food safety. The review process used a comprehensive search strategy and rigorous, transparent appraisal methods. Search strategy and identification of scientific articles and others literature sources used electronic databases were searched in June 2020 using a systematic search strategy by search engine Google Scholar and various databases like EBSCO, Wiley Online Library, Science Direct, Taylor and Pub Med. The data base search was conducted using Various keywords such as Halal Food, *Halalan Thayyiban*, issues in halal food, and food safety. The search findings were further narrowed using keyword 'chemical analysis'. This search was repeated using Google Scholar, then the Eligible literatures was analyzed by systematic literature reviews. The review critically appraise, evaluate, and identify limitations and strengths of studies related to *Halalan Thayyiban* of food products as a part of food safety, and role of analytical chemistry in this area. In the final section, some strength of studies about chemistry food safety.

RESULTS AND DISCUSSIONS

Halalan Thayyiban

According to Saaidin *et al.* (2018), Muslim consumers demand for Halal Assurance and would feel confident in dining when the Halal logo or certification of Halal is visible. Halal restaurant (food service) is based on the concept of Halalan Thayyiban to serve food and beverages following principles of the Islamic laws (Sharia) [19].

For the muslim consumers the basic quality in halal food is the food must be free from prohibited ingredients. It is not just stop there, the preparation of halal food includes the handling and processing stages are important as well. It is not limited to the ingredients only but also the operation where these are the most critical matters, means all the activities in handling and processing of the item must be accorded to halal criteria as stated in halal standard [18].

At present, Halal assurance is one of important food certifications, and it is increasingly adopted by the global food industries [4]. A concrete example of the importance of halal issues can be directly seen in the restaurant food service. Some restaurants labelled "halal and thayyib" offer solution for all consumers, to provide a sense of calm and comfort as well as an Islamic concept [14].

Related to this, the term Halalan Thayyiban has become more popular. Halalan Thayyiban concept in food industry has become an important thing since the awareness of muslim consumers have increase. The concept also attract non-muslim consumer, due to its clean and wholesome requirement. Halalan Thayyiban food products expected to be a good quality, clean and have many benefits for human body. Zainol *et al.* (2019) revealed that *Halalan Thayyiban* derives from two basic

terms, halal (things or actions that are permitted or lawful by the Syariah law) and Tayyib (wholesomeness and cleanliness) [27]. With respect to food products, halal indicates that the food consumed must be allowed to be consumed in accordance to the Islamic law and tayyib emphasizes that all food must be clean, good quality, nutritious and safe for consumption.

Food does not contain toxic elements and does not has a damaging effects on health is a realization of the concept of tayyiban [3]. *Halalan Thayyiban* is not only to consume halal food but also safe, clean, nutritious and quality foods. To provide information of the nutritional benefits of their food products, the nutrition label is made compulsory to be displayed on food packaging. It is important for the consumer to look into the halal logo and nutrition label on food in purchasing processed food products, to make sure the nutrition and the food product follow *Halalan Thayyiban* principle [27].

Halalan Thayyiban has become an important part of food service and food industry. The development of food service and food industry based on the principle of *Halalan Thayyiban* will form its own increasingly globalized trade cluster. According to Tieman (2015), The halal network depends on interpersonal trust and private relationships. A halal network or society will be important as well as local and international network of halal clusters, because it promotes halal innovation projects, promote new Islamic economic activities and reinforce the halal brand [23].

Izberk-Bilgin and Nakata (2016) have offer five lessons for businesses in using halal marketing for the Muslim segment, That is holistic meaning of halal, halal rules and rulers, halal policy, attract mainstream consumer, integrated halal approach [8].

Two lessons that interesting are the holistic meaning of halal and the integrated halal approach. Both of these lessons can be accommodated by the *Halalan Thayyiban* concept as an important part of food safety that supported by scientific evidences.

