COMPARISON OF AUTOCLAVE AND VACUUM OVEN TREATMENT ON RICE BRAN STABILITY AND CHEMICAL PROPERTIES

by

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Sekian, terima kasih.

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DECLARATION BY AUTHOR

This dissertation is composed of my original work and contains no material 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 carried out since the commencement of my research project and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution.

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LIST OF ABBREVIATION

Abbreviation	Caption
ANOVA	Analysis of variance
$CaCl_2$	Calcium chloride
CCD	Central composite design
CH_3COOH	Acetic acid
$CHCl_3$	Chloroform
DNA	Deoxyribonucleic acid
Eq.	Equation
FFA	Free fatty acid
g	Gram
g/mol	Gram per mole
H_2SO_4	Sulphuric acid
H_3BO_3	Boric acid
HCl	Hydrochloric acid
HPLC	High-performance liquid chromatography
K_2HPO_4	Dipotassium phosphate
kg	Kilogram
KI	Potassium iodide
M	Molarity
mEq	Milliequivalent
mg	Milligram
mg/L	Milligram per liter
min	Minute

mL	Milliliter
mL/min	Milliliter per minute
mM	Millimolar
MW	Molecular weight
N	Normality
$Na_2S_2O_3 \cdot 5H_2O$	Sodium thiosulfate pentahydrate
NaOH	Sodium hydroxide
nm	Nanometer
No	Number
p-NP	p-Nitrophenol
p-NPB	p-Nitrophenyl butyrate
PUFA	Polyunsaturated fatty acid
PV	Peroxide value
RB	Rice bran
rpm	Rotation per minute
RSM	Respond surface methodology
U	unit
UV-VIS	Ultraviolet–visible
v/v	Volume-to-volume ratio of a solution
w.b	Wet basis
µL	Microliter
µm	Micrometer

LIST OF SYMBOLS

Symbol	Caption
˚C	Degree Celcius
γ	Gamma
R^2	Coefficient determination
α	Alpha
β	Beta
β	Regression coefficients
δ	Delta
ε	Experimental error
k	Number of factors

PERBANDINGAN RAWATAN AUTOKLAF DAN PENGERINGAN VAKUM TERHADAP KESTABILAN DAN SIFAT KIMIA DEDAK PADI

ABSTRAK

Penstabilan dedak padi menggunakan haba telah digunapakai secara meluas untuk menyahaktifkan aktiviti enzim yang dapat melewatkan kemerosotan dan memanjangkan jangka hayat dedak padi. Namun, tidak ada laporan dalam literatur tentang penggunaan pengeringan vakum untuk menstabilkan dedak padi. Tujuan penyelidikan ini adalah untuk membandingkan prestasi penstabilan dedak padi dengan menggunakan rawatan autoklaf (120˚C, 20 minit) dan pengeringan vakum dari segi kestabilan dedak padi dan sifat kimia. Kaedah gerak balas permukaan (RSM) dengan penerapan reka bentuk komposit tengah (CCD) dan fungsi keinginan telah digunakan untuk menentukan keadaan optimum untuk menstabilkan dedak padi dengan menggunakan pengeringan vakum. Faktor yang dioptimumkan ialah suhu pengeringan (40-90˚C) dan masa (10-20 min) sementara tindak balas yang telah dikaji ialah kandungan lembapan, lemak kasar, protein kasar, nilai FFA, aktiviti lipase, nilai peroksida dan kandungan γ-oryzanol. Sifat kimia dan kestabilan penyimpanan dedak padi yang distabilkan dengan rawatan autoklaf dan pengeringan vakum yang dioptimumkan, telah dinilai dan dibandingkan. Terdapat perbezaan yang ketara ($p<0.05$) antara dedak padi yang dikeringkan secara autoklaf dan vakum dari segi kandungan kelembapan, lemak kasar dan protein kasar sementara tidak ada perbezaan yang ketara ($p<0.05$) antara kesan rawatan terhadap kandungan γ-oryzanol. Dedak padi yang telah distabilkan sama ada dengan rawatan autoklaf atau pengeringan vakum berkesan dalam menyahaktifkan enzim lipase dan lipoksigenase untuk penyimpanan yang selamat sehingga 3 bulan. Pengeringan vakum boleh dianggap sebagai alternatif untuk rawatan autoklaf berdasarkan perbezaan kecil dalam tindak balas dalam kajian ini antara kedua-dua rawatan.

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ABSTRACT

Heat stabilization of rice bran has been widely used to inactivate the enzyme activity which able to delay the deterioration and prolong the shelf life of the rice bran. However, there are no reports in the literature of using vacuum drying to stabilize rice bran. The purpose of this research is to compare the performance of rice bran stabilization by using autoclave treatment (120˚C, 20 minutes) and vacuum drying in terms of rice bran stability and chemical properties. Respond surface methodology (RSM) with the application of central composite design (CCD) and desirability function was used to determine the optimum condition to stabilize rice bran by using vacuum drying. The optimization factors were drying temperature (40-90˚C) and time (10-20 min) while the investigated responses were moisture content, crude fat, crude protein, FFA value, lipase activity, peroxide value and γ-oryzanol content. The chemical properties and storage stability of rice bran stabilized by autoclave treatment and optimized vacuum drying were evaluated and compared. Drying temperature of 90˚C and drying time of 10 min was found to be optimum for minimum moisture content, maximum crude fat, maximum crude protein, FFA value at 5%, minimum lipase activity, minimum peroxide value and maximum γ-oryzanol content. There was a significant difference (p<0.05) between autoclaved and vacuum dried rice bran in terms of moisture content, crude fat and crude protein while no significant difference (p<0.05) was observed between the effect of treatments on the γ-oryzanol content. Rice bran stabilized either by autoclave treatment or vacuum drying is effective in inactivating the lipase and lipoxygenase enzyme for its safe storage of up to 3 months. Vacuum drying can be considered as an alternative to

autoclave treatment based on small differences in responses obtained between both treatments as shown in this study.