

**STUDY OF PHYSICOCHEMICAL PROPERTIES AND SENSORY
EVALUATION OF WHITE BREAD USING THREE BRANDS OF
COMMERCIAL IMPROVER**

Kareem Balqis Romoke

(Matric No. 3140259)

Thesis submitted in partial fulfillment for the degree of

MASTER OF SCIENCE

FOOD BIOTECHNOLOGY

Faculty of Science and Technology

UNIVERSITI SAINS ISLAM MALAYSIA,

NILAI

April 2016

AUTHOR DECLARATION

In the Name of Allah, The Most Beneficent, The Most Merciful

I hereby declare that I am the author of this thesis titled “Study of Physicochemical Properties and Sensory Evaluation of White Bread Using Three Brands of Commercial Improver” and this is an original work of my own except for quotations, abbreviations, and summaries, which have been duly acknowledged.

Date: 4 April 2015.

Signature:



Name:

Kareem Balqis Romoke

Matrie No.:

3140259

Address:

B-03-04, Jati Apartment,

Nilai,

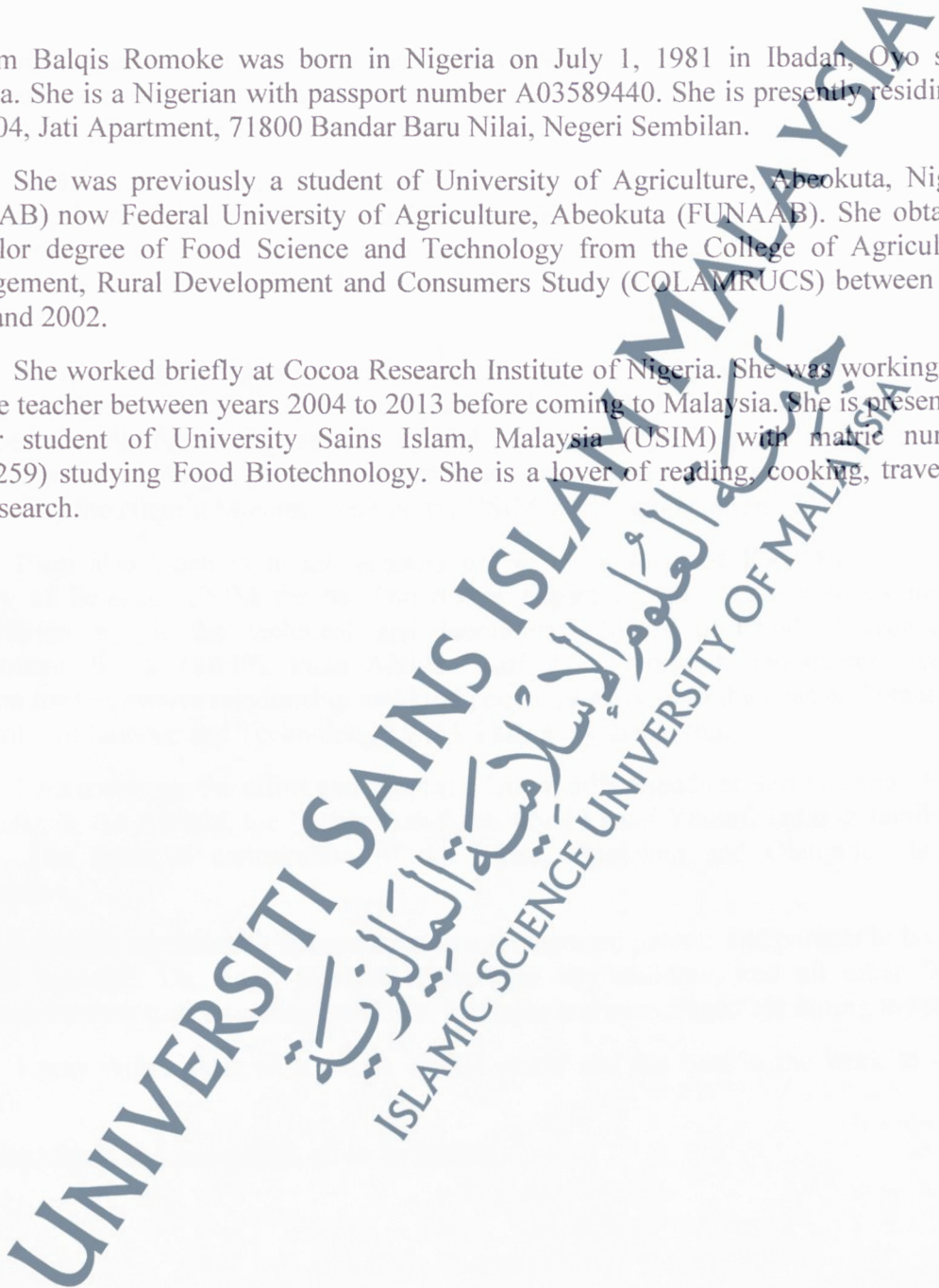
Negeri Sembilan, Malaysia.