Halalan Thayyiban and Food Safety

Halalan Thayyiban concept as an important part of food safety is closely related to standards for *Thayyib*. Food safety standards and certification are important to ensure food safety and consumer trust. The standards of thayyib products are food and beverages that good for the consumer, which can be observed from the aspect of health, proportional, and safety of the food and beverages [4,14].

Halalan Thayyiban concept for halal food products need to follow safe and hygienic guidelines. In other words, *Halalan Thayyiban* focus on shariah compliance and safety of food, because *Thayyiban* refer to wholesome, pure, clean, nourishing, and safe for consumers' health [9].

Some important issues can enhance our understanding of the *Halalan Thayyiban* concept as an important part of food safety. These Important issues i.e: food additives and food adulterations, both issues are closely related to the holistic meaning of halal and the integrated halal approach.

Issues on Food Additives

Food additives are used in food processing to make the food less fragile and preventing the deterioration of food quality during the production process [3]. Eating food that is not halal (haram) or doubtful (syubhah) is prohibited in Islam. Likewise, the use of haram or doubtful material ingredients as food additives or adulterant in food products is also prohibited [15]. Based on the concept of halal *Thayyiban*, the perception of food additives can not only be limited to the haram components of food additive agent. Moreover, the negative effects of using food additives also need to be considered as criteria of *Thayyiban*.

The quality of halal processed foods that contain halal food additives from the *Thayyiban* status aspect, need to be re-evaluate [3]. Many food additive agents are unhealthy and can change the originality of food characteristics. Additive agent have been used to increase durability or freshness of the food, but excessive amount and long run consumption of it may cause negative implication to the human body and can contribute to the problems of health, such chronic diseases and critical diseases [25]. Critical evaluation must be considered so that the use of additives does not erase the meaning of *Thayyiban* in halal food product.

Food consumers usually do not know the safety of food additives in the processed food. The information of food safety related data for consumers to determine any harmful chemical ingredients in the food is safe to be consumed is important [25].

This information can help consumers to decide the best food product to consume according to Islamic perspectives by meeting the *Halalan Thayyiban* criteria. The criteria that reflect standards and

quality of food ingredients through a process of verification and certification of safety and health [25].

Issues on Halal food adulterations

Halal authenticity has been an important issue in the food industry. Many cases of involving adulteration of haram or *mushbooh* ingredients in foods productions had reported [5]. Food adulteration is a process in which food quality is reduced or replacing food ingredients or adding unauthenticated substances or removing vital components from food for profit or other reasons [2]. Adulteration is a legal term for a food product which fails to meet certain standards, due to addition of a substances to more expensive substances to increase visible quantities, reduce manufacturing costs and other deceptive or malicious purpose. Food adulteration is reducing the quality of food by adding mixture or substitution of inferior substances or by removing of some valuable ingredient. As more food adulteration occur, Muslim consumers become more concern about the authenticity of halal food. Muslim consumers require an accurate information on food labels, because the ingredient label usually does not list the origin of the ingredients. Hidden ingredients in the food that come from various sources is a big problem for the Muslim consumers, due to this high demand for transparency in the food industry has enhanced the development of methods for the analysis of food ingredients [5].

Halal status of the meat could change according to the way of preparing it. That is why the animal should be slaughtered properly and prepared for consumption by the way of *Shariah* or Islamic practice, to make sure it stay halal [20].

Meat that suppose to be halal for Muslims turn out it could be the opposite. Meat that is bad for human consumption cannot be considered halal, even if it is derived from a halal- slaughtered animal. It is a crime committed by Muslim against Muslim, as well as by and against non-Muslims. Due to this the Halalness of food needs a regulation [13].

