

**OPTIMISING THE TENDERISATION AND SATURATED FAT REDUCTION  
IN BEEF BY GINGER EXTRACT USING RESPONSE SURFACE METHOD**



**INSTITUT PENYELIDIKAN, PEMBANGUNAN DAN PENGKOMERSILAN  
UNIVERSITI TEKNOLOGI MARA  
40450 SHAH ALAM, SELANGOR  
MALAYSIA**

**BY:**

**ASSOC. PROF. DR. ZAINAL SAMICHO  
ASSOC. PROF. DR. NORASHIKIN SAIM  
DR. AZAMI ZAHARIM**

**JULY 2006**



Biro Penyelidikan dan Perundingan  
Universiti Teknologi MARA  
40450 Shah Alam, Malaysia  
Tel : 03-55442094 / 5 / 3 / 2 Fax : 03-55442096  
Website : www.uitm.edu.my/brc



UNIVERSITI  
TEKNOLOGI  
MARA

**PENGURUSAN PENYELIDIKAN MENGGABUNGAN KREATIVITI DENGAN  
PRODUKTIVITI, KECEKAPAN DAN AKAUNTABILITI**

Penolong Naib Canselor  
(Penyelidikan)  
03-5544 2094/5  
azniz132@salam.itm.edu.my

Koordinator Penyelidikan  
(Sains dan Teknologi)  
03-5544 2091  
#mansur628@salam.uitm.edu.my

Koordinator Penyelidikan  
(Sains Kemasyarakatan &  
Kemanusiaan)  
03-5544 2097  
rosmimah@salam.itm.edu.my

Koordinator Perundingan  
(Kewangan)  
03-5544 2090  
shidah@salam.itm.edu.my

Koordinator Perundingan  
03-5544 2100  
wro@salam.itm.edu.my

Penolong Pendaftar  
03-5544 2092  
intan553@salam.itm.edu.my

Pegawai Eksekutif  
03-5544 2098  
rohani734@salam.itm.edu.my

Pentadbiran  
03-5544 2093

Unit Kewangan Zon 17  
03-55442099  
03-55442089  
03-55453440  
453mohdh@salam.itm.edu.my

Surat Kami : 600-BRC/ST.5/3/611  
Tarikh : 18 September 2003

Prof Madya Dr Zainal Samicho  
Fakulti Sains Gunaan  
Universiti Teknologi MARA  
40450 Shah Alam

Tuan

**TAJUK PENYELIDIKAN: TOTAL FAT CONTENT OF MEAT  
TENDERIZED USING SEVERAL GINGER EXTRACT**

Dengan hormatnya perkara di atas adalah dirujuk.

Sukacita dimaklumkan bahawa Mesyuarat Jawatankuasa Penyelidikan ke-68 pada 17 September 2003 telah membuat keputusan:

- i. Bersetuju meluluskan cadangan penyelidikan yang telah dikemukakan oleh tuan, Prof Madya Dr Hajah Norashikin Saim dan Dr Hj Azami Zaharim.
- ii. Tempoh projek penyelidikan ini ialah 12 bulan, iaitu bermula 1 Oktober 2003 hingga 30 September 2004.
- iii. Kos yang diluluskan ialah sebanyak RM 19,821.00 sahaja daripada Geran Dalam. Penggunaan geran yang diluluskan hanya akan diproses setelah perjanjian ditandatangani.
- iv. Tuan perlu membelanjakan 50% daripada geran penyelidikan yang telah diluluskan bagi projek tuan dalam tempoh 6 bulan pertama projek berjalan. Sehubungan itu, pihak Biro akan memantau penggunaan geran penyelidikan tuan untuk memastikan 50% daripada jumlah geran yang diluluskan telah dibelanjakan sehingga bulan Mac 2004.
- v. Semua pembelian peralatan yang kosnya melebihi RM 500.00 satu item perlu menggunakan Pesanan Jabatan Universiti Teknologi MARA (LO). Pihak tuan juga dikehendaki mematuhi peraturan penerimaan peralatan. Panduan penerimaan peralatan baru dan pengurusannya, dilampirkan.

Tarikh : 28 Julai 2006  
No.Fail Projek : 600-BRC / ST.5 / 3 / 611

Prof. Dr. Azni Zain Ahmed  
Penolong Naib Canselor (Penyelidikan)  
Institut Penyelidikan, Pembangunan dan Pengkomersilan  
Universiti Teknologi MARA  
40450 Shah Alam.

