

CHAPTER I

INTRODUCTION

Adulteration of foods ranges from the simple addition of natural compounds to the much more serious case of contamination with harmful substances (Defernez & Wilson, 1995). Therefore, numerous analytical methods have been used for the analysis of food adulterants such as differential scanning calorimetry (DSC), Fourier transform infrared (FTIR) spectroscopy, gas chromatography (GC), high performance liquid chromatography (HPLC), nuclear magnetic resonance (NMR) and DNA-based method (Coni et al., 1994; and Che Man & Mirghani, 2001). In particular, fats and oils for longtime have been liable to adulteration. Fats and oils adulteration is becoming more difficult to detect especially when the contaminant and the original oil or fat have similar properties, which are hard to differentiate (Rossell et al., 1983). For instance, some manufacturers prefer to mix lard or tallow with other vegetable oils to produce shortening, margarine and other specialty food oils to get the desired texture, flavor and melting profiles (Gillies, 1974); this is another religious and prohibition issue that Muslims and Jews face.

Hence, there is a great need for robust and trustworthy techniques for lard differentiation and detection for the practice of *Halal* authentication analysis by the relevant authorities. Past studies on lard detection were primarily based on GC, HPLC, FTIR and DSC, however their focus were mainly on raw or fresh products and some processed product (Rashood et al., 1996). Lard and its compounds have been largely displaced in modern times by compound fats made from refined coconut oil, palm kernel oil, cotton seed oil, and other vegetable oils (Regenstein et al., 2003).

Many papers have been published in the area of detection of adulteration by pork fatty acids in different food matrices such as: Identification of pork derivatives in food products by species-specific polymerase chain reaction (PCR) for halal verification (Che Man et al., 2005); analysis of potential lard adulteration in chocolate and chocolate products using Fourier Transform Infrared spectroscopy (Che Man et al., 2003; Rohman

et al., 2010;and Che Manet al.,2011) and the use of cooling and heating thermograms for monitoring of tallow, lard and chicken fat adulterations in canola oil (Marikkaret al., 2002).

Chemometrics, since its beginning, have played an important role in resolving the food industry problems. It has been used in very wide applications in food and beverages, such as grading of raw materials (Cadet et al., 1990). This is because of the vast amount of data derived by modern analytical instrumentation (Desire& Massart, 2003). In addition, in analytics, chemometric methods are the discipline that uses statistical and mathematical methods to get appropriate information on material systems. The usage of chemometrics strategies in fats and oils analysis have been reported. In many studies, that have done by Al-Alawi et al., (2004); Inon et al., (2003), Maggio et al., (2010) have studied the free fatty acids and fatty acids composition in virgin olive oil using FTIR spectroscopy combined with PLS. Rohman et al., (2012) used PCA to differentiate lard from other edible fats based on triacylglycerols.

Animal fat systems done in this study are represented by beef fat, and chicken fat with small increments of lard contaminants. The justification to use beef fat and chicken fats are because these are commonly used raw meat ingredients, consumed in the form of ground meat, or, as meat ingredients in processed meat.

Until date, there is no obtainable article in the literature related to detection of adulteration in mixture of animal-animal fats in very low concentrations using multivariate data analysis including principle component analysis (PCA) and K-mean cluster, which are selected as chemometric techniques.

Therefore, the main objectives of this research were:

- 1- To monitor fatty acids (FA) and triacylglycerols (TAG) profiles of lard, beef tallow, and chicken fat using GC-FID, HPLC, DSC, and FTIR spectroscopy.

- 2- To characterize and detect concentration of lard of certain percentages, within different fats such as beef tallow and chicken fat using the above-mentioned equipments and then analyzed with chemometric techniques; and
- 3- To determine the lowest possible limit of detection of lard in animal fat mixture models for each instrument.

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