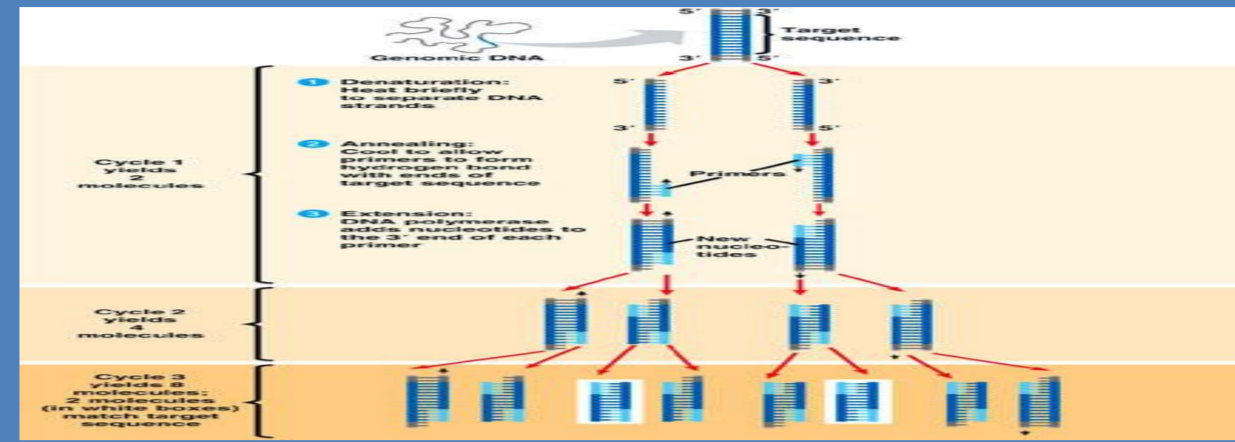
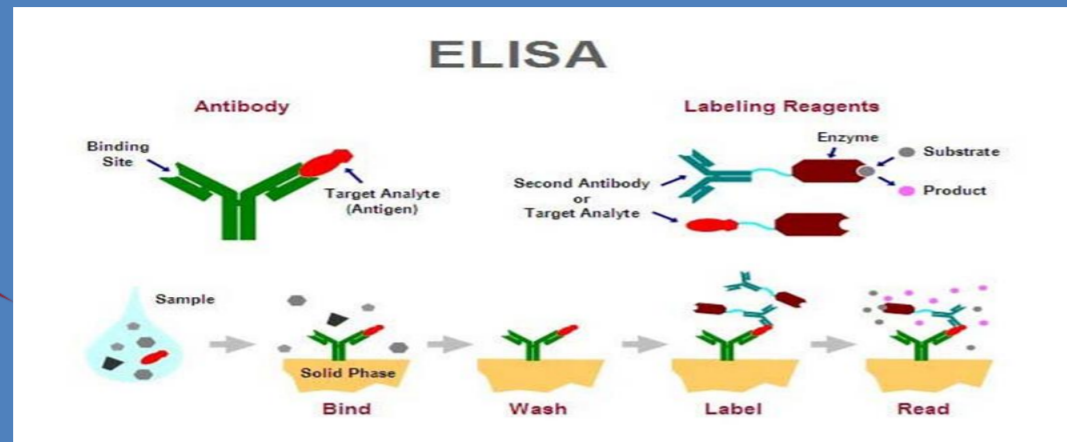


Analytical Methods for Halal Food Authentication: Principles, Comparisons and Food Applications

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INTRODUCTION

Food choice has normally been reflected individual expectations such as lifestyles, culture, religion and health concerns. From the Muslim societies' point of view, this expectation is usually related to halal situation of the food. A considerable number of methods have been developed to evaluate the authenticity and traceability of foods. The analytical methods used for halal food authentication might put in order as polymerase chain reaction, enzyme linked immunosorbent assays, mass spectrometry, chromatography, electronic nose and spectroscopy. These techniques offer a unique possibility for the rapid and reliable separation and quantitative determination of macro- and micro components of highly similar chemical structures in complicated matrices of foods and food products.

Chromatographic methods (HPLC, GC etc.) are used to determinate the pork, lard and pig gelatin in food matrix due to fatty acid, triglyceride and aminoacid composition of food and this method presents a high separation performance.

