

การนำความร้อระหว่างการกลั่นสลายแอลบในเตาเผาทรงกระบอก



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จุฬาลงกรณ์มหาวิทยาลัย

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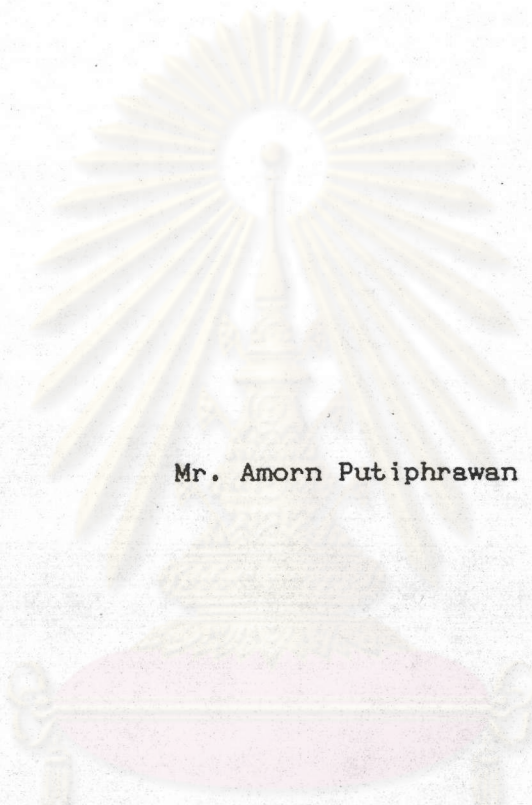
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HEAT CONDUCTION DURING PYROLYSIS OF RICE HULLS
IN A CYLINDRICAL FURNACE



Mr. Amorn Putiphrawan

ศูนย์วิทยทรัพยากร
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พิมพ์ต้นฉบับทศกัณฐ์วิทยานิพนธ์ภายในกรอบสี่เหลี่ยมนี้เพียงแผ่นเดียว

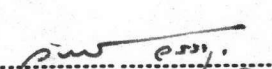


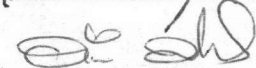
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งานวิจัยนี้ ศึกษาการกลั่นสลายแกลบ ในอุปกรณ์ที่สามารถวัดการเปลี่ยนแปลงความหนาแน่น และการเปลี่ยนอุณหภูมิทั้งที่ผิวหน้า และภายในเขตของแกลบ กระบวนการกลั่นสลายนี้ สามารถอธิบาย ด้วยแบบจำลองคณิตศาสตร์ ที่รวมปฏิกิริยาจลนพลศาสตร์ การถ่ายเทความร้อนโดยการนำ และความร้อน ที่ใช้ไปในระหว่างการกลั่นสลาย เมื่อนำแบบจำลองนี้ไปกำกับเส้นโปรไฟล์อุณหภูมิ ทำให้ได้ค่าการนำ ความร้อนชั่วขณะของแกลบ ที่แปรเปลี่ยนไปกับความหนาแน่น และอุณหภูมิ จากผลการทดลองพบว่า อุณหภูมิ ความชื้น และความหนาแน่น เป็นพารามิเตอร์ที่สำคัญสำหรับการกลั่นสลาย ภายใต้เงื่อนไขของการทดลองนี้ (ความชื้น = 0.11-24.04 เปอร์เซ็นต์, อุณหภูมิ = 350-500 องศาเซลเซียส และ ความหนาแน่น = 113.5-141.4 กิโลกรัมต่อลูกบาศก์เมตร) ค่าการนำความร้อนระหว่างการกลั่นสลาย มีค่า $k = 3.1 \times 10^{-3} + 4.5 \times 10^{-3} (\rho - 0.15) + 1.9 \times 10^{-6} (T - 20)$ จูลต่อวินาที เคลวิน เซนติเมตร

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

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ลายมือชื่อนิสิต อมร ฤทธิประวรพรณ
ลายมือชื่ออาจารย์ที่ปรึกษา 



พิมพ์ต้นฉบับขงทศกัณฑ์ชื่อวิทยานิพนธ์ภายในกรอบสี่เหลี่ยมนี้เพียงแผ่นเดียว



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IN A CYLINDRICAL FURNACE. THESIS ADVISOR : ASSO. PROF. WORAPHAT
ARTHAYUKTI, D. Ing., THESIS COADVISOR : ASSO. PROF. PATTARAPAN
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The pyrolysis of rice hulls is investigated with a simple device, which allows for measurement of the bulk density change and the change of surface and inside temperature of the rice hull bed. The pyrolysis process can be described by a mathematical model which includes the kinetics of the reaction, the heat transfer by conduction and the heat generation during pyrolysis. The fitting of this model on temperature profile curves has permitted the estimation of the transient thermal conductivity of rice hulls which varied with bulk density and temperature. The obtained experimental results indicate that the significant parameters of pyrolysis are temperature moisture content and bulk density. Under the experimental conditions of the study (moisture content = 0.11-24.04 %, temperature = 350-500 °C and bulk density = 113.5-141.4 kg/m³), the thermal conductivity value during pyrolysis was found to follow the following relationship $k = 3.1 \times 10^{-3} + 4.5 \times 10^{-3} (\rho - 0.15) + 1.9 \times 10^{-5} (T - 20)$ J/sec K cm.

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ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



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NOMENCLATURE

A	:	Pre-exponential factor, 1/min
C_p	:	Heat capacity, cal/g °C
C_{ps}	:	Heat capacity of the sample, cal/g °C
C_{pw}	:	Heat capacity of water, cal/g °C
E	:	Apparent activation energy, J/mol
H	:	Enthalpy, J/g
H_c	:	Heat capacity constant, cal/°C
k	:	Thermal conductivity, J/sec K cm
L	:	Length, cm
P	:	Pressure, g/cm sec
q_r	:	Heat flux on the r-direction, cal/sec cm ²
q_x	:	Heat flux on the x-direction, cal/sec cm ²
Q	:	Heat of reaction, J/g
r	:	Radial distance, cm
R	:	Radius of the furnace, cm
R_c	:	Heat loss rate or rate of temperature drop, °C/min
R_g	:	Universal gas constant, J/mol K
t	:	Time, min
T	:	Temperature, °C
T_0	:	Initial temperature, °C
T_{ref}	:	Reference temperature, °C
T_w	:	Wall temperature, °C
ΔT_c	:	Difference in temperature of cold water, °C

ΔT_f	:	Difference in temperature of calorimeter or initial temperature of calorimeter minus equilibrium temperature, °C
ΔT_h	:	Difference in temperature of hot water, °C
ΔT_m	:	Initial temperature of sample minus the equilibrium temperature of mixture, °C
ΔT_w	:	Equilibrium temperature minus initial temperature of water, °C
W_c	:	Weight of cold water, g
W_h	:	Weight of hot water, g
W_s	:	Weight of the sample, g
W_w	:	Weight of water, g
x	:	Distance on the x-axis, cm
ϵ_b	:	Bed porosity
ϵ_p	:	Particle porosity
ρ	:	Bulk density, kg/m ³
ρ_0	:	Initial bulk density, kg/m ³
ρ_a	:	Apparent density, kg/m ³
ρ_s	:	Skeletal density, kg/m ³
ρ_∞	:	Final bulk density, kg/m ³
θ	:	Time of cooling the sample, min
λ	:	Latent heat of vaporization