Benha University

Faculty of Science

Chemistry Department

Some Chemical Studies on Detecting Olive Oil Adulteration

A Thesis

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(Organic Chemistry)

By

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

APCI	Atmospheric PressureChemical Ionization
APCI-MS	Atmospheric Pressure Chemical Ionization - Mass Spectrometry
APPI	Atmospheric Pressure Photoionization
ATR	Attenuated Total Reflectance
ATR-FTIR	Attenuated Total Reflection - Fourier Transform Infrared
CALB	*Candida antarctica lipase B*
CDA	Canonical Discriminant Analysis
CVA	Canonical VariateAnalysis
CGC	Capillary Gas Chromatography
CGC–FID	Capillary Gas Chromatography -Flame Ionization Detector
CN	Carbon Number
CAD	Charged Aerosol Detector
CBTs	Classification Binary Trees
DSC	Differential scanning calorimeter
DA	Discriminant Analysis
DEPT	Distortionless Enhancement By Polarization Transfer
DHA	Docosahexaenoic Acid
ECN42	Equivalent Carbon Number 42
ELSD	Evaporative Light Scattering Detection
EEFS	Excitation–Emission Fluorescence Spectroscopy
EVOO	Extra Virgin Olive Oil
FA	Fatty Acid
FAME	Fatty Acid Methyl Ester
FTIR	Fourier Transform Infrared
FT-NIR	Fourier Transform Near-Infrared
FT-Raman	Fourier Transform Raman

FT	Fourier-Transform
GC	Gas Chromatography
GLC	Gas Liquid Chromatography
GA–PLS	Genetic Algorithms - Partial Least Square
GA–PLS	Genetic algorithms- Partial Least Square
HDL	High Density Lipoprotein
HPLC	High Performance Liquid Chromatography
HPLC-UV	High Performance Liquid Chromatography Method With Ultra-Violet Detection
HT-GC/EI-MS	High Temperature-Gas Chromatographic Method Coupled To Electron Ionization-Mass Spectrometry
IR	Infrared Spectrophotometry
IOC	International olive council
iPLS	interval Partial Least Square
KNN	K-Nearest Neighbours
LODs	Limit Of Detections
LDA	Linear Discriminant Analysis
OOL	Linoleo-Diolein
LC	Liquid Chromatography
LC–APPI-MS	Liquid Chromatography–Atmospheric Pressure Photoionization-Mass Spectrometry
MS	Mass Spectrometry
MALDI-TOF/MS	Matrix-Assisted Laser Desorption Ionization - Time Of Flight-Mass Spectrometry
MAEV	Mean Absolute Error of Validation
MdAEV	Median Absolute Error of Validation
MUFA	Mono-Unsaturated Fatty Acid

MRM	Multiple reaction monitoring
N-PLS	Multi-way Partial Least Squares
NIR	Near Infrared
NARP-LC-RID	Non-Aqueous Reverse-Phase - Liquid Chromatography-Refractive Index Detector
NTP	Non-Thermal Plasma
NP	Normal-Phase
NMR	Nuclear Magnetic Resonance
NOE	Nuclear Overhauser Enhancement
OLL	Oleo- Di-Linolein
OPO	Olive–Pomace Oil
OCPLS	One-Class Partial Least Squares
OSC	Orthogonal Signal Correction
PLL	Palmito-Di-Linolein
POO	Palmito-Di-Olein
POL	Palmito-Oleo-Linolein
PARAFAC	Parallel Factor Analysis
PLS	Partial Least Square
PLS-R	Partial Least Square-Regression
PLS-DA	Partial Least Squares Discriminant Analysis
PCI	Photo-Induced Chemical Ionization
PUFAs	Polyunsaturated Fatty Acids
PCA	Principal Component Analysis
PCR	Principle Component Regression
RI	Refractive Index
RID	Refractive Index Detector
REP	Relative Error of Prediction

ABSTRACT

Amany Nagah Ali Mostafa, Some Chemical Studies on Detecting Olive Oil Adulteration, Ph.D., Department of chemistry, Faculty of Science, Benha University, 2019.

This study focused on the application of three different chromatographic and three different spectroscopic methods for identification of adulteration of two olive oil varieties (Koroneiki and Croatina) with cheaper vegetable oils (sunflower, soybean and corn oils*)*. It was found from fatty acids profile that, adulteration of extra virgin olive oils with high linoleic acid oils could be detected with 10% (w/w) addition of both soybean and corn oils while, sunflower oil addition could not be found out at 10% (w/w). 1,3 specific lipase hydrolysis followed by gas chromatography and HPLC were used for detection of adulteration by studying the change in triglycerides composition. It was found that a decrease in OOO and POO and an increase in OOL, POL, OLL and PLL occurred with 2, 5 and 10% additions of sunflower, soybean and corn oil for Koroneiki and Croatina olive oils respectively. According to global method procedures, only pure Koroneiki and Croatina olive oils were genuine oils while olive oils admixtures with sunflower, soybean and corn oils were not genuine olive oils.

^{1}H NMR spectra of olive oils and their binary admixtures with 10% (w/w) (sunflower, soybean and corn oils) were discussed. The most obvious difference between the spectra of olive oils and their binary admixtures spectra was the appearance of the signal around 2.04 ppm due to allylic protons of linoleic acid in the binary admixtures while being absent in pure olive oils. This peak could be functioned as indicator of adulteration of olive oil with high linoleic acid oils. Furthermore, the peak integrals at 2.7 ppm showed a good correlation with the total sum of linoleic and linolenic acids.

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قســم الكيمياء

بعض الدراسات الكيميائية على كشف الغش فى زيت الزيتون

رسالة مقدمة من

أمانى نجاح على مصطفى فرحات

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