BIODATA OF AUTHOR

Kareem Balqis Romoke was born in Nigeria on July 1, 1981 in Ibadan, Oyo state, Nigeria. She is a Nigerian with passport number A03589440. She is presently residing at B-03-04, Jati Apartment, 71800 Bandar Baru Nilai, Negeri Sembilan.

She was previously a student of University of Agriculture, Abeokuta, Nigeria (UNAAB) now Federal University of Agriculture, Abeokuta (FUNAAB). She obtained Bachelor degree of Food Science and Technology from the College of Agricultural Management, Rural Development and Consumers Study (COLAMRUCS) between year 1998 and 2002.

She worked briefly at Cocoa Research Institute of Nigeria. She was working as a college teacher between years 2004 to 2013 before coming to Malaysia. She is presently a master student of University Sains Islam, Malaysia (USIM) with matric number (3140259) studying Food Biotechnology. She is a lover of reading, cooking, travelling and research.



ACKNOWLEDGEMENTS

My heartiest gratitude is to the most merciful ALLAH who has given me the strength and ability to commence this programme. Without His help, it would have been impossible to complete my programme and write this thesis.

I will like to express my deepest sense of gratitude and indebtedness to my supervisor, Professor Madya Chek Zaini Hassan, for giving me the opportunity to work under her guidance. The suggestions and recommendations of my supervisor during the course of this research work have been invaluable. May Allah reward you abundantly for your effort.

I will like to thank my friends and colleagues, Nur-Sharimah Abdullah, Amal Husna, Abtehal Younis, Khadijah, and Syarifah Hazirah Syd Jaafar for being supportive all times. I will like to express my special thanks and gratitude to my friends and neighbours for creating a peaceful environment throughout my stay in Nilai. The help rendered by the Nigeria Muslim community, USIM worth appreciation.

I am also indebted to all lecturers of the Department of Food Biotechnology, Faculty of Science, USIM for the knowledge impact on me. I wish to extend my appreciation to all the technical and laboratory officers of Food Biotechnology Department, Encik Zulkiffi, Puan Ainida Fauzi, Puan Norimah and others I cannot mention for their warm relationship and kind cooperation. Also to the dean and other staff of Faculty of Science and Technology USIM, I say a big thank you.

I acknowledge the effort and support of my family friends at Seri Iskandar, Perak. The Salmis, the Afolabi, the Bashir Yusuf, the Abdu Lateef Yussuf, Jadid & family and others. The financial contribution of the Tijani, Opatokun and Olatundun is well appreciated.

I present my heartfelt appreciation to my respected parents and parents in law, my beloved husband, Dr, Engr. Kareem Morakinyo, my children, and all other family members for their understanding, sacrifice, kindness and encouragement during my study.

I pray Allah grant all the best of this world and the best in the work to come (Amin).

Ya Allah! Bless and accept this effort as ibadah.

