



Applications to Halal Foods by Thermal Analysis

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Thailand Institute of Scientific and Technological Research, TISTR's "From Local to Global International Forum: Food Industry 4.0" was held on June 12 – 13, 2017 at the Centara Grand Hotel at Central Lad Phrao, Bangkok, Thailand. The food industry is one of the fastest growing sectors globally. Rigaku participated in the session "Food for Health and Safety: Trends in Food Safety Standards," with four representatives from member companies of JAIMA. Dr. T. Arii presented a talk entitled "Applications of Halal foods by thermal analysis".



"Halal" is an Arabic word meaning "lawful" or "allowable". Any product deemed Hhalal is permitted for use and consumption by Muslims. Besides being free from ingredients such as pork and alcohol, products must be healthy, wholesome, nutritious and of good quality. Many consumers are unaware that animal byproducts are used by food and cosmetics industries as additives and ingredients. This creates a need to expand the analytical techniques required to detect them. Previously, some analytical techniques were proposed and continuously developed for the authentication of halal products, such as Fourier transform infrared (FTIR), chromatography-based methods, differential scanning calorimetry (DSC), electronic nose, and DNA-based methods, so on. When it comes to halal food, most people think of meat because consumption of pork is of high concern for Islamic and Judaic communities. The processes of conversion in complex foods and even in pure food components (e.g. the denaturation of proteins) often exhibit only very low energy changes. Highly sensitive DSC is used for research and development, but it is also being used more and more in the food industry for routine process analysis and quality control.

A large amount of protein and fat are contained in raw meat. Information on the identification and quality of meats can be obtained via thermal denaturation and melting behavior by DSC. A comparison of the DSC curves obtained from raw beef, chicken and pork is shown in Fig.1. We can see that the meat proteins in the chicken undergo several conformational DSC endothermic changes, which originate from the transitions of myosin and sub-units at 55°C to 62°C, of sarcoplasmic proteins and collagens around 67°C and of actin at 75°C to 80°C. Additionally, the three different raw meats reveal characteristic endothermic DSC peaks, and therefore it is quite easy to distinguish them from each other. This means that the observed DSC curves correspond to characteristic "fingerprints" of the various muscle proteins that are key parameters in the identification of meats. The DSC curve of a mixture meat prepared with 50% each of pork and beef is also illustrated in this figure. Because the three characteristic endothermic DSC peaks at 55.7°C, 61.4°C and 78°C originating from the pork are clearly observed in this DSC curve, it confirms that the mixed meat contains pork. Based on the above-mentioned, we propose that high sensitive DSC provides characteristic transition curves that are effective for the identification of raw meat and is applicable to halal food as one methodology to identify the presence of pork in an unknown raw meat food with only a few mg amount.

We also visited the Halal Science Center of Chulalongkorn University on the day after TISTR's Forum, and presented this applications concerning Halal food to the laboratory staff. Rigaku's ThermoplusEVO2 DSC8231 was introduced into this Halal Science Center in January 2017. The center plays an important role in the enhancement of halal certification in Thailand to be applied by all Muslim restaurants for consumer protection, but especially for Muslim consumers.



With the growing Muslim population, the ability to provide safe and nutritious food is a global concern, and halal business will continue to increase in the future. Instrumental analysis plays an important role in the verification and authentication of halal products. New analytical techniques should be continuously developed in line with the increasing complexity of consumer products. We will continue to pay attention in the future to halal business through intensive communication with experts on Halal certification.

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Fig.1 A comparison of the DSC curves obtained from raw beef, chicken and pork and a mixture prepared with 50% pork and beef.

Heating Rate : 5°C/min

Sample weight : ca.7 mg

Pan : Aluminum standard 30 µL, hermetically sealed

