



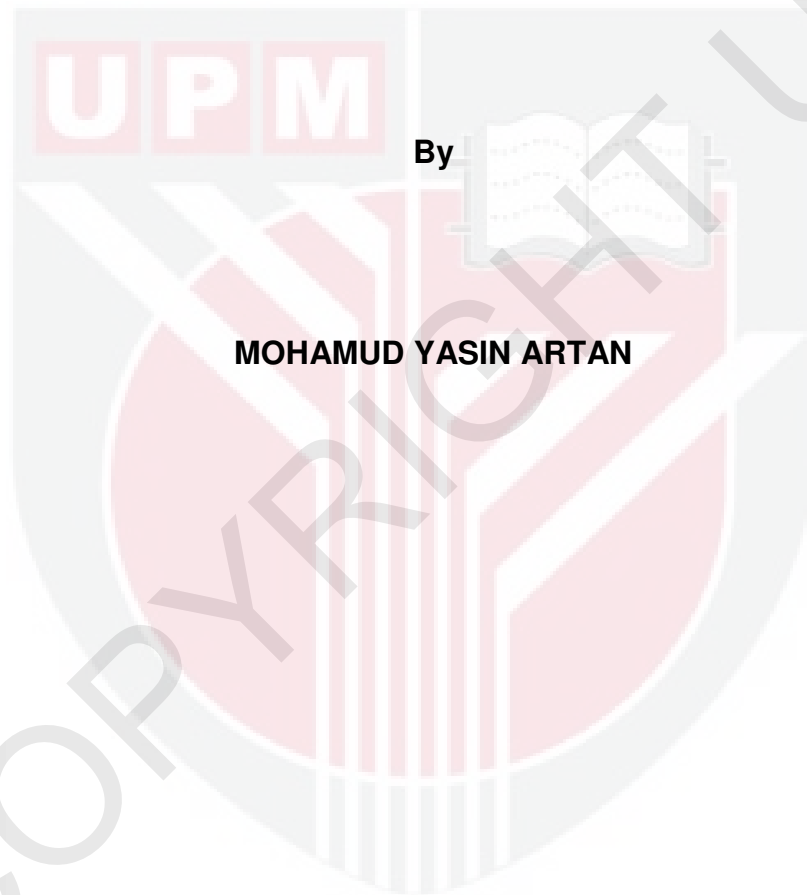
UNIVERSITI PUTRA MALAYSIA

**EFFECTS OF REFINED, BLEACHED AND DEODORIZED PALM
OIL/PALM STEARIN-BASED SHORTENINGS ON THE QUALITY
AND STALING OF WHITE BREAD**

MOHAMUD YASIN ARTAN

FSTM 2011 17

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STEARIN-BASED SHORTENINGS ON THE QUALITY AND STALING
OF WHITE BREAD**



By

MOHAMUD YASIN ARTAN

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

November 2011

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

EFFECTS OF REFINED, BLEACHED AND DEODORIZED PALM OIL/PALM STEARIN-BASED SHORTENINGS ON THE QUALITY AND STALING OF WHITE BREAD

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November 2011

Chairman: Assoc. Prof. Abdul Azis Ariffin, PhD

Faculty: Food Science and Technology

The objective of this research was to determine the effects of different types of refined, bleached and deodorized (RBD) palm oil/palm stearin-based shortenings on the quality and staling of white bread. For this purpose, shortenings of seven blends of RBD palm oil (PO) and palm stearin (PS) were prepared in three replications. Shortenings were blended in 100:00, 80:20, 60:40, 50:50, 40:60, 20:80 and 00:100 of PO: PS ratios, respectively. The fatty acid compositions (FA), triacylglycerols (TAG), thermal and rheological characteristics of both experimental and commercial shortenings were studied. In addition, iodine value (IV) analysis was carried out. The experiment was designed as a complete randomized design (CRD), with three separate

replications. In total, seven formulations of bread were prepared, and bread made from commercial shortening was used as a control, while those made without shortening were used as comparisons with other bread samples. Bread made using emulsifiers was also used in this research. The bread samples were tested for loaf volume, specific volume, crust colour, crumb colour and texture profile analysis. Breads were investigated at ambient temperature and various aging times using differential scanning calorimetry (DSC) and texture analyzer (TA-XT2) to determine starch retrogradation and crumb firmness, respectively.