Enzyme-Linked Immuno Sorbent Assay (ELISA) is a method used to define the species of meat products. ELISA provides the opportunity to analyze a great number of samples in a short time. Electronic nose method is used for determination and separation of lards from the other fats.

Spectroscopic techniques, another validation technique, operates in a different and limited frequency range depending on the size of the processes and energy exchange. These techniques are acceptable in agriculture and food products for both qualitative and quantitative analysis, and provides an alternative to time-consuming wet chemical techniques. Among DNA-based methods, polymerase chain reaction (PCR) is the most well developed molecular technique up to now and provides a simple, rapid, highly sensitive and specific detection for constituents of animal origin in foods.

This study will focus on the review and discussion with selected examples of commonly used analytical methods for food authentication in halal food industry.

Various chromatographic techniques offer a unique possibility for the rapid and reliable separation and quantitative determination of macro- and microcomponents of highly similar chemical structures in complicated matrices of foods and food products (Forgács and Cserhádi, 2003; Nollet, 2003). Because of their advantageous separation characteristics, numerous chromatographic techniques have been tested, accepted and employed in the analysis of food and food products. Chromatographic methods can be equally employed for the measurement of the component of foods, the amount of legal or illegal additives, environmental pollutants and xenobiotics that are health hazards. Because of the high separation capacity of chromatographic techniques, they can be used for authenticity and traceability tests of Foods (Cserhádi et. al., 2005).

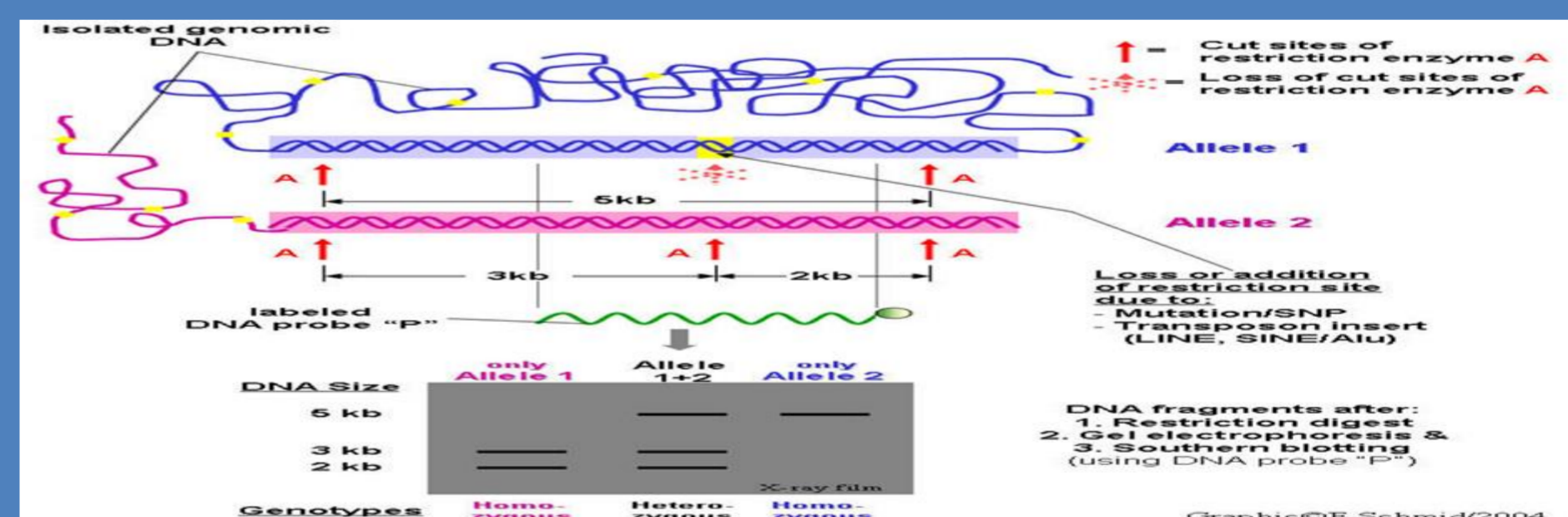
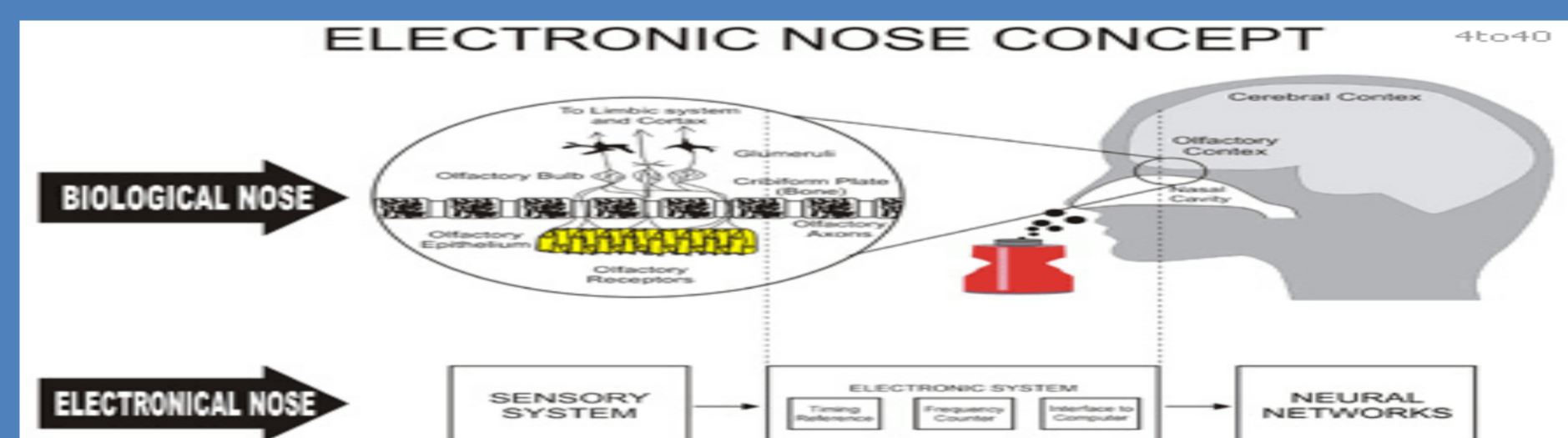
The electronic nose includes several types of electronic gas sensors that are partly specific. Appropriate statistical methods can determine complex flavors. Electronic nose usage is increasingly used in the evaluation of volatile components of food. Man works by imitating the nose. The sensors here are going to be the brain's electrical signals. Electronic nose is the analog of the human sniff system (Nurjuliana et al., 2011) A characteristic fingerprint flavor can determine a number of tornadoes, such as swine fat swallowing. They were used to determine the swine fat challenge applied to Palm oil (Van Ruth et. al., 2010) as well as the fingerprint flavor of sausages made from pork and other meat types (Montowska & Pospiech, 2013).

