UNIVERSITI PUTRA MALAYSIA

PRESERVATION OF YELLOW ALKALINE NOODLES USING DIFFERENT RADIATION TECHNOLOGIES

ANISSA SORAYA

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By

ANISSA SORAYA

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

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DEDICATION

To my beloved family. The people I love the most

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

PRESERVATION OF YELLOW ALKALINE NOODLES USING DIFFERENT RADIATION TECHNOLOGIES

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Chairman : Assoc. Prof. Roselina Karim, PhD

Faculty : Food Science and Technology

Yellow alkaline noodles (YAN) are very susceptible to spoilage. Currently, boric acid, a carcinogenic compound, was commonly applied as YAN preservative. The present study was conducted to investigate feasible radiation technologies to produce preservative-free yet long life YAN. These included applying gamma irradiation to improve the microbiological quality of wheat flour which was used as the main raw material, and post processing treatment using combination of microwave (MW) and pulsed-Ultra Violet (pulsed-UV) to reduce the microbiological contamination of YAN.

Wheat flour for making noodles was irradiated using a ^{60}Co Gamma ray at six different doses (0, 2, 4, 6, 8 and 10 kGy). The chemical composition, physicochemical properties, and microbiological quality of wheat flour were analysed. The irradiated flours were used for making YAN. The colour

quality, textural properties, cooking quality, and the microbiological quality of YAN were analysed.

Gamma irradiation did not cause any significant ($P > 0.05$) change on the chemical composition of wheat flour, whereas it caused significant changes ($P < 0.05$) in the physicochemical properties of wheat flour and YAN made from it. Gamma irradiation significantly ($P < 0.05$) reduced total microorganism load in wheat flour and YAN. All textural parameters of YAN were significantly ($P < 0.05$) affected by irradiation, except for springiness. In term of cooking quality, the cooking time was unaffected by irradiation, whereas cooking loss were significantly ($P < 0.05$) increased as the irradiation dose was increased. These findings confirmed that gamma irradiation was effective in reducing the microorganism load in wheat flour but it affected the physicochemical properties of wheat flour and resulted in undesirable textural properties and cooking quality of YAN. Therefore, this treatment was not applied in further study.

Spoilage of YAN might also be caused by cross contamination from the environment during noodles preparation. Therefore, the post-processing decontamination treatment is deemed necessary. Combination of pulsed-UV and microwave treatment was chosen to reduce the microorganism load in YAN. Factorial design was employed to study the effect of microwave heating time at a power of 900 W (2450 MHz) and pulsed-UV energy level on the microbiological quality and textural properties of YAN. Twenty combinations of different microwave heating times (0 to 10 s) and pulsed-ultra violet energy

level (0 to 7 J/cm^2) were applied on the parboiled YAN. The response optimiser was applied to determine the optimum combination of these technologies in reducing the microorganism load in YAN without causing detrimental effects in the textural properties.The results of this study showed that the optimum combination is 5 s of microwave at power of 900 W (2450 MHz) followed by 3.5 J/cm^2 pulsed-UV treatment.

YAN was treated using the optimum combination of microwave and pulsed-UV and stored at ambient (28±2 ^{o}C) and chilled (4±2 ^{o}C) temperature. The results showed that the shelf life of treated YAN at ambient and chilled temperatures were 1.5 days and 3.6 weeks, respectively, while, the shelf life of untreated YAN (control) at ambient and chilled temperatures were 0.5 day and 2 weeks, respectively.

In general, it can be concluded that gamma irradiation in the dose tested is not feasible for the decontamination of wheat flour. Meanwhile, application of combination microwave heating followed by pulsed-UV treatment was found to be effective in reducing the microorganism load in YAN. Combination of this treatment with chilled storage could further improve the YAN shelf life. A new processing method for extending the shelf life of preservative-free YAN was discovered and it can be proposed as an alternative processing method to replace the current practices.

Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan Ijazah Sarjana Sains

PENGAWETAN MEE KUNING BERALKALI MENGGUNAKAN BERBAGAI TEKNOLOGI PENYINARAN

Oleh

ANISSA SORAYA

Jun 2011

Pengerusi : Prof. Madya Roselina Karim, PhD

Fakulti : Sains dan Teknologi Makanan

Mee kuning beralkali sangat rentan terhadap kerosakan. Saat ini, asid borik, suatu zat karsonogenik, banyak digunakan sebagai bahan pengawet mee kuning beralkali. Kajian ini dijalankan untuk menyelidik teknologi penyinaran yang mempunyai potensi memproduksi mee kuning beralkali bebas zat awet dan tahan lama. Ini termasuklah mengaplikasikan sinaran gamma untuk memperbaiki kualiti mikrobiologi tepung gandum yang digunakan sebagai bahan mentah utama, dan perlakuan pasca pemprosesan dengan menggunakan kombinasi teknologi untuk mengurangkan beban mikroorganisma mee kuning beralkali.

