APPLICATION OF SPECTROSCOPIC TECHNIQUES AS FAST DETECTION METHODS FOR THE QUALITY OF SOME FOODS

By

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ABSTRACT

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The present study aimed to evaluate the quality, including adulteration, of honey and meat by classical and advanced methods (HPLC, GC, SDS-PAGE and PCR) in parallel with FT-IR and Raman spectroscopic as fast and easy detection methods.

Physicochemical properties of honey and honey adulterated with glucose or sucrose were determined. Total soluble solids (TSS), pH and electrical conductivity of honey and its adulterated samples ranged between (84.10 - 84.50%), (3.80 - 4.63) and (11.73 – 232.32µS), respectively. The viscosity of adulterated honey with glucose syrup was the highest. Results of HPLC indicated that authentic honey had higher fructose/glucose ratio than adulterated honey samples. Also, honey adulterated with sucrose syrup had the highest HMF content.

The FT-IR and FT-Raman spectral peaks of sucrose, glucose and fructose were identified at different concentrations. Selected main specific peaks provide the best calibration curves with (r^2>0.9). Also, FT-IR and FT-Raman techniques were used to evaluate authentic honey and its adulterated with glucose and sucrose syrup.

Chemical composition of meat showed that moisture and fat content were higher in pork meat than in chicken and beef. On contrary, protein content of beef was the highest. Color parameters and pH demonstrated that beef meat had the highest redness parameter and pH value. While, the pure minced pork had low redness value (6.14), and minced beef meat adulterated with 25, 50 and 75 % of pork meat was 19.10, 16.22 and 11.87, respectively.

FT-IR spectral bands of beef, chicken and pork meats showed beef meat had a specific spectral bands at 900, 977, 1040, 1110, 1169 &

$1303\ cm^{-1}$. Pork meat had unique peaks at 1075, 847 and 720 cm^{-1}, while chicken meat had specific peaks at 1152, 1093, 950 and 765 cm^{-1}.

The FT-IR spectra afford information on the functional groups of lard. Calibration curve of pork fat (lard) was prepared by concentration levels at 10, 20, 40, 50 and 70%. The obtained standard curves of selected important peaks related to lipids had higher (R^2 >0.9). The identification of beef burger adulterated with pork meat using FTIR and Raman techniques showed that the intensity of wave numbers that referred to amide I and amide II was decreased when the adulteration percentage of pork meat increased, while the major lipid peaks were relatively more intense when the adulteration ratio of pork meat was increased. Moreover, the FT-IR and FT-Raman spectra of extracted fat from beef burger that adulterated by pork fat at (10 & 20%), indicated that there are good correlations (R^2 > 0.9) between control burger and adulterated burger by pork fat in some specific spectral band corresponding to pork fat structure.

Protein profile of chicken, beef and pork by SDS-PAGE showed that pork meat had specific bands at 142, 97and 17 kDa, while beef meat had unique bands at 139, 65 and 8 kDa, and chicken meat had specific bands at 129, 110 and 88 kDa.

Simplex and Multiplex PCR with species specific primers were successively applied for discriminating between beef, chicken and pork in minced meat and its mixtures without interfering.

Gas chromatography-flame ionization detector was used to detect the adulteration of minced beef and chicken meat with pork meat based on fatty acid profiles. The results indicated that the proportion of oleic C18:1/ linoleic C18:2 ratio was decreased when the adulteration ratio with pork was increased. In addition, the proportion of C18:1/ C18:2 ratio was 1.23 and 4.07 for chicken and pork fat, respectively. This ratio increased when the adulteration ratio with pork was increased.

Keywords: Spectroscopic techniques, FTIR, Raman, PCR, SDS-PAGE, GC, honey, meat, quality, adulteration, lard

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