The immunological method ELISA is based on the antigen-antibody relationship and is a method used to perform meat species identification. The method was used in the detection of domestically heat stable skeletal muscle protein in a first cooked meat product. It was able to detect up to 0.5% of pork in the meat mixture (Ballin, 2010).

TECHNIQUES

Over the past several years, a number of spectroscopic techniques have been developed that allow complex chemical information to be determined about the samples being scanned. Different spectroscopic techniques operate over different and limited frequency ranges depending on the process being studied and the magnitude of the associated energy change. A range of spectroscopic techniques, such as Fourier transform, NIR, MIR, Raman spectroscopy have been widely and successfully used as sensitive and fast analytical techniques for the authentication and quality analysis of a variety of agro-food products. These techniques have the advantage of being non-destructive and have a relatively low analysis cost. In addition, these spectroscopic techniques can be adopted for both qualitative and quantitative analysis of agriculture and food products, and provide an alternative to wet-chemical and time-consuming techniques (Lohumi et. al., 2013).

Detection of animal protein depends on the nature of the protein. Pork protein detection might be impossible, particularly if proteins are degraded or severely or altered during processing. In such a case, DNA based methods like PCR can be employed to detect pork protein adulteration in meat products. To successfully detect a species with PCR, adequate genetic markers are chosen to develop the assay. Either nuclear or mitochondrial genes can be targeted (Fajardo et al., 2008). Among the mitochondrial genes, cytochrome b (cyt b) (Aida et al., 2005; Murugaiah et al., 2009) and 12S rRNA (Chen et al., 2010; Girish et al., 2005) are the most commonly used markers in the development of DNA methods for meat species authentication..



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