ABSTRAK

Dalam usaha untuk mengkaji pengaruh tiga jenama ibu roti komersial yang bertujuan untuk menilai perbezaan dalam fungsi mereka dan menilai kesannya terhadap kualiti produk dan penerimaan, penilaian terhadap kesan kualiti tepung dan teknik pembakaran kepada ciri-ciri fizikokimia dan sensorik roti putih telah dibuat. Kesan ibu roti komersial telah dipantau pada roti yang dihasilkan daripada tepung dengan kandungan gluten yang berbeza dan satu kajian perbandingan antara sampel – sampel roti telah dijalankan dengan menggunakan teknik “Autolyse” dan “Straight dough”.

Sifat-sifat fizikokimia mendapati bahawa roti yang boleh diterima boleh dihasilkan dari kedua-dua tepung serba guna dan tepung yang bergluten tinggi menggunakan mana-mana tiga ibu roti komersial, dengan jenama ibu roti A menunjukkan prestasi terbaik dalam ciri-ciri sampel roti. Hasil kajian membuktikan bahawa penggunaan ibu roti bergantung kepada jenis tepung, dan impak positif semakin meningkat dengan penggunaan tepung yang lebih berkualiti, di mana tepung bergluten tinggi menghasilkan roti yang lebih baik.

Untuk teknik pembakaran, sampel roti yang menggunakan teknik Autolyse menunjukkan hasil yang lebih baik dari segi parameter fizikokimia dan lebih diterima dalam ujian pengguna, berbanding sampel roti yang menggunakan teknik Straight dough. Teknik pembakaran Autolyse telah menghasilkan sampel roti yang lebih ringan, dengan isipadu spesifik yang lebih tinggi, serta mampu mengekalkan kelembapan roti dengan lebih baik, dan ini lebih mendatangkan kepuasan baik kepada pengeluar mahupun pengguna.

Bagi sampel Autolyse, berat sampel adalah di antara 489.43 sehingga 499.80 g manakala berat sampel Straight dough adalah di antara 605.93 sehingga 609.57 g. Sementara isipadu spesifik setiap sampel adalah diantara (3.96 sehingga 4.03) bagi sampel Autolyse, dan di antara (2.85 sehingga 3.00) bagi sampel doh lurus. Ujian pengguna mendapati bahawa pengguna lebih gemar roti Autolyse, sebagaimana hasil indeks penerimaan menunjukkan skor di antara 67.91 sehingga 70.35% bagi sampel Autolyse, dan 63.57 sehingga 69.17% untuk sampel Straight dough.

Berdasarkan hasil kajian, terbukti bahawa penggunaan ibu roti adalah penting dalam pembuatan roti, manakala ibu roti bergantung kepada jenis tepung dan menunjukkan kesan yang lebih positif dengan penggunaan tepung yang lebih berkualiti. Metode pemprosesan juga amat mempengaruhi kualiti roti yang dihasilkan kerana tepung bergluten tinggi menghasilkan roti yang lebih baik berbanding tepung serbaguna, dan teknik Autolyse menghasilkan roti yang memenuhi citarasa pengguna.

ABSTRACT

In order to study the influence of three brands of commercial bread improver aimed at evaluating differences in their functionality and assess their impact on product quality and acceptance, the effect of flour quality and baking technique on the physicochemical and sensory characteristics of white bread were assessed. The effect of commercial improver were monitored on bread produced from flour with different gluten strength and a comparative study between bread samples prepared using Autolyse technique and Straight dough samples was conducted.

The physicochemical properties revealed that acceptable bread could be produced from both all-purpose and high gluten flour using any of the three commercial improvers with brand A improver exhibiting the best performance in the characteristics of the bread samples. It was evidenced from the result that improver usage was flour dependent and had higher positive effect on quality flour as high gluten flour produced better output.

For the baking technique, Autolyse samples showed better result in the physicochemical parameter tested and were more acceptable in the consumer test compared to Straight dough baked samples. Autolyse samples were lighter in weight, had greater specific volume and retained moisture better which implies better satisfaction to both producer and consumers of bread. The weight values were in the range of 489.43 to 499.80 g and 605.93 to 609.57 g, specific volume ranges between (3.96 to 4.03) and (2.85 to 3.00) for Autolyse and Straight dough baked loaves respectively. The consumer test indicated that consumers preferred the Autolyse bread as the outcome of the index of acceptability revealed score between 67.91 to 70.35% and 63.57 to 69.17% for Autolyse and Straight dough samples respectively.

