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Tarikh

CHALLENGES IN PRODUCING POROUS STARCH: A COMPARATIVE INSIGHT BETWEEN SAGO AND CORN STARCH

by

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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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CAMILIAS OO KAI XUAN

JULY 2020

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LIST OF ABBREVIATIONS

Abbreviations	Captions
Da	Dalton
DE	Dextrose Equivalent
DP	Degree of Polymerization
FTIR	Fourier Transform Infrared
ha	hectares
HMT	Heat Moisture Treatment
SEM	Scanning Electron Microscopy

LIST OF SYMBOLS

Symbols	Captions
®	Registered
α	Alpha
β	Beta
<	Less than
>	Greater than
~	Approximately
%	Percentage
µ	Micro

CABARAN DALAM PENGHASILAN KANJI BERLIANG:PERBANDINGAN ANTARA KANJI SAGU DENGAN JAGUNG

ABSTRAK

Kanji asal mempunyai penggunaan yang terhad dalam industri kerana sifatnya yang tidak stabil. Peningkatan permintaan industri untuk bahan mentah yang konsisten telah meningkatkan trend penggunaan kanji yang terubah suai sebagai bahan makanan dan bukannya kanji asal. Dalam beberapa tahun terakhir ini, kanji berliang telah banyak digunakan dalam industri makanan disebabkan oleh kemampuan penjerapan dan enkapsulasi. Kanji berliang dapat diperoleh daripada sumber botani yang berlainan tetapi kecekapan pembentukan liang adalah berbeza bergantung kepada penggunaan pelbagai jenis kanji yang mempunyai ciri-ciri berbeza seperti sifat permukaan, saiz granul, struktur dalaman, nisbah amilosa-amilopektin dan kompaun granul. Kanji jagung adalah antara kanji yang paling kerap digunakan untuk menghasilkan kanji berliang kerana sifat kerentanan yang tinggi terhadap pembentukan liang dan telah dikomersialkan seperti StarrierR® dan Cargill. Kanji sagu adalah sejenis kanji degil yang banyak terdapat di Malaysia, tetapi ia jarang digunakan untuk menghasilkan kanji berliang kerana kecekapan pembentukan liang yang rendah. Oleh itu, ulasan artikel ini memberi penekanan kepada cabaran dalam penghasilan kanji berliang yang jarang dibincangkan oleh penyelidik-penyelidik lain dengan memberi tumpuan kepada aspek jenis kanji dan enzim. Perbandingan juga dibuat untuk mengkaji kesan rawatan yang sama (beku cair, pencucian etanol, kelembapan haba, ultrasonik, hidrolisis enzim) terhadap pembentukan struktur berliang dalam kanji jenis degil dan rentan, contohnya dengan menggunakan kanji sagu dan jagung. Mikrograf SEM menunjukkan tahap pembentukan liang yang berbeza antara kanji sagu dengan kanji jagung walaupun rawatan yang sama diberikan. Rawatan intensif berkesan dalam menghasilkan struktur

berliang dalam kanji sagu yang bersifat degil, tetapi ini boleh menyebabkan gangguan kepada struktur berliang dalam kanji jagung bersifat rentan kerana rawatan yang dilakukan secara keterlaluan. Oleh itu, rawatan harus disesuaikan mengikut jenis kanji supaya struktur berliang yang terbaik dapat dihasilkan.

CHALLENGES IN PRODUCING POROUS STARCH: A COMPARATIVE INSIGHT BETWEEN SAGO AND CORN STARCH

ABSTRACT

Native starch has limited industrial usages due to its unstable properties. With the industry demand for consistency of raw materials, there is a growing interest in using modified starch as food ingredients instead of native starch. In recent years, porous starch has gained its acceptance in food industry owing to its adsorption and encapsulation ability. Porous starch can be obtained from different botanical sources, however, the pore-forming efficiency will be different due to the effect of starch types with varied surface characteristics, granule size, internal structure, amylose-amylopectin ratio or the presence of compound granule. Among the starches, corn starch is the most preferred type for porous starch production due to the high susceptibility to pore formation and it has been commercialized so far, like StarrierR® and Cargill. Sago starch, an example of resistant-type starch, is less likely to be used in producing porous starch although it is widely available in Malaysia, owing to the low pore-forming efficiency. Therefore, this review enlightens the challenges in producing porous starch which have rarely been discussed among researchers, mainly focused on the effect of starch types and enzyme types. A comparative insight is also presented by investigating the effects of similar treatments (freeze thawing, ethanol wash, heat moisture treatment, ultrasonic, enzyme hydrolysis) on the development porous structure in resistant-type and susceptible-type starches, using sago and corn starch as examples. SEM micrographs demonstrated the different extent of pore formation in sago and corn starch although similar treatments were applied. Intensive treatments are effective in producing porous structure in resistant-type sago starch, but these can lead to the disruption of porous structure in susceptible-type corn starch due

to over-processing. Therefore, starch treatments should be customized according to starch types in order to develop well-defined porous structure.