



UNIVERSITI PUTRA MALAYSIA

**DETECTION OF GELATIN ORIGIN USING FOURIER TRANSFORM
INFRARED SPECTROSCOPY AND HIGH PERFORMANCE LIQUID
CHROMATOGRAPHY**

NORAKASHA BINTI RUSLI

IPPH 2011 1

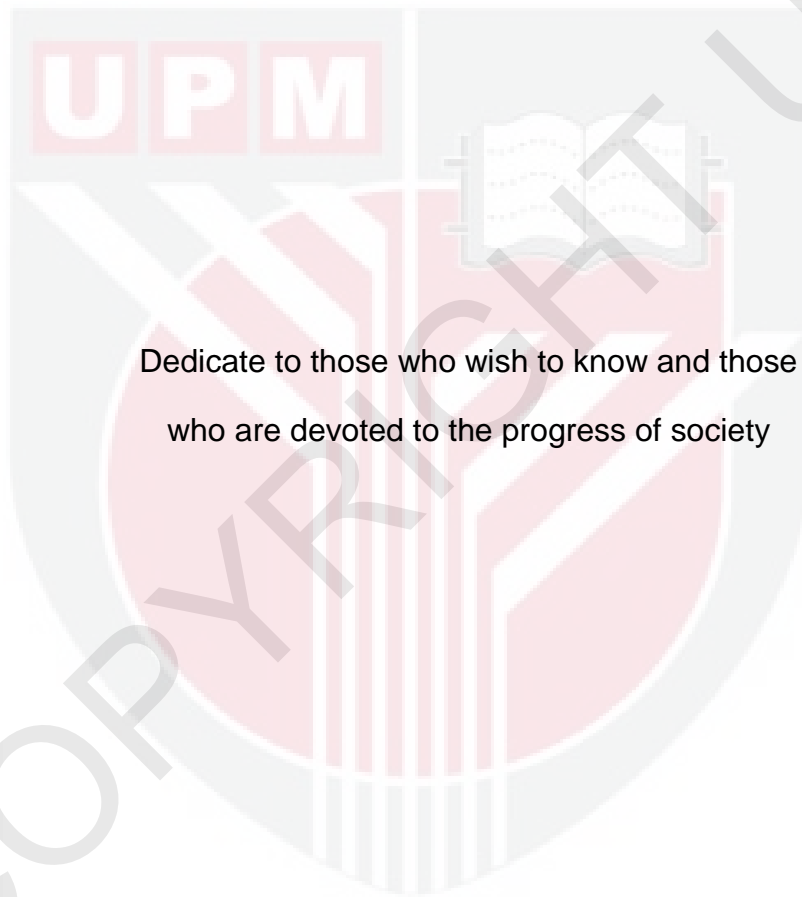
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SPECTROSCOPY AND HIGH PERFORMANCE LIQUID CHROMATOGRAPHY**

By

NORAKASHA BINTI RUSLI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirements for the Degree of Master Science

DECEMBER 2011



Dedicate to those who wish to know and those
who are devoted to the progress of society

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master Science

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February 2011

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Institute : Halal Products Research Institute

A study on detection of gelatin origin was conducted. Rapid method was developed using Fourier transform infrared (FTIR) spectroscopy to distinguish between bovine and porcine gelatin. The results showed that FTIR spectroscopy was capable of distinguishing bovine and porcine gelatin by analyzing the region between $3290-3280\text{ cm}^{-1}$ and $1660-1200\text{ cm}^{-1}$ using discriminant analysis (DA). The Cooman's plot clearly showed that both gelatins were classified according to their respective group.

The subsequent study explains the application of high performance liquid chromatography (HPLC) in ascertaining the source of gelatin using amino acid analysis. A partial least square (PLS) calibration demonstrated good linear regression (R^2) of 0.991 and 0.983 for Sigma and Merck gelatin standards, correlation between actual values against predicted data obtained from the

cross-validation of gelatin mixture. Three major amino acids namely glycine (Gly), proline (Pro) and hydroxyproline (Hyp) were applied in principal component analysis (PCA) and the score plots obtained show good separation between pure bovine, pure porcine or the mixture of bovine and porcine gelatin for both Sigma and Merck standards.

