UNIVERSITI PUTRA MALAYSIA

MICROWAVE-BASED TECHNIQUE FOR DETERMINATION OF CHOLESTEROL IN MILK PRODUCTS

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MASTER OF SCIENCE

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MICROWAVE-BASED TECHNIQUE FOR DETERMINATION OF CHOLESTEROL IN MILK PRODUCTS

By

NOORHASMIERA ABU JAHAR

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

June 2011

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Abstract of the thesis presented to the Senate of Univesiti Putra Malaysia in fulfillment of the requirements for the degree of Master of Science

MICROWAVE-BASED TECHNIQUE FOR DETERMINATION OF CHOLESTEROL IN MILK PRODUCTS

By

NOORHASMIERA ABU JAHAR

June 2011

Chairperson : Associate Professor Nor Azah Yusof, PhD

Faculty : Science

A new method for determination of cholesterol in milk products has been developed based on dielectric properties of the cholesterol enzymatic reaction at microwave frequencies in the range of 0.2-20 GHz. The dielectric properties of cholesterol solutions, enzyme and the product of cholesterol-enzyme reaction were measured using an Open Ended Coaxial Probe (OECP) coupled with automated network analyzer (ANA) at room temperature (25°C). At frequency 4.98GHz and 10.9GHz the dielectric loss difference was obtain by subtracting the dielectric after the enzymatic reaction of cholesterol with dielectric of cholesterol oxidase alone. The cholesterol to cholesterol oxidase ratio at 1:2 is the best experimental condition for the detection of cholesterol using this system. The relative standard deviation (RSD) of the reproducilibity was calculated to be 1.85% for frequency 4.98 GHz and 2.06% for frequency 10.9 GHz at concentration of 38.67 ppm. The limit of detection was calculated to be 0.83 ppm at frequency 4.98GHz and 1.18 ppm at frequency 10.9 GHz. The results obtained from the developed method were compared with the standard method of cholesterol determination (BOHAC extraction- HPLC). The comparison result shows a poor agreement between the developed method and

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standard method. The value of $t_{calc} > t_{table}$ at 95% confidence level, thus, there is significant difference between both techniques at this confidence level. This may be due to interference of other compound such as protein, calcium, water and carbohydrate in the milk that affects the dielectric loss and because dielectric loss is too sensitive compared to dielectric constant.

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

TEKNIK BERTERASKAN GELOMBANG MIKRO UNTUK PENGESANAN KOLESTROL DALAM PRODUK SUSU

Oleh

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Pengerusi : Prof. Madya Nor Azah Yusof, PhD

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Satu kaedah baru untuk mengesan kolesterol dalam makanan telah dibagunkan bedasarkan sifat dielektrik tindakbalas enzim kolesterol pada frekuansi gelombang mikro dalam julat 0.2-20GHz. Ciri-ciri dielektrik kolesterol, enzim dan tindakbalas enzim dan kolesterol telah diukur menggunakan sensor dwipaksi terbuka hujung dengan kawalan komputer perisian analisis automatik rangkaian pada suhu bilik (25°C). Pada frekuensi 4.98 GHz dan 10.9 GHz perubahan kehilangan dielektrik diperolehi dengan menolak dielektrik selepas tindakbalas kolesterol dan enzim degan dielektrik kolesterol oksidase dengan ratio 1:2 adalah keadaan terbaik untuk mengesan kolesterol menggunakan system ini. Nilai sisihan piawai relatif dikira ialah 1.85% untuk frekuensi 4.98 GHz dan 2.06% untuk frekuansi 10.9 GHz pada kepekatan 38.67 ppm. Had pengesanan dikira ialah 0.83 ppm di frequensi 4.98GHz dan 1.18 ppm di frequensi 10.9GHz. Keputusan yang diperolehi daripada kedah yang dibangunkan dibandingkan dengan kaedah piawai untuk mengesan iaitu (BOHAC extraction- HPLC). Keputusan perbanding kurang memuaskan antara kaedah baru dan kaedah piawai. Nilai $t_{calc} > t_{table}$ pada 95% darjah keyakinan, ini menunjukan perbezaan yang nyata di antara kedua-dua kaedah pada darjah

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keyakinan tersebut. Ini kerana terdapat gangguan unsure-unsur lain seperti protein, kalcium, air dan karbohidrat dalam susu yang menggangu kehilangan dielekrik dan kerana kehilangan dielektrik lebih sensitif berbanding pemalar dielektrik.

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APPROVAL

I certify that an Examination Committee has met on **date of viva voce** to conduct the final examination of **Noorhasmiera Abu Jahar** on her **degree** thesis entitled **"Microwave-based Technique for Determination of Cholesterol in Milk Products"** in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulation 1981. The committee recommends that the candidate be awarded the (Name of relevant degree).

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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.

_____

NOORHASMIERA ABU JAHAR

Date: 10 June 2011

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