It was evidenced from the results that the usage of commercial improver is significant in bread production, improvers were flour dependent and have higher positive effect on quality flour, and processing method greatly influenced bread quality as high gluten flour gave better output over all-purpose flour and Autolyse samples produced quality bread that gained consumer preference.

MULAKHKHAS AL-BATH

ملخص البحث

هذا العمل يهدف لدراسة تأثير ثلاث أنواع تجارية من محسنات الخبز على جودة المنتج ودرجة قبوله. وكذلك تم تقييم تأثير جودة الدقيق وتقنية اعداد الخبز على الخصائص الفيزيائية والحسية للخبز الأبيض. من ناحية اخرى تم كذلك مراقبة تأثير المحسنات التجارية على صلابة الخبز وحفاظه على قوامه. وقد تم كذلك اجراء مقارنة تبين تأثير طريقتين مختلفتين لاعداد الخبز على المنتج النهائي.

دراسة الخصائص الفيزيائية والكيميائية للخبز أظهرت أن المنتج الجيد يمكن انتاجه بأحد الطريقتين المستخدمتين وبدقيق ذو محتوى بروتين عالي بغض النظر عن نوع المحسن المستخدم. النتائج ايضا أظهرت أن استخدام المحسنات يظهر تأثيره الايجابي على المنتج باستخدام دقيق عالي الجودة كما هو الحال بالنسبة لاستخدام الدقيق ذو محتوى بروتيني عالي فكلهما يؤدي لتحسين المواصفات النهائية للمنتج.

بالنسبة لطريقة الاعداد العينات المعدة بالطريقة الغير تقليدية اظهرت نتائج افضل في اختبار المعاملات الفيزيائية والكيميائية وكذلك قبول اكثر من ناحية الطالب مقارنة بالطريقة التقليدية. تحليل العينات لكلا الطريقتين اعطى النتائج التالية، وزن العينات المعدة بتراوح بين 489.43 جم الي 499.80 جم و 605.93 جم الي 609.57 جم , بينما حجم العينات بين (5.96 الي 4.03) و (2.85 الي 3.00) بالنسبة للطريقة الغير تقليدية و التقليدية, على التوالي. كما اشار اختبار المستهلك أن المستهلكين يفضلون الخبز المعد بالطريقة الغير تقليدية. ووفقا لنتائج احصائية لمؤشر القبول كشفت النتيجة أن بين 67.91 الي 70.35% يفضلون المنتج المعد بالطريقة الغير تقليدية, بينما 63.57 الي 69.17% للخبز التقليدي.

لقد أثبتت نتائج هذه الدراسة أن استخدام المحسن التجاري له تأثير فعال في إنتاج الخبز. تأثير المحسن له علاقة بجودة الدقيق المستخدم وله فعالية كبيرة على المنتج. طريقة الاعداد ايضا له تأثير كبير على جودة الخبز كما أن الدقيق ذو المحتوى البروتيني العالي يساعد على تحسين المنتج في كل الأحوال. اخيرا النتائج ايضا توضح ان الخبز المعد بالطريقة الغير تقليدية اسهم في تحسين المنتج وحيازة رضا المستهلك.

2.4.4 Salts	18
2.4.5 Sugars	19
2.4.6 Lipids	20
2.5 Principle of Bread Making	20
2.5.1 Mixing	20
2.5.1.2 Autolyse: Improved Mixing	21
2.5.2. Fermentation	21
2.5.3 Proofing	22
2.5.4 Baking	22
2.6 Staling	23
2.7 Textural Attribute	24
2.8 Sensory Quality	25
2.8.1 Sensory Characteristics of Bread	25
2.8.2 Sensory Characterization	26
2.9 Water Activity	26
2.9.10 Health and Nutritional Properties of Bread	27
% US Recommended Daily Allowance	28
CHAPTER III	29
EVALUATION OF FUNCTIONALITY OF THREE DIFFERENT BRANDS OF COMMERCIAL IMPROVERS ON WHITE BREAD CHARACTERISTICS	29
3.1 Introduction	29
3.2 Materials and Methods	31
3.2.1 Baking Terminology	31
3.2.2 Raw Materials	32
3.2.3 Determination of Percentage Gluten in Flour	33
3.2.4 Baking Procedure	34
3.3 Baking Properties	35