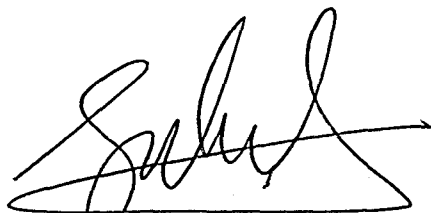
Ybhg. Prof.,

**LAPORAN AKHIR PENYELIDIKAN "OPTIMISING THE TENDERISATION AND SATURATED FAT REDUCTION IN BEEF BY GINGER EXTRACT USING RESPONSE SURFACE METHOD".**

Merujuk kepada perkara di atas, bersama – sama ini disertakan 2(dua) naskah laporan akhir penyelidikan bertajuk "OPTIMISING THE TENDERISATION AND SATURATED FAT REDUCTION IN BEEF BY GINGER EXTRACT USING RESPONSE SURFACE METHOD" bagi menggantikan tajuk asal "TOTAL FAT CONTENT OF MEAT TENDERIZED USING SEVERAL GINGER EXTRACT".

Sekian, terima kasih.

Yang benar



**PROF. MADYA DR. ZAINAL SAMICHO**  
Ketua  
Projek Penyelidikan.

TABLE OF CONTENTS		PAGE
LIST OF TABLES		vii
LIST OF FIGURES		xi
LIST OF ABBREVIATIONS		xvii
ABSTRACT		xix
CHAPTER ONE : INTRODUCTON		1
CHAPTER TWO : LITERATURE REVIEW		5
2.1. Meat		5
2.1.1 Beef		8
2.2. Ginger		8
2.2.1 Ginger Extract and Meat		9
2.3 Tenderisation		10
2.4 Fat		11
2.4.1 Saturated Fat		12
2.4.1.1 Myristic Acid		14
2.4.1.2 Palmitic Acid		15
2.4.1.3 Stearic Acid		16
2.4.1.4 Saturated Fat and Ginger		17
2.5 Response Surface Methodology Optimisation		18
CHAPTER THREE : RESEARCH METHODS		19
3.1. MATERIALS		19
3.1.1 Sample Preparation of Ginger Extract		19

# OPTIMISATION OF THE TENDERISATION AND SATURATED FAT REDUCTION IN BEEF BY GINGER EXTRACT USING RESPONSE SURFACE METHOD

## ABSTRACT

The purpose of this study was to investigate the usage of ginger (“Halia Putih”: *Zingiber officinale* Rosc. var *Officinale* and “Halia Bara”: *Zingiber officinale* Rosc. var *Rhubrum* Thailade) on the tenderisation and saturated fat reduction of beef. Ginger extracts were diluted in the range of 20% - 100%. Physical properties for both ginger extracts such as cloudiness, acidity, pulp content and total soluble solid were determined using UV-Vis spectrophotometer, pH meter, centrifuge machine and hand refractometer respectively. It was found that the more ginger extract diluted, the higher pH values *vice versa* for the percentage of pulp content, total soluble solid and absorbance values. By using Response Surface Method of the MINITAB software (version 14), experimental design could be created whereby variables such as ginger extract concentration, temperature and time of immersion were involved. Beef were immersed in different ginger extract concentrations and shaken in shaking water bath with temperatures ranging from 30°C to 70°C, for immersion times ranging from 5 to 25 minutes. The tenderisation of treated beef was immediately measured using Texture Analyzer, TX TA2i with P2N needle probe. The optimum conditions for beef tenderisation using “Halia Putih” and “Halia Bara” could be determined using regression equations and response surface models of response surface methodology. The highest increment of tenderisation in beef was determined in beef which was treated with “Halia Bara” that is 60.88% at the optimum condition: 100% ginger extract concentration, immersion temperature of 30°C and immersion time of 18 minutes. “Halia Bara” showed tremendous activity in reducing toughness in beef compared to “Halia Putih”. It was found that only test variable, concentration of ginger extract ( $X_1$ ) gave significant effect at 5% level on the percentage increment of beef tenderisation. To determine the saturated fat content of beef such as myristic, palmitic and stearic acids, about 1 $\mu$ l methyl ester was injected to Gas Chromatography (Hewlett Packard, 5890 Series II). The highest reduction of myristic acid content that could be predicted was up to 71.12% when beef was treated with “Halia Bara” at the feasible optimum condition of 100% ginger extract concentration, immersion temperature of 70°C and immersion time of 14.3 minutes. The highest reduction of palmitic acid content that could be predicted was up to 79.93% when beef was treated with “Halia Bara” at the feasible optimum condition of 99% ginger extract concentration, immersion temperature of 30°C and immersion time of 5 minutes. The highest reduction of stearic acid content that could be predicted was up to 76.83% when beef was treated with “Halia Bara” at the feasible optimum condition of 100% ginger extract concentration, immersion temperature of 70°C and immersion time of 16.7 minutes. In addition, the significant regression equations or models at 5% levels were also created for the estimation of the percentage reduction of tenderisation and saturated fat in beef which was treated with “Halia Putih” and “Halia Bara”.