The results revealed that the prominent fatty acids in the products were palmitic (46.24-63.48%), oleic (24.59-40.33%) and linoleic (6.46-9.91%). At the same time, triacylglycerols (TAG), such as OOO, OOP and OOS, were found to decrease, while PPO increased due to the increase in the palm stearin content of the shortenings. Increasing the content of palm oil in the shortenings caused a decrease in viscosity, storage modulus (G') and loss modulus (G'') values. On the other hand, certain parameters such as the onset, peak and endset temperatures ($^{\circ}\text{C}$) were detected for both the melting and cooling data. However, increasing the palm stearin content in the samples showed increases in the onset, peak, endset temperatures and peak height, and vice versa. Likewise, increasing palm stearin content in the shortening formulations could decrease loaf volume and specific volume. The statistical analysis showed that breads made using the shortening formulation consisted of 100% palm stearin had the highest volume and specific volume, but they were the least in terms of

density. However, loaf volume, specific volume and crumb texture of the bread samples showed significant differences ($p < 0.05$) as compared with the bread that was made without shortening. In addition, bread crusts without shortening were observed to have lighter colour than those made with shortenings. The hardness, springiness, cohesiveness, gumminess and chewiness of bread samples were found to range between 603.30-1350.7(g), 0.86-0.92(mm), 0.70-0.76, 441.95-1002.90(g), and 353.70-874.3(gmm), respectively. Meanwhile, the texture profile analysis showed that the white bread containing shortening type 100:00 had the least crumb hardness, while those made without shortening had the highest crumb hardness. During storage, DSC showed one endothermic peak for all aging times and the onset temperature ranged from 116.06 to 132.22 °C; and 123.50 to 139.17 °C for the 1st day and 7th days, respectively. Meanwhile, the texture analyzer showed that the bread made from shortening formulation 100:00 (PO: PS) had the least crumb firmness, while those made without shortening had the highest crumb firmness. In general, there was no significant difference ($p < 0.05$) between bread samples that were made using 60:40 and control. Thus, this research demonstrated that using RBD palm oil/palm stearin-based shortenings in breadmaking could contribute to a better quality and delay bread staling.

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

**KESAN LELEMAK MINYAK SAWIT/STEARIN SAWIT YANG TELAH
DITAPIS, DILUNTUR DAN DINYAHBAU KE ATAS KUALITI DAN TAHAP
KEROSAKAN ROTI PUTIH**

Oleh

MOHAMUD YASIN ARTAN

November 2011

Pengerusi: Prof. Madya Abdul Azis Ariffin, PhD

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Tujuan kajian ini dijalankan adalah untuk mengenalpasti kesan perbezaan lemak yang diperbuat daripada minyak sawit dan stearin sawit yang telah ditapis (*refined*), diluntur (*bleached*) dan dinyahbau (*deoderized*) (RBD) ke atas kualiti dan tahap kerosakan roti putih. Untuk tujuan ini, tujuh (7) lemak yang dihasilkan daripada campuran minyak sawit (PO) RBD dan stearin sawit (PS) RBD disediakan sebanyak tiga replikasi. Bagi menghasilkan lemak tersebut, campuran PO dan PS (masing-masing dalam nisbah 100:0, 80:20, 60:40, 50:50, 40:60, 20:80 dan 0:100) telah dihasilkan. Komposisi asid lemak, tri-gliserida,