Finally, the third study was conducted to know the capabilities of these detection methods to be applied in real food samples. Market samples were analyzed by both FTIR spectroscopy and amino acid analysis. Results presented by Cooman's plot and PCA proved that the samples were distinctly divided in two groups accordingly depending on their source without any confusion or mistake. However, the analysis cannot be done for the samples containing added ingredients such as flavouring and colouring.

In conclusion, this study provides methods for determining the source of gelatin focused on bovine and porcine. These methods are suitable to be use in the analysis of halal food authentication.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**PENGESANAN SUMBER GELATIN MENGGUNAKAN SPEKTROSKOPI
FOURIER TRANSFORM INFRA MERAH DAN KROMATOGRAFI CECAIR
PRESTASI TINGGI**

Oleh

NORAKASHA BINTI RUSLI

Februari 2011

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Pengesanan sumber gelatin telah dikaji. Kaedah pantas telah dibangunkan menggunakan spektroskopi Fourier transform infra merah (FTIR) untuk membezakan antara sumber gelatin lembu dan khinzir. Hasil kajian menunjukkan bahawa spektroskopi FTIR dapat membezakan antara gelatin lembu dan khinzir dengan menganalisis julat di antara $3290\text{--}3280\text{ cm}^{-1}$ dan $1660\text{--}1200\text{ cm}^{-1}$ menggunakan analisis diskriminasi (DA). Plot Cooman's jelas menunjukkan bahawa kedua-dua gelatin tersebut dapat diklasifikasikan mengikut kumpulan masing-masing.

Kajian seterusnya menerangkan aplikasi kromatografi cecair prestasi tinggi (HPLC) dalam menentukan sumber gelatin menggunakan analisis asid amino. Kalibrasi 'partial least square' menunjukkan persamaan linear (R^2) yang baik

masing-masing bersamaan 0.991 dan 0.983 bagi gelatin standard Sigma dan Merck, iaitu korelasi antara nilai sebenar dengan data ramalan yang diperolehi daripada model pengesanan campuran gelatin. Tiga asid amino utama iaitu glycine (Gly), proline (Pro) dan hydroxyproline (Hyp) telah digunakan dalam analisis komponen utama (PCA) and plot skor yang diperolehi menunjukkan pemisahan yang baik antara gelatin lembu asli, gelatin khinzir asli dan campuran antara gelatin lembu dan khinzir bagi kedua-dua standard Sigma dan Merck.

Akhir sekali, kajian ketiga dijalankan untuk mengetahui keupayaan kaedah pengesanan ini untuk digunapakai dalam sampel makanan sebenar. Sampel pasaran dianalisis menggunakan kedua-dua kaedah iaitu spektroskopi FTIR dan analisis amino asid. Hasil kajian yang ditunjukkan melalui plot Cooman's dan PCA membuktikan bahawa sampel terbahagi dengan jelas dalam dua kumpulan mengikut sumber masing-masing tanpa apa-apa kekeliruan dan kesilapan. Walau bagaimanapun, analisis ini tidak dapat dilakukan bagi sampel yang mengandungi bahan tambah seperti perasa dan pewarna.

Kesimpulannya, kajian ini menyediakan kaedah untuk menentukan sumber gelatin dengan menumpukan hanya kepada gelatin lembu dan khinzir. Kaedah ini sesuai untuk digunakan dalam analisis pengesanan makanan halal.

ACKNOWLEDGEMENTS

In the name of Allah, Most Gracious, Most Merciful. Alhamdulillah, after a long journey, undergoing ups and downs in this research, finally the study on “Detection and verification of gelatin sources using FTIR and HPLC technique” have been completed with Allah’s grace. I would like to thank Allah S.W.T for giving me the strength to fulfill this requirement in order to complete my research.