3.3.1 Loaf Volume and Weight	35
3.3.1.1 The Specific Volume	35
3.3.1.2 Bread Density	36
3.3.1.3 Loaf Height	36
3.3.1.4 Average Weight Loss	36
3.3.2 Crumb and Crust Colour	36
3.3.3 Texture Analysis	37
3.3.4 Moisture Analysis	37
3.3.5 Statistical Analysis	37
3.4 Results and Discussion	38
3.4.1. Gluten Content Determination	38
3.4.2 Physicochemical Characterization of Bread	39
3.4.3 Crust and Crumb Colour L*, a* and b* Values of Bread	43
3.4.4 Bread Firmness	44
3.4.5 Moisture Content (percentage) Values of Bread Crumb	46
3.5 Discussion	47
3.6 Conclusion	49
EFFECT OF COMMERCIAL IMPROVER ON THE PROXIMATE COMPOSITION AND SENSORY CHARACTERIZATION OF WHITE BREAD FROM FLOUR WITH DIFFERENT GLUTEN STRENGTH	51
4.1 Introduction	51
4.2 Materials and Methods	52
4.2.1 Raw Materials	52
4.2.2 Physical Measurement	53
4.2.3 Proximate Analysis	53
4.2.3.1 Moisture Content	53
4.2.3.2 Crude Fibre	54
4.2.3.3 Fat Analysis	55

4.2.3.4 Protein Analysis	55
4.2.3.5 Ash Content	56
4.2.3.6 Carbohydrate	57
4.2.3.7 Energy Contents (Kcal)	57
4.2.3.8 Water Activity	57
4.2.4 Sensory Analysis	57
4.3 Statistical Analysis	58
4.4 Result and Discussion	59
4.4.1 Physical Characterization	59
4.4.1.1 Gluten Composition of Flour	59
4.4.1.2 Physical Characteristics	60
4.4.1.3 Colour Analysis	60
4.4.1.4 Crumb Structure	62
4.4.1.5 Textural Property of Bread	63
4.4.2 Chemical Analysis	64
4.4.2.1 Proximate Analysis	64
4.4.2.2 Moisture Content of Bread Samples	66
4.4.2.3 Water Activity	68
4.4.3 Sensory Characteristics	69
4.4.3.1 Sensory Analysis	69
4.5 Conclusion	73
CHAPTER V	74
INFLUENCE OF BREAD PREPARATION AND IMPROVERS ON PHYSICAL AND ORGANOLEPTIC QUALITY OF BREAD	74
5.1 INTRODUCTION	74
5.2 Materials and Method	76
5.2.1 Baking Procedure	76
5.2.1.1 Straight Dough Method	76

5.2.1.2 Autolyse Technique	76
5.3 Bread Characteristics	77
5.3.1 Physical Measurement	77
5.3.2 Moisture Content	77
5.3.3 Crumb Structure	78
5.3.4 Crumb and Crust Colour	78
5.3.5 Texture Profile Analysis	78
5.3.6 Organoleptic Properties	78
5.3.7 Statistical Analysis	79
5.4 Result and Discussion	79
5.4.1 Physical Properties	79
5.4.2 Moisture Content	81
5.4.3 Water Activity	83
5.4.4 Textural Properties of Bread	85
5.4.5 Colour Measurement	86
5.4.6 Crumb Structure	88
5.4.7 Organoleptic Analysis	90
5.5 Conclusion	91
Chapter VI	92
CONCLUSION AND RECOMMENDATION	92
6.1 Conclusion	92
6.2 Recommendation	92
BIBLIOGRAPHY	93
Appendix	100

