UNIVERSITI PUTRA MALAYSIA

UTILIZATION OF SOY PROTEIN ISOLATES IN THE PRODUCTION OF CHOCOLATES AND CHOCOLATE BEVERAGE POWDERS

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UTILIZATION OF SOY PROTEIN ISOLATES IN THE PRODUCTION OF CHOCOLATES AND CHOCOLATE BEVERAGE POWDERS

BY

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Thesis Submitted in Fulfilment of the Requirements
for the Degree of Master of Science
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Especially Dedicated to:

My Beloved Husband, Mohd Rosdee Hj. Yaacob,
My Loving Mother, Nik Aminah Zakaria, and
family.

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UTILIZATION OF SOY PROTEIN ISOLATES IN THE PRODUCTION OF CHOCOLATES AND CHOCOLATE BEVERAGE POWDERS

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January, 1997

Chairman: Assoc. Prof. Asiah Bt. Mohd. Zain

Faculty : Faculty of Food Scince and Biotechnology

Soy protein isolates (SPI) were incorporated in chocolate and chocolate beverage powders with the objectives of (i) increasing the protein content of the products, (ii) studying their effects on physical, chemical and sensory properties, and (iii) determining the chocolate stability during storage. Protein contents of chocolates with 5%, 10%, 15% and 20% SPI increased by 2.40%, 4.87%, 7.37% and 9.14% (wb), respectively, when compared to the control. From the amino acid profile, SPI-chocolates had low methionine content (25.12 mg/g protein) but still closed to the control (27.55mg/g protein), while high lysine content (60.01 mg/g protein) when 10% was added. The contents of other types of amino acid were almost similar to those of control. Sensory evaluation results showed that chocolates

with 5% SPI was the most acceptable, while 10% and 15% SPI were moderately acceptable. However 20% SPI was unacceptable because of its powdery flavour and white crystal (bloom) formation. SPI has the capability of preventing the bloom formation in chocolate, especially 7.5% SPI. The Totox Value (TV) of all chocolates was found to be highest at week 3, while the lowest level was at week 10 when 10% SPI was used. During storage, all chocolates slightly increased in hardness and darker in colour. Response Surface Methodology (RSM) was then applied in experimental design in order to study the physical effects of alkalized cocoa powder (ACP) and soy lecithin (SL) on chocolate beverage powders (CBPs). As a result, the best physical effect of SL on CBPs was around 2-4%, while for ACP, it was found to be at 20%. SPI-Chocolate beverage powders (SCBPs) were produced from a mixture of the optimum levels of ACP (20%) and maximum level of SL (4%). Control and SCBPs with 10-60% SPI had a lower sedimentation (0.46% and 0.58-0.88%, respectively) than SPI and SCBPs singly (14.17% and 2.08%, respectively). SPI completed the wettability test faster than CBPs (62.23 sec and 303.90 sec, respectively). This showed that addition of more SPI can accelerate the wettability of SCBPs. CBPs had higher solubility (67.13%) than SPI (34.13%), thus the incorporation of SPI had reduced the solubility of SCBPs. The overall acceptability of the control and, 10% and 20% SPI were highly accepted, while 30% and 40% SPI were moderately accepted, but 50% and 60% SPI were rejected due to the creamy texture, high viscosity, and high soy flavour. SCBPs were accepted at 10-40% SPI levels and contained 20.70-40.85% (db) of protein. With

the addition of up to 30% SPI, the methionine content decreased (20.24 mg/g protein) but it was still closed to the control (24.46 mg/g protein). Lysine content increased up to 30.20 mg/g protein as compared to the control (12.76 mg/g protein).