I would also like to express my appreciation to my project supervisor, Mr. Dzulkifly bin Mat Hashim for all his valuable advice, encouragement, supervision and willingness to share his expertise throughout this project. I would also like to thank my committee members, Prof. Dr. Yaakob bin Che man and Assoc. Prof. Dr. Shuhaimi bin Mustafa for their wisdom and guidance in helping me completing my project.

Thank you to my husband, Rozzamri bin Ashari for his inspiration, motivation, moral support, financial support and time. For my late parents, Mariah binti Salim and Rusli bin Abu Hassan, this is the best gift that I can give to you. Thank you for all the love and advices that you instill within me, educating me to grow into this wonderful human being today with great moral values. Your memories and words have always been my inspiration and

motivation to achieve greatness in life. To my family and friends, this is a proof that no victory can be achieved without effort and patient.

My thanks also go to all staff in Halal Products Research Institute, Cik Noorfaizan, Cik Mafuza, Cik Wan Siti Farizan, En. Abdul Rohman, and all my lab mates. I would like to express my deepest gratitude to the Ministry of Science, Technology and Innovation Malaysia (MOSTI) for funding this study (Science Fund No. 05-01-04-SF0625 awarded to Prof. Dr. Yaakob B. Che Man).

APPROVAL

I certify that an Examination Committee has meet on 23 February 2011 to conduct the final examination of Norakasha binti Rusli on her master thesis entitled Detection of Gelatin Origin using Fourier Transform Infrared Spectroscopy and High Performance Liquid Chromatography in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the master.

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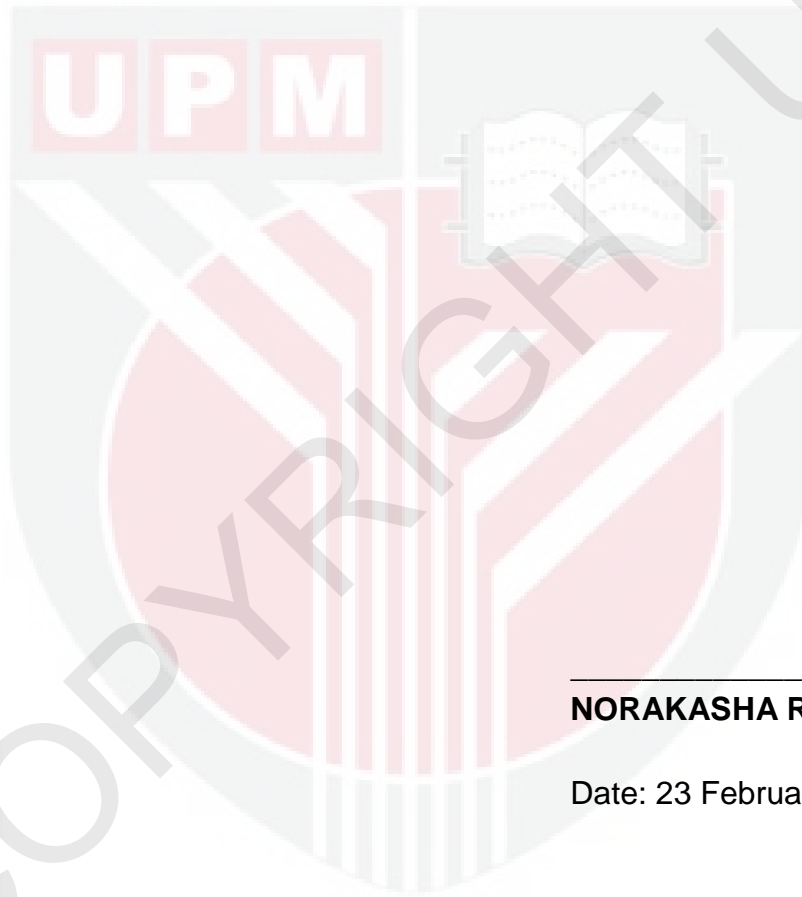
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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



NORAKASHA RUSLI

Date: 23 February 2011

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