LIST OF TABLES

Content	page
Table 2.1: Wheat classification	13
Table 2.2: Recommended Daily Allowance of Nutrients	28
Table 3.1: The Commercial improvers and their ingredients	33
Table 3.2: Bread Recipe and Quantity	34
Table 3.3: Gluten composition of flour	38
Table 3.4: Loaf volume, Specific volume, density, weight, loaf height, and percentage Weight loss of All-purpose sample produced with different improvers	40
Table 3.5: Loaf volume, Specific volume, density, weight, loaf height, and percentage Weight loss of High gluten samples produced with different improvers	41
Table 3.6: Crust and crumb colour L*, a*, b* values of all-purpose bread samples	43
Table 3.7: Crust and crumb colour L*, a*, b* values of High gluten bread samples	44
Table 3.8: Firmness of all-purpose bread samples	45
Table 3.9: Firmness of High gluten bread samples	45
Table 3.10: Moisture content of samples from All-purpose flour	46
Table 3.11: Moisture content of samples from High gluten flour	47
Table 4.1: Volume, weight, loaf height, specific volume and weight loss of bread samples	60
Table 4.2: Colour parameter of bread samples	62
Table 4.3: Firmness of bread samples on days 1, 5 and 10	63
Table 4.4: Proximate composition of bread samples	65
Table 4.5: Moisture content of bread on Day 1, 5 and 10 after baking	67
Table 4.6: Water activity of Bread Samples on Days 1, 5 and 10 after baking	68
Table 4.7: Consumers acceptability of bread samples	70

Table 5.1: Physical characteristic of Autolyse and Straight dough bread samples	80
Table 5.2: Moisture content of Bread Samples on Days 1, 5 and 10 after baking	81
Table 5.3: Water activity of Bread Samples on Days 1, 5 and 10 after baking	83
Table 5.4: Firmness of Bread Samples on Days 1, 5 and 10 after baking	85
Table 5.5: Crust and Crumb colour of autolyse and straight dough bread samples	87
Table 5.6: Organoleptic assessment of autolyse and straight dough samples	90

LIST OF FIGURES

Content	page
Figure 2.1: Comparison of whole wheat and white bread	27
Figure 3.1: Gluten ball and structure for high protein flour and all-purpose flour	39
Figure 4.1: Sample images of breadcrumb KS (Control). HS1 (High gluten samples) and AS1 (all-purpose samples)	62
Figure 4.2: Firmness (g) of bread samples on days 1, 5 and 10	64
Figure 4.3: Moisture content (%) of Bread Samples on Days 1, 5 and 10 after baking	67
Figure 4.4: Water Activity of Bread Samples on Days 1, 5 and 10 after Baking	69
Figure 4.5: Organoleptic analysis of baked bread samples	71
Figure 4.6: Organoleptic analysis of the control baked bread sample (KS)	71
Figure 4.7: Organoleptic analysis of high gluten baked bread sample (HS1)	72
Figure 4.8: Organoleptic analysis of all-purpose baked bread sample (AS1)	72
Figure 5.1: Moisture content (percentage) of bread on day 1, 5 and 10 after baking	82
Figure 5.2: Water activity of Bread Samples on Days 1, 5 and 10 after baking	84
Figure 5.3: Firmness of Bread Samples on Days 1, 5 and 10 after baking	86
Figure 5.4: Colour measurement of crust and crumb of bread samples	88
Figure 5.5: Crumb structure of bread	89
Figure 5.6: Consumer acceptability of bread samples prepared using autolyse and straight dough method	91

LIST OF ABBREVIATIONS AND SYMBOLS

a*	Redness
AACC	Association of American Cereal Chemists
ANOVA	Analysis of Variance
AOAC	Association of Official Analytical Chemists
A _w	Water Activity
b*	Yellowness
°C	Degree Celsius
CBI	Commercial Bread Improver
cm	Centimeters
C ₆ H ₁₂ O ₆	Glucose
C ₂ H ₅ OH	Alcohol
CO ₂	Carbon dioxide
FAO	Food and Agriculture Organisation
g	Grammes
H ₂ O	Water
IA	Index of Acceptability
IARC	International Agency for Research
KB	Potassium Bromate
Kcal	Kilocalories
Kg	Kilograms
L*	Lightness
O ₂	Oxygen
RTE	Ready-to-Eat
SV	Specific Volume
VOL	Volume
WHO	World Health Organisation