Meat Adulteration is defined as the addition or replacement of undeclared substances or materials to make the product appear more valuable than it is. It is divided to 4 main areas; meat origin, meat substitution, meat processing or treatment, and non-meat ingredient additions. Some examples of this issues are Formalin in Meat, Glonggong meat (meat/animal that injected by water), Tiren (meat coming from animal that died yesterday), Fake Meat, Exotic Meat (come from wild animal species), Meat Containing Foodborne Zoonotic Diseases, Mislabeled Meat, Aniline Meat, Garbage Meat (meat that collected from garbage sites), and Food Terrorism. Islam strongly emphasises the aspect of *halalan Thayyiban* of food consumption among its followers, that is why it must be gained clearly from halal animals that have been slaughtered based on Islamic practices and free from contamination of harmful elements. Because of this type of fraud, the muslim must be careful in choosing the foods they gonna eat [17]. Halal forensic laboratory testing method can be applied for food adulteration screening to make sure the food products is halal [11].

Halalan Thayyiban Integrity food

Halalan Thayyiban as a part of food safety is a continuous process in the food service and food industry. It is important to pay special attention to *Halalan Thayyiban* Risk Management Plan (HTRMP).

The HTRMP is important in management to control the quality, safety and Halal Thayyiban of product start from raw material until reach to consumer, and it is also important for the company to control and manage their halalness start from the procurement until end user [21].

Food supply chain is not only concerned about food but also the origin, transparency, potential for fraud and adulteration, increasing consumers, confidence, traceability and quality issues. Halal food supply chain integrity encompasses protective and preventive measures to ensure food products remain halal from production until they reach consumers [22].

Food safety is part of halal integrity as wholesomeness (*tayyab*), because halal integrity present details of the halal status of the product. Halal integrity make sure that the product remain halal throughout the supply chain and free from any activities that might breached the halal status [22]. In this context it is very important to strengthen the role of food analysis in the integrity of *Halalan Thayyiban* food products.

The role of food analysis in the integrity of *Halalan Thayyiban* food products is very closely related to role of Chemistry Analytical methods. chemistry analytical methods are very important for analysis of halal authenticity in food products as integrity of *Halalan Thayyiban* food product.

Halalan Thayyiban and Role Of Analytical Chemistry Methods

Food products could be contaminated with small amounts of Haram substances that cannot be detected by vision, smell, or taste [11]. Role of chemistry analytical methods are very important for halal authenticity in food products. The analytical methods have been developed as a tool of scientific validation to solve the issues of the halal authentication. Hassan *et al.* (2018) revealed that the analytical methods are important for halal authenticity in food and pharmaceutical products. Numerous analytical methods have been developed to deal with the emerging issues, some of the main chemical methods used for the authentication analysis are biochemical, chromatography, mass spectrometry, electrophoresis, and spectroscopic techniques [6].

With increase complexity of the consumer products a new analytical techniques need to be developed [12]. The analytical methods have been developed as tool of scientific validation to solve the issues of the halal authentication. Hassan *et al.* (2018) revealed that the analytical methods are important for halal authenticity in food and pharmaceutical products. Numerous analytical methods have been developed to deal with the emerging issues, some of the main chemical methods used for the authentication analysis are biochemical, chromatography, mass spectrometry, electrophoresis, and spectroscopic techniques [6].

The results of laboratory work are needed in efforts to enforce food law, food safety, quality policy, and decision making. In particular halal food control, monitoring of certain haram ingredients in raw materials and final food products that show compliance with some halal requirements. This helps provide information and customer confidence. At the same time, this part of the belief in halal authority [1].

It is clear that the demands of *Halalan Thayyiban* food product have increase, and it trigger some issues that require the development of various chemistry methods for food analysis. This development of various chemistry methods for food analysis is important to make sure the *Halalan Thayyiban* food products fulfill the requirement of its *Halalan Thayyiban* concept in food industry.

Analytical methods have become important for halal authenticity in food and pharmaceutical products. It has been developed to deal with the emerging issues because it is the only scientific validation for the halal authentication for now, some of the main chemical methods such as biochemical, chromatography, mass spectrometry, electrophoresis, and spectroscopic techniques used for the authentication analysis [6].