karakter terma dan reologi kedua-dua lelemak eksperimen dan komersial dikaji. Selain itu, analisis nilai iodin (IV) juga telah dijalankan. Eksperimen dijalankan menggunakan kaedah CRD dengan tiga replikasi berlainan. Tujuh formulasi roti telah disediakan dan roti yang dibuat dengan menggunakan lelemak komersial digunakan sebagai sampel kawalan. Manakala roti yang dibuat tanpa menggunakan lelemak telah digunakan sebagai perbandingan kepada sample roti yang lain. Roti yang dihasilkan melalui penggunaan pengemulsi turut digunakan dalam kajian ini. Sampel roti diuji dengan menentukan jumlah isipadu roti, isipadu khusus, warna kulit, warna serbuk dan analisis profil tekstur. Ujikaji roti tersebut dijalankan di dalam keadaan suhu bilik dengan beberapa selang masa menggunakan DSC dan penganalisis tekstur (TA-XT2) bagi menentukan kerosakan kanji dan kepadatan serbuk.

Dapatan kajian menunjukkan bahawa kandungan asid lemak yang utama dalam produk ini terdiri daripada palmitik (46.24-63.48%), oleik (24.59-40.33%) dan linoleik (6.46-9.91%). Sementara itu, *triacylglycerols* (TAG) seperti OOO, OOP dan OOS didapati telah menurun, manakala PPO telah meningkat disebabkan oleh peningkatan kandungan stearin sawit dalam lelemak. Peningkatan kandungan minyak kelapa sawit dalam lelemak menyebabkan pengurangan kelikatan, pengurangan nilai modulus simpanan (G') dan pengurangan nilai modulus terhilang (G''). Suhu ($^{\circ}\text{C}$) bagi *Onset*, *Peak* dan *Endset* dikesan bagi kedua-dua data pencairan dan pembekuan. Walau bagaimanapun, peningkatan kandungan stearin sawit dalam sampel telah menunjukkan peningkatan suhu

mula, puncak dan suhu akhir dan begitu juga sebaliknya. Peningkatan kandungan stearin sawit dalam formulasi lelemak telah menurunkan isipadu roti dan isipadu khusus. Analisis statistik menunjukkan bahawa roti yang diperbuat daripada 100% stearin sawit mempunyai isipadu dan isipadu khusus yang paling tinggi, tetapi dengan ketumpatan yang paling rendah. Walau bagaimanapun, isipadu roti, isipadu khusus dan tekstur serbuk sampel roti menunjukkan perbezaan signifikasi ($P < 0.05$) berbanding dengan roti yang diperbuat tanpa menggunakan lelemak. Selain itu, warna kulit roti tanpa lelemak didapati lebih cerah berbanding roti dengan lelemak. Kekerasan, kekenyalan, kepaduan, kelekatan dan keboleh kunyahan sampel roti masing-masing dalam had 603.30–350.7(g), 0.86–0.92(mm), 0.70–0.76, 441.95–1002.90(g), dan 353.70–874.3(gmm). Selain itu, analisis tekstur profil yang dijalankan menunjukkan bahawa roti yang mengandungi lelemak 100:0 mempunyai kekerasan serbuk yang paling kurang, manakala roti yang dibuat tanpa lelemak mempunyai kekerasan serbuk yang paling tinggi. Semasa penyimpanan, DSC menunjukkan 1 puncak endotermik bagi semua selang masa dan suhu permulaan pada hari pertama dan ketiga masing-masing berada dalam lingkungan 116.06 – 132.22 °C; dan 123.50-139.17 °C. Penganalisis tekstur menunjukkan roti yang diperbuat daripada formulasi lelemak 100 (PO:PS) mempunyai kepadatan serbuk yang paling rendah, manakala roti yang diperbuat tanpa lelemak mempunyai kepadatan serbuk yang paling tinggi. Secara keseluruhan, tiada perbezaan signifikasi ($p < 0.05$) antara sampel roti yang diperbuat menggunakan lelemak dengan nisbah 60:40 dan kawalan. Kajian yang dilakukan menunjukkan bahawa penggunaan lelemak daripada

minyak sawit RBD dan stearin sawit RBD dapat menyumbangkan kepada peningkatan kualiti dan melambatkan kerosakan roti didalam proses pembuatan roti.