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PENGGUNAAN SOYA PROTEIN ISOLAT DI DALAM PENGHASILAN COKLAT DAN SERBUK MINUMAN COKLAT

Oleh

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Soya protein isolat (SPI) telah digunakan di dalam penghasilan coklat dan serbuk minuman coklat bertujuan untuk (i) meningkatkan kandungan protein di dalam produk, (ii) mengkaji kesan ciri-ciri fizikal, kimia dan penilaian deria produk; dan iii) mengenalpasti kestabilan coklat semasa penyimpanan. Kandungan protein di dalam coklat dengan 5%, 10%, 15% dan 20% SPI didapati meningkat sehingga 2.40%, 4.87%, 7.37%, dan 9.14% (bb) apabila dibandingkan dengan kawalan. Daripada profil asid amino, coklat-SPI mempunyai kandungan methionin yang lebih rendah (25.12 mg/g protein) tetapi hampir menyamai kawalan (27.55 mg/g protein), manakala kandungan lysin lebih tinggi (60.01 mg/ g protein) apabila 10% SPI ditambah. Asid-asid amino yang lain hampir menyamai kandungan asid amino kawalan. Keputusan penilaian deria menunjukkan coklat dengan 5% SPI adalah yang

paling diterima, manakala 10% dan 15% SPI sederhana diterima tetapi 20% SPI tidak diterima disebabkan oleh citarasa bertepung dan pembentukan kristal putih (bloom). SPI mempunyai keupayaan untuk menghalang pembentukan kristal putih terutama pada tahap 7.5% SPI. Nilai Totox (TV) untuk kesemua coklat didapati paling tinggi pada minggu ke 3, manakala 10% SPI memberikan nilai TV yang paling rendah pada minggu ke 10. Kesemua coklat menunjukkan sedikit peningkatan di dalam kekerasan dan warna menjadi lebih gelap semasa penyimpanan dilakukan. Perkaedahan Tindakbalas Permukaan (RSM) digunakan di dalam reka bentuk ujikaji untuk mengkaji kesan-kesan fizikal serbuk koko beralkali (ACP) dan lesitin soya (SL) ke atas serbuk minuman coklat (CBPs). CBPs menunjukkan kesan-kesan fizikal terbaik di antara 2-4% SL dan 20% ACP. Serbuk minuman coklat-SPI (SCBPs) telah dihasilkan dengan menggunakan tahap optimum ACP (20%) dan maksimum SL (4%). Kawalan dan SCBPs dengan 10-60% SPI mempunyai tahap pemendakan yang rendah (0.46% dan 0.58-0.88%) berbanding dengan SPI (14.17%) dan CBPs (2.08%). SPI mempunyai tahap pembasahan yang paling cepat iaitu 62.23 saat, berbanding dengan CBPs (303.90 saat). Ini menunjukkan penambahan lebih banyak SPI dapat mempercepatkan lagi tahap pembasahan SCBPs. CBPs mempunyai tahap kelarutan yang tinggi (67.13%) berbanding dengan SPI (34.13%), dengan itu peningkatan SPI dapat mengurangkan tahap kelarutan SCBPs. Penerimaan keseluruhan untuk kawalan dan SCBPs pada tahap 10% dan 20% SPI adalah yang paling diterima, manakala 30% dan 40% SPI sederhana diterima, tetapi 50% dan 60% SPI tidak dapat diterima disebabkan oleh citarasa berkrim, lebih pekat dan mempunyai rasa soya yang ketara. SCBPs hanya diterima pada tahap 10-40%, yang mana kandungan protein adalah di antara 20.70-

40.85% (bk). Pada tahap penambahan SPI sehingga 30%, kandungan methionin menurun di dalam SCBPs (20.24 mg/g protein) tetapi masih menghampiri nilai kawalan (24.46 mg/g protein). Kandungan lysin telah meningkat sehingga 30.20 mg/g protein berbanding kawalan (12.76 mg/g protein).

CHAPTER 1

GENERAL INTRODUCTION

Soybean is known as a supplier of protein, and various soy protein products have been produced. These products are available in various forms, such as, soy flour, soy grits, soy protein concentrates, soy protein isolates, and textured products.

Soy flour is recognized as a valuable foodstuff for many countries. Great improvements have been made in methods of preparation and in removing the unpleasant bitter flavour. Soy flour and soy protein concentrates have similar nutritional value, and with good physical characteristics, such as colour, flavour and odour. Soy protein isolates has a bland to mild cereal flavour, off-white to light tan colour, and none to mild cereal odour (Mattil, 1974).

Many protein-rich additives are used as protein fortifiers. Soy based products have been used by many industries to increase the protein content in their products. According to Smith and Circle (1972), soy bean has been recognized as a good source of vegetable for human food. Isolates are available for uses where the functional properties