ENZYMATIC HYDROLYSIS AND YEAST FERMENTATION OF OKARA

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by

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A dissertation submitted in the partial fulfillment of the requirements for the degree of Bachelor of Technology (B.Tech) in the field of Bioprocess Technology

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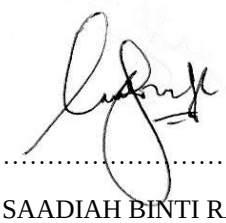
DECLARATION BY AUTHOR

This dissertation is consisting of my original work and does not contains any material that has been previously published or written by another person except where due reference has been made in the text. The content of my dissertation is the result of work I have done since the beginning of my research project and does not include a substantial part of the work that has been submitted in any university or other tertiary institution to qualify for the award of any other degree or diploma.



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LIST OF SYMBOLS

Symbol	Caption
%	Percentage
=	Equal to
°C	Degree of celcius
>	More than
<	Less than
+	Plus
-	Minus
/	Divide

LIST OF ABBREVIATIONS

Abbreviations	Caption
mg	Milligram
g	Gram
RSM	Response Surface Methodology
ANOVA	Analysis of variance
BBD	Box-Behnken design
mL	Milliliter
pH	Potential of hydrogen
DNS	Dinitrosalicyclic Acid
Rpm	Revolutions per minute
sp	Species
FBG	Fungal Beta-Glucanase
nm	Nanometer
L	Liter
µg	Microgram
v/w	Volume per weight
min	minute
h	hour
Df	Degree of freedom
R^2	Coefficient of determination

et al.	And the others
Pr(>F)	Probability (>F value)

HIDROLISIS ENZIMATIK DAN PENAPAIAN TERHADAP OKARA

ABSTRAK

Pengeluaran produk berasaskan kacang soya menghasilkan sisa lebihan yang tidak larut yang dipanggil okara. Pada masa ini, produk sampingan yang kaya dengan protein, lemak, dan serat ini telah dibuang sebagai sisa pertanian kerana sifatnya yang kurang baik seperti mudah membusuk dan mempunyai tinggi kandungan serat makanan yang tidak larut. Untuk mengatasi masalah ini, pemberian nilai kepada okara dengan rawatan biologi dapat menjadi salah satu pendekatan yang menjanjikan dapat meningkatkan nilai pemakanan okara. Objektif kajian ini adalah untuk menentukan keadaan optimum hidrolisis enzimatik bagi pengeluaran jumlah gula oleh Viscozyme L dan menyelidiki komposisi protein dari okara setelah penapaian oleh *Saccharomyces cerevisiae*. Pengoptimuman hidrolisis enzimatik dilakukan dengan menggunakan metodologi tindak balas permukaan, (RSM) oleh perisian R. Kesan dan interaksi ketiga-tiga pemboleh ubah; kepekatan enzim (1-5% v/w), suhu (25-50 ° C) dan pH (3.5-5.5) yang diselidiki untuk mendapatkan pengeluaran jumlah gula yang maksimum. Hasil analisis ANOVA menunjukkan pengaruh yang signifikan dari ketiga-tiga pemboleh ubah ini terhadap pengeluaran jumlah gula. Jumlah gula tertinggi, 1000 ug/mL telah diperolehi pada keadaan hidrolisis enzimatik yang optimum, 24°C, kepekatan enzim 4.8% (v/w) dan pH 5.5. Penapaian okara dengan *S. cerevisiae* menemui perubahan kemajuan yis selama 72 jam. Sel yis menggunakan jumlah gula sebagai sumber utama untuk menjalani penapaian aerobik. Penapaian okara mengandungi komposisi gula neutral termasuk sukrosa, glukosa, dan fruktosa. Jumlah kandungan protein meningkat dari 19.43% kepada 26.88% dalam keadaan kering. Oleh itu, okara yang dirawat dengan enzim dan *S. cerevisiae* dapat meningkatkan nilai dan sifat okara selepas ini.

ENZYMATIC HYDROLYSIS AND YEAST FERMENTATION OF OKARA

ABSTRACT

The production of soybean-based product results in an insoluble residue called okara. This by-product that rich in protein, fat, and fiber nowadays was discarded as an agro-waste due to its poor properties such as easily putrefy and has high content of insoluble dietary fiber. To overcome this problem, a valorization of okara by the biological treatment could become one of the promising approaches to improve the nutritional value of okara. The objectives of this study were to determine optimum enzymatic hydrolysis condition on the release of total sugar by Viscozyme L and investigate the total protein content of okara after fermentation by *Saccharomyces cerevisiae*. The optimization of the enzymatic hydrolysis was carried out using response surface methodology (RSM) by R software. The effect and interaction of three variables; concentration of enzyme (1-5% v/w), temperature (25-50°C) and pH (3.5-5.5) were investigated to obtain the maximum release of total sugar. The results of ANOVA analysis showed a significant effect of these three variables on the release of total sugar content. The highest total sugar content of 1000 ug/mL was obtained on optimal condition of enzymatic hydrolysis at 24°C, enzyme concentration of 4.8% (v/w) and pH 5.5. Fermentation of okara with *S. cerevisiae* found a change in yeast viability over 72 hours. Yeast cell utilized total sugar as the main sources to undergo aerobic fermentation. The fermentation-treated okara slurry contained a composition of neutral sugars including sucrose, glucose, and fructose. The total protein content was increased from 19.43% to 26.88% on a dry basis. Therefore, okara treated with enzyme and *S. cerevisiae* could improve the value and properties of okara afterwards.