ACKNOWLEDGEMENTS

I would like to express my deepest appreciation and profound gratitude to all my supervisory committee members. Without their guidance and persistent help, this thesis would not have been possible. I would also like to thank my supervisor, Associate Professor Dr. Azis Ariffin, whose encouragement, support and guidance from the very early stage of this research, have helped and given me extraordinary experiences throughout the work. His belief, i.e. it would be possible for me complete the work, had kept me going. In addition, my gratitude also goes to both Dr. Roselina Karim and Dr. Boo Huey Chern for their constant guidance, extremely valuable advice, statistical support, and crucial contribution, and they are indeed a backbone of this research and thesis. I gratefully thank Prof. Dr. Yaakob Che Man and Dr. Chin Nyuk Ling for their support, constructive comments, patience and encouragement. A note of thanks should also go to the technical staff at the Faculty of Food Science and Technology, especially Mr Razali Othman, Mr Abdul Halim Abdul Rahman and Ms Jamaliah Ahmad who had given me the very much needed technical support and assistance.

Last but definitely not the least, I would like to express my deepest gratitude to my big family. My wonderful parents, Mr. Yasin Artan and Mrs. Isnino Barre, deserve a special recognition for their tremendous encouragement, supports, patience and prayers throughout my candidature. I dedicate this thesis to both

of them. I gratefully acknowledge my wife Nimo for her love and continuing encouragement, I LOVE YOU!



I certify that a Thesis Examination Committee has met on 8 November 2011 to conduct the final examination of Mohamud Yasin Artan on his thesis entitled "Effects of Refined, Bleached and Deodorized Palm Oil/Palm Stearin-Based Shortenings on the Quality and Staling of White Bread" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The committee recommends that the student be awarded the Master of Science.

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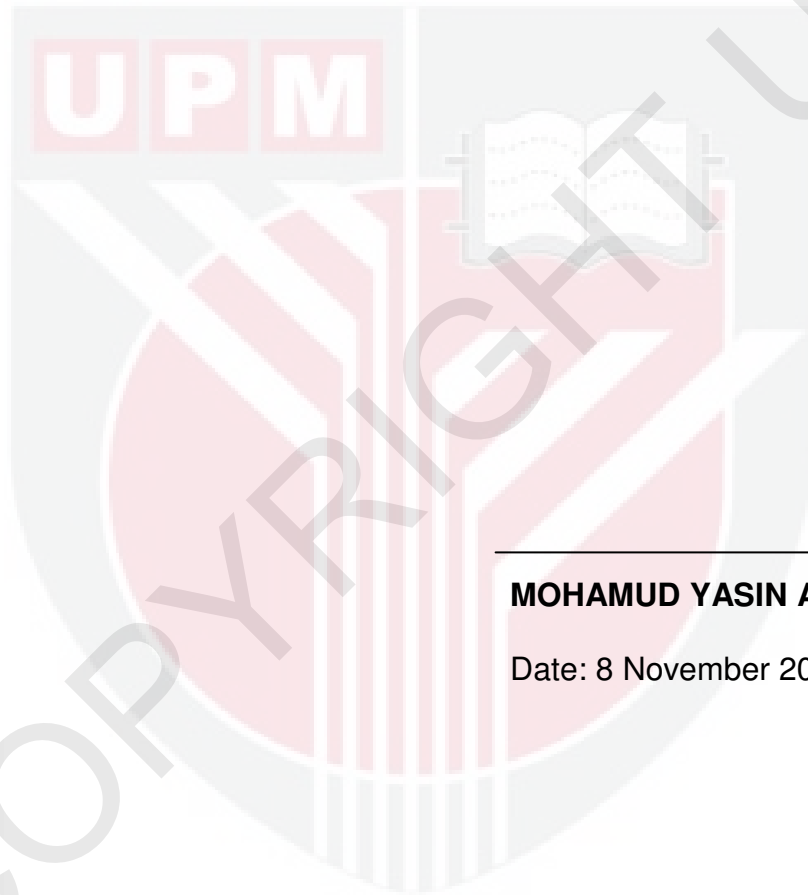
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DECLARATION

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 institutions.



MOHAMUD YASIN ARTAN

Date: 8 November 2011

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