

STABILITY OF WAX-BASED OLEOGEL AS  
NOVEL FRYING MEDIUM OF PAR-FRIED  
FRENCH FRIES

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# STABILITY OF WAX-BASED OLEOGEL AS NOVEL FRYING MEDIUM OF PAR-FRIED FRENCH FRIES

by

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School of Industrial Technology

Universiti Sains Malaysia

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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.

— *Yuan* —

(LAM XUE YUAN)

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## LIST OF ABBREVIATIONS

<b>Abbreviation</b>	<b>Caption</b>
°C	degree Celsius
a*	Redness
AOAC	Association of Official Analytical Chemists
AOCS	American Oil Chemists' Society
b*	Yellowness
BW	Beeswax
CDW	Candelilla wax
CBW	Carnauba wax
cm	Centimetre
CSO	Cottonseed oil
DSC	Differential scanning calorimeter
Eq	Equation
FFA	Free fatty acid
FTIR	Fourier transform infrared
g	Gram
GRAS	Generally recognised as safe
HOSFO	High oleic sunflower oil
hr	Hour
IV	Iodine value
kg	Kilogram
L	Litre
L*	Lightness
meq	Milliequivalent

mg	Milligram
min	Minute
mL	Millilitre
mm	Millimetre
N	Newton (Force)
psi	Pound per square inch
PV	Peroxide value
RBW	Rice bran wax
s	Second
SEM	Scanning electron microscope
SFW	Sunflower wax
TOTOX	Total oxidation value
TPC	Total polar compound
μm	Micrometer
UV-Vis	Ultraviolet-visible

## LIST OF SYMBOLS

<b>Symbol</b>	<b>Caption</b>
%	Percentage
C	Carbon
MDA	Malondialdehyde
TCA	Trichloroacetic acid
TMP	1,1,3,3-Tetraethoxypropane

# **KESTABILAN OLEOGEL BERASASKAN LILIN SEBAGAI MEDIUM MENGGORENG BAHARU BAGI PAR GORENG KENTANG**

## **ABSTRAK**

Oleogel berasaskan lilin membentuk rangkaian gel hidrofobik tiga dimensi dalam minyak dan berpotensi untuk melapisi struktur permukaan makanan goreng dari penyerapan minyak yang berlebihan. Kentang goreng adalah salah satu makanan ringan yang banyak dimakan yang menyumbang kepada pengambilan lemak yang berlebihan di seluruh dunia. Oleh itu, strategi untuk meningkatkan kestabilan oksidatif makanan goreng adalah aspek penting yang harus dipertimbangkan. Tujuan kajian ini adalah untuk mengkaji kefungsiian oleogel berasaskan lilin dalam medium penggorengan dalam meningkatkan kestabilan oksidatif pada kentang goreng dan menilai kesannya terhadap sifat fisiokimia kedua-dua minyak kitaran penggorengan berulang kali dan kentang goreng. Jalur kentang dikisar dan menjalani proses penggorengan dua langkah: 1) par-goreng selama 1 minit pada suhu 190 °C tanpa minyak gel (kawalan) dan dengan minyak gel (lilin 0.05%; lilin candelilla (CDW) atau lilin dedak padi (RBW)), simpan dalam pembeku sembur pada suhu -18 °C selama 30 minit, dan disejukkbeu untuk menyerupai amalan komersial, dan 2) menggoreng selama 1.5 minit pada suhu 190 °C. Sebanyak 30 kitaran menggoreng dilakukan. Sampel minyak pada selang 5 kitaran penggorengan dan kentang goreng dari kitar 1 dan 30 disimpan untuk analisis kualiti. Kentang goreng yang digoreng dengan minyak oleogel CDW menghasilkan tekstur dan jumlah perbezaan warna kentang goreng yang setanding berbanding dengan sampel kawalan. Walau bagaimanapun, oleogel RBW lebih terdedah kepada pengoksidaan dan menghasilkan warna kentang goreng yang lebih gelap. Untuk kualiti minyak yang digoreng berulang kali, minyak yang digunakan untuk menggoreng sampel CDW menunjukkan kestabilan oksidatif yang

lebih tinggi berbanding RBW dan sampel kawalan dengan nilai FFA terendah dan nilai PV dan TOTOX yang setanding. Secara keseluruhan, penggunaan oleogel dalam langkah par-goreng dijangka dapat mengurangi pengambilan minyak dari kentang goreng, dan oleogel CDW dipilih untuk kestabilan yang lebih baik terhadap pengoksidaan dan kualiti yang setanding dengan kawalan yang menjanjikan penghasilan kentang goreng yang lebih sihat.



## **STABILITY OF WAX-BASED OLEOGEL AS NOVEL FRYING MEDIUM OF PAR-FRIED FRENCH FRIES**

### **ABSTARCT**

Wax-based oleogels form three-dimensional hydrophobic gel network in oil and potential to coat the surface structure of fried food from excessive oil absorption. French fries are one of the highly consumed snacks that contribute to significant fat intake around the world. Therefore, strategies to improve oxidative stability of fried food is an important aspect to be considered. The aims of this study were to investigate the functionality of wax-based oleogels as par frying medium in improving oxidative stability of fried potato strips and evaluate their effects on physiochemical properties of both frying oil subjected to repeated frying cycles and French fries. Potato strips were blanched and subjected to two-steps frying process: 1) par frying for 1 min at 190 °C without (control) and with gelled oil (0.05% wax; candelilla (CDW) or rice brand (RBW)), blast frozen at -18 °C for 30 min, and stored in freezer to mimic commercial practice, and 2) frying for 1.5 min at 190 °C. A total of 30 frying cycles were carried out. Oil samples at interval of 5 frying cycles and French fries from 1<sup>st</sup> and 30<sup>th</sup> cycles were collected for quality analyses. French fries par fried with CDW oleogel oil resulted in comparable texture and total colour difference ( $\Delta E$ ) of French fries with the control samples. However, RBW oleogel was slightly more prone to oxidation and resulted in darker colour French fries. For the quality of oil subjected to repeated frying cycles, the oil used to fry the CDW sample showed higher oxidative stability compared to RBW and control samples with lowest FFA value and comparable in PV and TOTOX values. Overall, the use of oleogel during par frying were expected to reduce oil uptake of French fries, and CDW oleogel was preferred

with better stability against oxidation and comparable in quality with control which is promising in producing healthier French fries.