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Rapid Detection of Pork Gelatin in Hard Shell Capsules on Supplement Products Using FTIR and PCA

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A B S T R A C T

This study aimed to develop a fast and low-cost detection method to determine the difference between hard shell capsules on supplement products containing pork or non-pork gelatin using Fourier Transform Infrared (FTIR) spectroscopy and Partial Component Analysis (PCA). Twelve hardshell capsules were used, among which Eight samples were pure made from pork and some adulterated with cow. The samples were detected before using *real-time* PCR to determine the identity of the samples. All the gelatin samples were measured with the FTIR spectrophotometer in the reflection mode. Spectra were collectedin the wavenumber range from 4000-650 cm^{-1}. The results show that the PCA model with the data was pre-processed before PCA was performed. The absorbance data from FTIR were pre-processed using the *Savitsky-Golay* smoothing technique and continued with normalization by peak normalisation before being subjected to PCA. This newly developed method is fast, involves simple sample preparation and islow-cost.

1. INTRODUCTION

1.1. Research Background

A highly processed protein called gelatin is frequently used as a thickening and gelling agent (E441). Collagen comes from items like bones, hides, and skins from animal slaughterhouses and is hydrolyzed to create gelatin [1]. Controlled basic or acidic hydrolysis of connective tissue raw material, high-temperature water extraction, sterilization, and drying are all steps in gelatin manufacturing. These procedures are not standardized and impact the final gelatin product's characteristics, making them challenging to distinguish. Numerous studies on analytical techniques that can identify the difference between porcine and bovine gelatins have been published. For instance, real-time PCR [2,3,4,5,6,7,8].

1.2. Literature Review

The real-time PCR technique is an advancement over traditional PCR techniques. Despite the simplicity of the traditional PCR procedure, quantitative information cannot be obtained from the PCR results [9]. Salamah, in 2021, studied the use of real-time PCR combined with the primer of cyt-b to distinguish the gummy bear made from porcine and bovine. The developed technique is precise and trustworthy for acknowledging gelatin sources in food and pharmaceutical procedures [9].

Bovine and porcine gelatins can also be distinguished by amino acid analysis and enzyme-linked immunosorbent assay (ELISA) [2,4,6,7]. However, both techniques require repeated results and experience because the sample preparation is so difficult and sensitive. Instead of focusing on gelatin identification, most reported approaches have emphasized meat species identification. However, as damaged proteins and nucleic acids result from prolonged heat processing, it can be challenging to recover high-quality DNA, a necessary need. The unfortunate thing about this method is that it comes from the cost of detection—the sample preparation is also one of many disadvantages things in PCR-based analyses [2,3,4,5,6,7,8].

Knowing the origins of gelatin is crucial because Muslim nations expressly restrict the use of pig products and because there are worries about possible disease transfer to humans [10,11]. Methods that rely on physicochemical properties, such as infrared spectroscopy, have been proven suitable for differentiating a pork mixture.

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