Tepung gandum komersial yang digunakan untuk membuat mee kuning beralkali diberi perlakuan menggunakan sinaran gamma ^{60}Co pada enam dos yang berbeza iatu 0, 2, 4, 6, 8 dan 10 kGy. Kandungan kimia, sifat fizikokimia, serta kualiti mikrobiologi daripada tepung gandum dianalisis.

Tepung gadum yang telah diberi perlakuan sinaran gamma digunakan untuk membuat mee kuning beralkali. Ciri warna, sifat tekstur, kualiti memasak, dan kualiti mikrobiologi mee kuning dianalisis.

Perlakuan dengan sinaran gamma tidak menyebabkan perubahan yang signifikan ($P > 0.05$) pada tepung gandum, namun ia mengakibatkan perubahan signifikan ($P < 0.05$) pada sifat fizikokimia tepung gandum dan mee kuning beralkali yang terbuat dari padanya. Perlakuan sinaran gamma menurukan beban mikroorganisma dalam tepung gandum dan mee kuning beralkali secara signifikan ($P < 0.05$). Semua parameter tekstur mee kuning beralkali dipengaruhi oleh perlakuan penyinaran gamma secara signifikan ($P < 0.05$), kecuali untuk keanjalan. Dari segi kualiti memasak, masa memasak mee kuning beralkali tidak berubah dengan perlakuan sinaran gamma, namun kehilangan padatan akibat proses memasak mee meningkat secara signifikan ($P < 0.05$) dengan peningkatan dos sinaran gamma. Penemuan ini menegaskan bahawa perlakuan sinaran gamma berkesan untuk mengurangkan pencemaran mikrobial pada tepung gandum tetapi ia mempengaruhi sifat fizikokimia tepung gandum dan menghasilkan mee kuning beralkali yang memiliki sifat tekstur dan kualiti memasak yang tidak diingini. Oleh kerananya, perlakuan ini tidak diaplikasikan pada tahap penyelidikan berikutnya

Selain pencemaran dari tepung gandum, kerosakan mee kuning beralkali mungkin juga disebabkan oleh pencemaran silang dari ruang sekitaran semasa penyediaan mee kuning. Oleh kerana itu, perlakuan dekontaminasi

pasca pemprosesan amatlah diperlukan. Kombinasi antara perlakuan pulsa-ultra ungu dan pemanasan dengan gelombang mikro mempunyai potensi untuk digunakan sebagai proses dekontaminasi pada mee kuning beralkali. Reka bentuk faktorial digunakan untuk mengkaji pengaruh pemanasan gelombang mikro pada aras kuasa 900 W (2450 MHz) dan perlakuan pulsa-ultra ungu pada kualiti mikrobiologi dan sifat tekstur mee kuning beralkali. Dua puluh kombinasi masa pemanasan dengan gelombang mikro yang berbeza (0 hingga 10 saat) dan aras tenaga pulsa-ultra ungu (0 hingga 7 J/sm^2) diberi pada mee kuning separa masak. Pengoptimuman respons digunakan untuk menentukan kombinasi optimum dari pada kedua teknologi ini dalam menurunkan beban mikroorganisma tanpa mengakibatkan kerosakan tekstur. Hasil kajian menunjukkan bahawa kombinasi optimum adalah pemanasan dengan gelombang mikro selama 5 saat pada aras kuasa 900 W (2450 MHz) diikuti dengan perlakuan pulsa-ultra ungu dengan tenaga sebanyak 3.5 J/sm^2.

Mee kuning beralkali diberi perlakuan dengan menggunakan kombinasi optimum pemanasan dengan gelombang mikro dan perlakuan pulsa-ultra ungu lalu disimpan pada suhu ambien (28±2 ^{o}C) dan pada keadaan sejuk (4±2 ^{o}C). Hasil kajian menunjukkan bahawa jangka hayat mee kuning beralkali yang diberi perlakuan adalah 1.5 hari pada suhu ambien dan 3.6 minggu pada suhu sejuk. Sementara itu, jangka hayat mee kuning beralkali tanpa perlakuan adalah 0.5 hari pada suhu ambien dan 2 minggu pada suhu sejuk.

Secara umumnya, dapat disimpulkan bahawa perlakuan penyinaran gamma pada dos yang dikaji tidak sesuai untuk dekontaminasi tepung gandum. Sementara itu, kombinasi pemanasan gelombang mikro diikuti oleh perlakuan pulsa-ultra ungu berkesan untuk mengurangkan beban mikroorganisma dalam mee kuning beralkali. Kombinasi perlakuan tersebut dengan penyimpanan sejuk boleh memanjangkan lagi jangka hayat mee kuning beralkali. Satu kaedah pemprosesan untuk memanjangkan jangka hayat mee kuning yang berkhasiat dan bebas dari bahan awet telah ditemui dan dapat menggantikan kaedah pemprosesan yang sedia ada.

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I certify that an examination committee has met on date/month/year to conduct the final examination of Anissa Soraya on her Master of Science thesis entitled “Preservation of Yellow Alkaline Noodles Using Different Radiation Technologies” 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 of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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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.

ANISSA SORAYA

Date: 13 June 2011

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