Lesson from Gelatin Issue

Several techniques such as FTIR, HPLC, PCR and others have been developed to assist consumers in choosing food products [5]. Pork gelatin is a fairly

widespread issue on the topic of halal food and halal pharmaceutical products. The development of chemical methods in the analysis of gelatin from pork is a representative example for the development of chemical methods in the analysis of the halal status of a product.

The enzyme-linked immunosorbent assay (ELISA) method is a biochemical technique, involves the quantification of biologically molecular interaction and normally used in immunology to determine the presence of antibody and antigen. ELISA was developed to identify bovine and porcine gelatins [6].

Polymerase chain reaction (PCR) is another analytical method in biochemistry that has been widely used to identify gelatin for halal authentication purposes. It is used in detecting the presence of deoxyribonucleic acid (DNA) and quantification of trace DNA, to identify porcine and pork DNA as well as other animals in gelatin, food, and pharmaceutical products. Real-time PCR is one of the most common PCR techniques such as PCR-restriction fragment length polymorphism, species-specific PCR, and multiplex PCR. Real-time PCR is used to detect the presence of porcine DNA in food and pharmaceutical products [6].

The high-performance liquid chromatography (HPLC) method was used to profile the amino acid content in the gelatin in the form of chromatogram and the peak heights are observed to discriminate the sources of gelatin, and it identified bovine and porcine gelatins [6].

Sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE) is an electrophoretic method used to separate molecules based on their molecular weight, and commonly used to analyze proteins in complex extracts. The method was used to examined the differences of electrophoretic polypeptides between porcine and bovine gelatin, and used to differentiate bovine and porcine gelatin

in processed foods and adulterated samples. The distinct patterns between both gelatins estimated the origin of the gelatin and indicated the adulteration of the gelatin [6].

Fourier transform infrared (FTIR) spectroscopy is another analytical method used in identification of the sources of gelatin and other nonhalal substances. The FTIR spectroscopy method is simple and accurate for discriminating spectra between samples, and useful to deal with numerous adulteration problems in food products. The FTIR result in the form spectrum represents the molecular fingerprint of samples, and it covers the details on functional groups and chemical compositions of samples. Spectrum of each sample is different, it make gelatin sources identification and halal authentication more practical. Although immense similarity of chemical properties and structures of the proteins between the gelatins make it difficult to discriminate the sources accurately [6].

Principal component analysis (PCA)

Chemometrics is an important part of analytical chemistry, it combines mathematics, statistics, and logic to design or select optimal measurement procedures and experiments that enable the extraction of maximum chemical information. Extraction of maximum chemical information is relevant to analyze chemical data and helps in understanding chemical systems [10].

Principal component analysis (PCA) is a nonparametric technique and Chemometric tool which is used to extract relevant information in data analysis, It is widely used in multivariate data analysis to extract information from data with multiple variables. The PCA method reduces the proportion of the data and extracts the most pertinent information from the data set [6]. The principal component analysis (PCA) is one of various chemometric techniques that reduces the dimensions of the data sets and simplifies the data for easy and meaningful interpretations [10].

Obviously, analytical capacity is needed in control of *Halalan Thayyiban* food products. This is manifested by the availability of qualified laboratory facilities and human resources with expertise and skills. Development and Sustainability of the analytical capacity can be realized by training of human resources who have competence in food analysis of the *Halalan Thayyiban* food products.

Training of Food Analysis of The *Halalan Thayyiban* Food Products

Education and research is one of five pillars that critical in building a strong halal production and trade cluster the halal cluster model [23]. Therefore, the integration of research results into education becoming more important in the development and sustainability of the analytical capacity, by training the human resources who have competence in food analysis of the *Halalan Thayyiban* food products. This training is training of the Halal assurance as a importance part of food safety.

