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Review Article

The Role of Chemical Analysis in the Halal Authentication of Food and Pharmaceutical Products

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ABSTRACT

Food and pharmaceutical products (drugs and cosmetics) are one of the essential human needs since the human civilization. It is an obligation for Muslim to consume and use the halal consumer goods. Currently, there are numerous food and pharmaceutical products available in the market supplied to consumers in which the actual contents of these products are not clear; consequently, the halal verification and authentication of these are highly required. Non-halal items commonly found are pig derivatives such as pork, lard, and gelatin as well as alcohol (khamr), blood, dead meats, and the allowed animals to be consumed which are not slaughtered according to Syariah law. One of the ways to authenticate the halalness of the food and pharmaceutical products is chemical analysis which is relied to find the specific markers present or absent in the products they contain. Currently, some analytical techniques have been proposed and continuously developed for the authentication of halal products such as Fourier transform infrared (FTIR), chromatography-based methods, differential scanning calorimetry, electronic nose, and DNA-based methods. However, these methods can not verify the non-halal items which are not physical, chemical, or biological in nature like dead animal. Consequently, another method should be performed, i.e. direct and monitoring the production step (from farm to table). Besides, to succed the verification and authentication of halal products, passing the legislation of "Halal products assurance" by Indonesian parliament is urgently needed.

Keyword: chemical analysis, food, pharmaceutical, halal authentication

1. Introduction

Foods, drugs, cosmetics and daily personal care are all essential and daily human needs demanded by modern society. In line with the progress of science and technology as well as with product development, the diversity of consumer products is increasing from year to year. As a result, consumers often do not know the actual contents of what they consume in terms of its raw material and processing.

From a Muslim point of view, knowing the status of raw materials and production process of the consumer items is essential due to the Syari'ah obligation stating that any Muslim must consume only the halal and wholesome products (Al-Qaradawi, 1997). This situation is increasingly important since many consumer products are imported from places (nation) which do not follow the restriction of Halal preparation according to Islamic syari'ah. Consequently, the verification and authentication of halal products is highly demanded in order to maintain the sanctity of Islamic religion.

2. Halal and wholesome products

Islam teaches its followers to consume only the permitted products (halal and wholesome products). Halal implies more spiritual (immaterial) aspects indicating obedience to Allah, while wholesome relates to more material aspect indicating physical implication of nutritional values. This is a strong indication that Islam is religion that cares not only worldly aspects of life but also spiritual aspects of life. This implication tend to more spiritual as can be seen from some verses in Quran such as Al-Baqarah verse 168 stating "O ye people, eat of what is on earth, halal (lawful) and good (wholesome); and do not follow the footsteps of the evil one, for he is to you an avowed enemy".

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Halal is an Arabic term meaning "*permitted, allowed, lawful or licit*". When used in the relationship to food, drugs and cosmetics products, halal can be understood as any foods or pharmaceutical products permissible to be consumed or used by Muslims (Eliasi and Dwyer, 2002). The opposite of Halal term is Haram. The haram items are grouped into nine classes as described by Regenstein (2003) as well as Sazili and Che Man (2010), namely (1) dead animals, (2) blood, (3) pig and its derivatives such as pork, lard, and gelatin (4) halal animals slaughtered without pronouncing the name of God (Allah), (5) animals killed in a manner that prevents their blood from being fully drained from their bodies, (6) all kinds of intoxicants, including alcohol or khamr (7) carnivorous animals with fangs such as lions, dogs, wolves, or tigers, (8) birds with sharp claws (birds of prey) such as falcons, eagles, owls, or vultures, and (9) land animals such as frogs or snakes.

3. Non-halal items in food and pharmaceutical products

Most non-halal items found in the market are pork and its derivatives such as pork, lard, gelatin, and porcine-based products. Besides, it is also possible to find dead meat, blood (especially in local market) and meat obtained from slaughtering under unislamic system. Besides in food, some non-halal items are also found in medical preparation which can be listed as below:

1. Insulin, it is matter of fact that pig insulin is similar to human insulin. It is therefore understood that pig insulin was commonly employed in the past. Nowadays, it is still used for approximately 17 % of the time, but human insulin and cow insulin of about 70 and 8 %, respectively
2. Heparin, this compound work as anti-coagulating agent to prevent blocking blood vessel. Heparin was commonly obtained from pig (sodium heparin known as Lovenox from Aventis Pharma Specialitis, French)
3. Gelatin, a protein derived from animal collagen (pig, lamb, cow). Gelatin from pig is more abundant compared to gelatin derived from halal animals; consequently, Muslim must be aware to this reality.
4. Alcohol, this item is still used in cough syrup

In addition, non halal items were also found in cosmetics and other personal care products. Non-halal items employed in cosmetics preparation can be classified based on their origin, namely human and animal. In the case of cosmetics preparation, the problem commonly relates to the "najs" (impure) status of the ingredients. Some of them are listed as follows:

1. Keratin, a chemical obtained from human hair and employed as coloring agent of hair
2. Albumin, derived from human serum and used as solvent to dissolve active ingredient in cosmetics formulation
3. Placenta extract, prepared by extraction of human placenta under a particular procedure. The extract is believed to be the cosmetic preparation of choice for anti-aging product and skin care. It is reported that 320 tons of placenta are used per year
4. Hyaluronic acid, a chemical obtained from the womb and commonly used for whitening and skin care cosmetics.

