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**EVALUATION OF RICE HUSK POWDER AS AN
ANTICAKING AGENT IN COFFEE POWDER**

by

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A dissertation submitted in partial fulfilment of the requirements for the Degree of
Bachelor of Technology (B. Tech) in the field of Food Technology
School of Industrial Technology
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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 ABBREVIATIONS AND SYMBOLS

Abbreviation	Caption
BET	Brunauer–Emmett–Teller
GAB	Guggenheim-Anderson-de Boer
RH	Relative humidity
RHP	Rice husk powder
SEM	Scanning electron microscopy

Symbol	Description
a_w	Water activity
a^*	Redness
b^*	Yellowness
C	Guggenheim constant
C_{aw}	Critical water activity
k	Correction factor related to multilayer heat sorption
L^*	Lightness
P	P-value
m_0	Monolayer moisture content
R^2	Coefficient of determination

PENILAIAN SERBUK SEKAM PADI SEBAGAI AGEN ANTIPENGERAKAN DALAM SERBUK KOPI

ABSTRAK

Agen antipengerakan sintetik telah digunakan secara meluas untuk menyelesaikan pengetulan serbuk. Namun, keprihatinan konsumen yang semakin meningkat telah menyebabkan peningkatan tuntutan terhadap 'clean label'. Bahan semula jadi yang berpotensi seperti sekam padi yang mempunyai kemampuan menyerap air yang tinggi masih belum dikaji dan dikembangkan sebagai agen antipengerakan. Kajian ini bertujuan untuk menilai keberkesanan serbuk sekam padi sebagai agen antipengerakan dalam serbuk kopi, khususnya dengan pencirian, pengoptimuman, dan kajian isotherm penyerapan lembapan. Dalam kajian ini, sekam padi dikisar kepada kelas saiz serbuk yang berbeza ($<75 \mu\text{m}$, $75\text{--}250 \mu\text{m}$ dan $250\text{--}500 \mu\text{m}$). Pencirian dijalankan berdasarkan kandungan silika, kandungan serat, saiz dan taburan partikel, dan morfologi partikel. Lima sampel yang disediakan ialah sampel kawalan, serbuk kopi yang mengandungi jumlah serbuk sekam padi yang berbeza (1.0%, 1.7% dan 3.0%) dan 1.7% silikon dioksida (rujukan komersial). Sampel telah diseimbangkan dengan kelembapan relatif yang berbeza (23%, 43% dan 62%) untuk menyediakan sampel yang diseimbangkan kelembapan. Sifat antipengerakan dinilai berdasarkan warna, isotherm penyerapan lembapan dan sifat aliran. Serbuk sekam padi mempunyai kandungan silika dan kandungan serat yang tinggi secara relatif, dengan nilai eksperimen purata 16.96% dan 41.83% masing-masing. Kelas saiz $<75 \mu\text{m}$ mempunyai kemampuan antipengerakan yang terhebat kerana saiz partikelnya yang terkecil dan taburannya yang terluas. Morfologi partikel menunjukkan lapisan matriks serat-silika yang berlapis-lapisan dengan ruang antara lapisan. Kelembapan relatif dan jumlah serbuk sekam padi mempunyai kesan signifikan terhadap warna sampel. Sifat

aliran meningkat dengan peningkatan jumlah serbuk sekam padi tetapi menurun dengan peningkatan kelembapan relatif. Sampel yang didedahkan kepada kelembapan relatif 62% telah menjadi ketulan sepenuhnya. Sedikit peningkatan dalam penyerapan lembapan dan peningkatan sifat aliran telah ditunjukkan oleh 1.0% serbuk sekam padi. Antara semua jumlah yang dikaji, 3.0% serbuk sekam padi mempunyai sifat antipengerakan yang terhebat disebabkan penyerapan lembapannya yang tertinggi dan peningkatan sifat alirannya yang tertinggi.

EVALUATION OF RICE HUSK POWDER AS AN ANTICAKING AGENT IN COFFEE POWDER

ABSTRACT

Synthetic anticaking agents have been widely used to solve powder caking. However, the increasing concern of consumers leads to the rising demand on clean labels. Potential natural ingredients such as rice husk which has high water adsorbing ability are yet to be studied and developed as anticaking agents. This study aims to evaluate the effectiveness of rice husk powder as an anticaking agent in coffee powder, specifically by characterisation, optimisation and study of moisture sorption isotherm. In this study, rice husk was milled into different size classes of powder (<75 μm , 75–250 μm and 250–500 μm). Characterisation was conducted based on silica content, fibre content, particle size and distribution, and particle morphology. Five samples prepared were control sample and coffee powder containing different amount of rice husk powder (1.0%, 1.7% and 3.0%) and 1.7% silicon dioxide (commercial reference). Samples were equilibrated with different relative humidities (23%, 43% and 62%) to prepare moisture-equilibrated samples. Anticaking properties were evaluated based on colour, moisture sorption isotherm and flowability. Rice husk powder had relatively high silica content and fibre content, with mean experimental values of 16.96% and 41.83% respectively. Size class of <75 μm had the greatest anticaking ability due to its smallest particle size and widest distribution. Particle morphology showed extensive layers of fibre-silica matrix with interlayer spaces. Relative humidity and amount of rice husk powder had significant impact on colour of the samples. Flowability increased with increasing amount of rice husk powder but decreased with increasing relative humidity. Samples subjected to 62% relative humidity were completely caked. Little moisture sorption increment and flow improvement were

showed by 1.0% rice husk powder. Among all amount studied, 3.0% rice husk powder had the greatest anticaking properties due to its highest moisture sorption and highest flow improvement.