CHAPTER VII

CONCLUSION

This study were undertaken to monitor fatty acids (FA), and triacylglycerols (TAG) profiles of lard, beef tallow, and chicken fat, using four different analytical tools (GC, HPLC, FTIR and DSC). The detection and characterization of the limited concentration of added lard within different mixtures with beef tallow and lard with chicken fat were carried out using the previous mentioned equipments coupled with chemometric techniques.

From the results, lard detection and differentiation from beef tallow and chicken fat was difficult, especially when they were mixed and this is because of their physicochemical properties. GC-FID results showed that lard contained higher C18: 2cis FA and low C16:0 FA compared to beef tallow and chicken fat. HPLC results illustrated that lard and chicken contained higher PPL, PPO TAGs and low PLO than beef tallow. Moreover, DSC results demonstrated that by using melting thermograms, it is possible to detect lard adulteration in beef tallow and chicken fat, even less than 1 %, while it is difficult by using cooling thermograms to do so, especially in chicken fat with lard.

Furthermore, the results showed also that GC-FID or HPLC alone was not enough to be appealed for lard adulteration detection. However, DSC and FTIR had shown to be robust analytical techniques as fingerprints tool for lard detection in food matrice after the integration with chromatographic techniques. Moreover, coupling these analytical techniques (GC-FID, HPLC, DSC, and FTIR) with chemometrics, especially principal components analysis (PCA) and cluster analysis (CA) revealed better interpretation and more comprehensive clarification of the extracted data from the equipments. Besides, PCA has helped to achieve in the detection of lard adulteration within the mixtures of beef tallow- lard and chicken fat-lard as low as 0.5 % of lard especially in GC-FID, HPLC, and DSC. K-mean cluster was only able to differentiate between pure beef tallow, pure chicken fat and pure lard.

As a recommendation, the integration of GC-FID, HPLC, DSC, and FTIR displayed as very useful and applicable techniques for Halal analysis and authenticity, especially for lard adulteration detection. Future continuation of this study should look into more replications as well as the percentages of incorporated lard should be higher in the mixtures with other animal fats to elaborate more information. In addition, it is much recommended to focus more on DSC thermograms (cooling and melting) and FTIR spectrums in term of fatty acids level for advance understanding of the interaction of animal fats mixtures, especially in very small amounts. Furthermore, the implementation of chemometric techniques in analytical methods will further improve the detection methods of lard in food matrix to contribute more into Halal analytical methods.

It is good to be aware that the adulteration is not always fixed using only two types of animal fats. It may be by mixing more than three types of animal fats or even adding vegetable oils to animal fats and many others.