Halal training is important for human resource development in the halal industry [7]. Training is a process that applies different methods to strengthen employees' knowledge and skill needed to perform their job effectively, and an aspect of human resources development function of the organization. Specialized and affordable training and development is needed for companies and employees to increase their competitiveness. A company does not have to be run, operated or owned by muslim to produce halal products as long as the product is produced under strict regulations, supervision, support, guidance and the important factor is the trained and competent muslim production inspector must ensure thehalal needs and standard requirements are fulfilled [7].

Adequate human resources is the key to halal business sustainability. Therefore, the development of halal studies and training programs is one of the accelerators in providing quality human resources for the halal industry. Systematic planning for halal studies and training must be designed perfectly to provide knowledge about halal concepts and management aspects [26].

The training program is not limited to the understanding of at halal training activities carried out specifically. In conducting education at the university, providing topics related to Halalan Thayyiban in courses related to food studies is also part of the training program. Some Chemistry Department and Food Science Department provide courses of Food Chemistry as expertise courses or elective courses. The training program of Halalan Thayyiban as a part of food safety can be carried out by providing some topics of Halalan Thayyiban. some topics related to the chemical analysis of *Halalan Thayyiban* food products. We use the term *Halalan Thayyiban Chemistry* for these topics.

The experience of researchers from various countries is an important input for the development of *Halalan Thayyiban Chemistry*. Based on what has been explained in the discussion above, several topics of Halalan Thayyiban Chemistry *Halalan Thayyiban Chemistry* can be given to students participating in food chemistry courses, including: *HalalanThayyiban* principle, chemical analysis in

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Analysis of *Halalan Thayyiban* food products (biochemical technique, chromatography techniques, mass spectrometry techniques, electrophoresis techniques, spectroscopic techniques), Chemometric Method in Analysis of *Halalan Thayyiban* food products, and Laboratory Safety in food analysis of *Halalan Thayyiban* food products.

We believe that in this training, the concept of *Halalan Thayyiban* is very important to be taught. According to Mursyidi (2013), Chemical analysis is important to verify and authenticate the halal products, but does not cover all of non halal matters such as those which are not chemical in nature (slaughtering system).

Topic about chemometric method in analysis of *Halalan Thayyiban* food products is very important to be given in this training, because it can provide the trainees with ability to manage chemical analysis data thus increase the accuracy of chemical analysis results. There is an information gap about the specific procedures of laboratory safety for the *Halalan Thayyiban* food analysis laboratory. The procedures must be developed immediately and applied in the training of human resources who will be responsible to the Halal assurance of food products as an important part of food safety.

CONCLUSIONS

In conclusion, There is a close interrelationships between *Halalan Toyibban* - Safety Food. This is a positive impact to attention of food products for muslim consumers, due to practice and development of chemistry methods in food analysis for *Halalan Thayyiban* in food products and food service. *Halalan Thayyiban* concept in food industry has become important due to its clean and wholesome requirements, and has encourage Food Safety development in food service practice and food industry. *Halalan Thayyiban* concept has trigger the development of various chemistry methods in Food Analysis for the benefit of food safety. Chemistry methods is develop for better food analysis, and it increase the accuracy of the food analysis. Some topics of chemistry methods that can be offered in the training of human resources who will be responsible to the Halal assurance of food products as an important part of food safety. These topics include: *Halalan Thayyiban* principle, chemical analysis in analysis of *Halalan Thayyiban* of food products (biochemical technique, chromatography techniques, mass spectrometry techniques, electrophoresis techniques, spectroscopic techniques), *Chemometric* Method in analysis of *Halalan Thayyiban* of food products, and Laboratory Safety in food analysis of *Halalan Thayyiban* of food products.

AUTHOR CONTRIBUTIONS

Luther Kadang and Abdullah Mutis prepared and wrote the manuscript under the supervision of other authors. Amor Tresna Karyawati and Samudi provided some inputs and reviewed the draft for publication.

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