EFFECTS OF HEAT MOISTURE TREATMENT ON THE PHYSICOCHEMICAL PROPERTIES OF LEGUME FLOURS

by

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This dissertation is composed of my original work and contains no material previously published or written by another person except where due to reference has been made in the text. The content of my dissertation is the result of work that 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 of diploma in any university or other tertiary institution.

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

Abbreviation	**Caption**
%	Percentage
°C	Degree Celsius
A	alpha
BS	Buckwheat starch
DP	Degree of polymerization
DSC	Differential Scanning Calorimetry
FT-IR	Fourier Transform Infrared Spectroscopy
g	gram
HCl	Hydrochloric acid
HCP	Heat moisture treatment of chickpea flour
HMB	Heat moisture treatment of mung bean flour
HMT	Heat moisture treatment
hr	Hour
JFS	Jackfruit starch
KBr	Potassium bromide
KOH	Potassium hydroxide
kV	Kilovolt
Mg	Milligram
min	Minute
mL	Milliliter
mol	Molarity
NCP	Native chickpea flour
nm	Nanometer
NMB	Native mung bean flour
RC	Relative crystallinity
RDS	Rapidly digestible starch
rpm	Revolutions per minute

RS	Resistant starch
SCFA	Short chains of fatty acids
SDS	Slowly digestible starch
SEM	Scanning Electron Microscope
SPSS	Statistical package for the Social Science
To	Onset temperature of gelatinization
Tc	End of gelatinization temperature
Tp	Peak temperature
XRD	X-ray Diffraction
ΔH	Enthalpy of gelatinization temperature
μm	Micrometer

KESAN PENGUBAHSUAI PADA FIZIKOKIMIA TEPUNG KEKACANG

ABSTRAK

Heat moisture treatment (HMT) adalah rawatan hidrotermal yang mengubah sifat fizikokimia *resistant starch* (RS) dengan membantu interaksi kanji dalam kawasan amorf dan kristal dan / atau mengganggu kristal kanji. Dalam kajian ini, HMT digunakan untuk memodifikasi tepung kekacang (kacang hijau dan tepung kacang kuda), sifat fizikokimia dan kandungan *resistant starch* dianalisis. Kanji telah dirawat pada kadar kelembapan 30% selama 16 jam pada suhu 100 °C. Berdasarkan keputusan, *heat moisture treatment* tepung kacang hijau (HMB) dan *heat moisture treatment* tepung kacang kuda (HCP) menunjukkan penurunan yang ketara ($p < 0.05$) dalam kandungan amilosa kerana panas menyebabkan perubahan penyesuaian amilosa, mengurangkan keupayaan amilosa untuk membentuk kompleks dengan iodin. Kanji HMT memaparkan ukuran yang tidak teratur dan permukaan kasar berbanding kanji asli ketika diperhatikan di bawah mikroskopi SEM. Sementara itu, kedua kanji asli kelihatan halus, tanpa kekasaran atau struktur pori di permukaannya. Semua kanji menunjukkan corak jenis-C dengan puncak intensiti pada 17° dan 23° dan beberapa puncak terletak pada 15°. Walau bagaimanapun, kristaliniti relatif menurun selepas HMT, menunjukkan gangguan kristal kanji. Kanji HMT menunjukkan sedikit penurunan dalam *Fourier Transform Infrared* (FT-IR) 1047 cm^{-1} dan 1022 cm^{-1} kanji HMT menunjukkan berbanding kanji asli. Daya pembengkakan yang berkurang berkaitan dengan suhu gelatinisasi, di mana memerlukan suhu yang lebih tinggi untuk mencairkan kristal kanji HMT. Daripada kesusasteraan, disimpulkan bahawa *resistant starch* pada tepung kekacang akan meningkat dengan ketara selepas HMT. Faktor-faktor yang mempengaruhi kandungan *RS* adalah kandungan amilosa, pembengkakan dan kelarutan, butiran kanji, corak sinar-X, kristaliniti dan suhu gelatinisasi.

EFFECTS OF MODIFICATION ON THE PHYSICO-CHEMICAL PROPERTIES OF LEGUMES FLOURS

ABSTRACT

Heat moisture treatment (HMT) is a hydrothermal treatment that changes the physicochemical properties of resistant starch by facilitating starch interaction within the amorphous and crystalline regions and/or disrupting starch crystals. In this study, HMT was used to modify legume flours (mung bean and chickpea flour) and physicochemical properties and resistant starch content were analyzed. The starches have been treated at 30% moisture content for 16 h at 100 °C. From the results, heat moisture treatment of mung bean flour (HMB) and heat moisture treatment of chickpea flour (HCP) show a significant decrease ($p<0.05$) in amylose content, due to heat induce by HMT, that able to change the amylose conformation, reduce the ability of amylose to form a complex with iodine. HMT starches display an irregular size and rough surface compared to native starches when observed under SEM microscopy. Meanwhile, both native starches appeared smooth, with no roughness or pore structure on their surfaces. All the starches exhibit a C-type pattern with strong peaks at 17° and 23° and a few peaks located at 15°. However, the relative crystallinity decreased after HMT treatment, indicating the disruption of starch crystals. The HMT starches shows slightly decrease in Fourier Transform Infrared (FT-IR) absorbance ratio of 1047 cm^{-1} and 1022 cm^{-1} compared to native starches. Reducing swelling power related to the gelatinization temperature, which required higher temperature to melt crystalline of HMT starches. From the literature, it was concluded that the resistant starch of legume flour will increase significantly after HMT. The influential factors in resistant starch content were discovered to be amylose content, swelling and solubility, starch granule, X-ray pattern, crystallinity and gelatinization temperature.