These four cosmetics preparations employ human tissue and organs, therefore it is recommended not to use these substances.

4. The role of chemical analysis in Halal authentication

Given the fact that foods, drugs, and cosmetics are of chemical origin, regardless they are halal or haram, these three categories of important consumer goods, can be identified using chemical analysis based on the their specific chemical characteristics. For the halal and haram assessment, analytical methods are basically focused on qualitative (identification) analysis rather than quantitative analysis. This is simply because the haram status is very much determined by *the kind of matter rather* than the quantity. In this regard, qualitative analysis is more focus only consumer goods (foods, drugs, and cosmetics) containing or consisting of those explicitly prescribed by Allah SWT in Holy Quran and as stated by Rasulullah Muhammad SAW. On the other hand, quantitative analysis is primarily aimed to determine the limit of detection using available analytical methods. Looking at the above items classified haram, it is clear that the haram items used for drugs and cosmetics are relatively simple compared to that of foods. Besides alcohol, more haram items (placenta and fetus) are introduced in cosmetics preparation in recent years.

Looking at the problems faced by analytical chemist in supporting data for verification of halal products, there are several points that should be emphasized. Firstly, haram goods are generally mixed, intentionally or unintentionally, with other items having similar chemical properties, for example, lard is mixed with fat from plant of origin. Consequently, it raises difficulty in identifying the target compound. Secondly, if haram item is a contaminant that appears during the process, meaning the quantity is relatively, the method used must be sensitive and selective. Thus, the negative result does not necessarily mean the absence of the haram compounds/items that are immaterial, i.e. of haram status due to slaughtering system. It is, therefore, direct and continuous on the spot monitoring by government authority is essential.

This paper will not present detail of the chemical analysis as it has been fully reviewed by Rohman and Che Man (2012) for analysis of pig derivatives in food and by same author (2008) for lard analysis in food products. The authors use some important methods, namely Fourier Transform Infrared Spectroscopy, chromatography based-methods differential scanning

calorimetry, electronic Nose (EiNose) technology, and DNA-based methods.

FTIR Spectroscopy was reported (Che Man and Mirghani, 2001) to give accurate and reliable results with a 3% detection limit for analysis of lard in the mixture with other animal fats. FTIR spectroscopy was also developed for quantitative analysis of lard in some food products such as chocolate, cake and meatball formulations (Che Man et al., 2005; Syahariza et al., 2005; Rohman et al., 2011. In addition this method is simple to perform and offer rapid result (2 minutes/per one sample measurement).

The chromatographic-based techniques offer rapid and reliable tools for the separation and quantitative analysis of non halal items by determining the major and minor components present in food/cosmetics products. Because of their advantageous separation characteristics, numerous chromatographic techniques have been tested, accepted, and employed in the analysis of non-halal items in food products. The disadvantage of this technique is generally the multiple step sample preparation that is needed before chromatographic analysis. The use of chromatographic-based techniques for analysis of non-halal items can be found in Rohman and Che Man (2011). Meanwhile, the differential scanning calorimetry is one of the thermal analytical methods used to characterize the thermal properties of non-halal items. DSC offers a direct method to study the thermal properties of various materials and has a possibility to be developed as quality control procedure in halal products (Rohman and Che Man 2008).

Electronic nose technology is based on the development of a chemistry of odor where each odor is related to the presence of a specific compound. The instrument comprises an array of electronic chemical sensors and an appropriate pattern recognition system, capable of recognizing a simple or complex odor. It was reported this method could be used for monitoring the presence of lard in food sample such as cooking oil. In addition, it could also be applied to identify adulterated oil by the characteristic 2-dimensional olfactory images called VapourPrintTM. E-nose method is an interesting alternative choice offering easier operation with reliable results that could be achieved within minutes. It is, therefore, useful for rapid identification of lard adulteration in relatively low concentration (1%). Very recently, this instrument has been used for analysis of lard aroma in some food products (Juliana *et al*., 2011[a]; Juliana *et al.* 2011[b]).

DNA-based technology is an important approach for species identification. It is understandable because DNA is relatively stable during and after process of production. The method was reported to give excellent results for pig species and its derivative in samples, particularly lard and gelatin. In addition, the method is considered the most reliable method for determining halal status of an ingredient. As has been widely known, every species has its own specific character different from the other. However, this is difficult to apply in its derivatives, especially when further reactions occur. For examples, glycerol-mononitrate, magnesium stearate, sodium/potassium stearate.

Different from haram goods from pig and its derivatives, especially gelatin and lard which are still possible to be identified using the existing methods, but it is not so for dead meat (carrion) or halal animals slaughtered under unislamic way. To the best of the author knowledge, there is no difference in chemical specification or composition between meat derived by Islamic and Unislamic slaughtering systems. Again, the haram status of these consumer goods is immaterial in nature, nothing to do with the chemistry but fully to the basis of belief (*iman*).

5. Conclusion

Chemical analysis plays an important role to verify and to authenticate the halal products; however, chemical analytical method does not cover all of non halal matters, especially those which are not chemical in nature (slaughtering system). New analytical techniques should be continuously developed in line with increase complexity of the consumer products. Finally, the intensive communication among experts on Halal certification (Ulama or Muslim scholar and certification bodies) is needed.

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