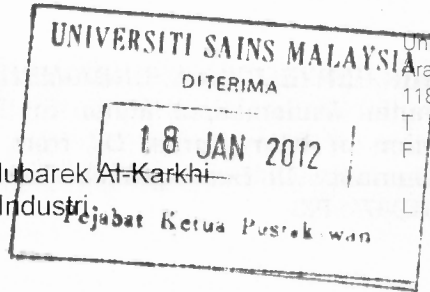




Canselori,

No. Fail : F0352  
Tarikh : 2 Disember 2011

Prof. Madya Abbas Fadhl Mubarek At-Karkhi  
Pusat Pengajian Teknologi Industri  
Universiti Sains Malaysia



Universiti Sains Malaysia  
Aras 6, Bangunan Canselori  
11800, USM Pulau Pinang  
T : (6)04-653 3108/3178/3988/5019  
F : (6)04-656 6466/8470  
: (6)04-653 2350  
L : www.research.usm.my

Tuan,

**LAPORAN AKHIR SKIM GERAN PENYELIDIKAN FUNDAMENTAL (FRGS)**

Tajuk Projek : A Mass Tranfer Mathematical Model for Super and Near - Critical  
CO2 Extration of Palm Kernel Oil from Stress Analysis of Non  
Spherical Geometry Oil Bearing Cell in Palm Cake

No. Akaun : 203/PTEKIND/671193

Dengan hormatnya perkara di atas dirujuk.

2. Terlebih dahulu saya ucapkan ribuan terima kasih di atas satu salinan laporan akhir untuk projek penyelidikan seperti tajuk di atas.
3. Adalah dimaklumkan walaupun projek ini telah selesai, kerjasama Jabatan Bendahari dipohon untuk menguruskan penutupan akaun projek pada selewat-lewatnya **31 Disember 2011**. Tempoh ini bertujuan untuk menyelesaikan semua urusan tuntutan dan bayaran yang telah dibelanjakan di dalam tempoh projek. Walau bagaimanapun, tuan dinasihatkan supaya tidak mengeluarkan borang-borang pesanan baru di dalam tempoh ini.
4. Selanjutnya sila ambil perhatian terhadap perkara-perkara berikut sekiranya berkaitan:
  - (i) Semua penerbitan harus merakamkan penghargaan kepada **Skim Geran Penyelidikan Fundamental (FRGS)** dan tuan dipohon mengemukakan satu salinan ke Pejabat ini.
  - (ii) Bahagian Penyelidikan & Inovasi boleh/akan mengagihkan semula peralatan yang telah dibeli menggunakan peruntukan geran ini seandainya terdapat penyelidik lain yang memerlukan peralatan tersebut.
5. Akhir sekali, tahniah di atas usaha dan kejayaan pihak tuan dapat menyelesaikan projek ini dengan jayanya.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"  
'Memastikan Kelestarian Hari Esok'

Yang menjalankan tugas,

  
(AMR OTHMAN)  
Penolong Pendaftar  
Unit Pengurusan Geran & Kontrak

HAN, HAR, SM

# LAPORAN AKHIR SKIM GERAN PENYELIDIKAN FUNDAMENTAL (FRGS)

Tajuk Projek : A Mass Transfer Mathematical Model for Super and Near - Critical CO<sub>2</sub> Extration of Palm Kernel Oil from Stress Analysis of Non Spherical Geometry Oil Bearing Cell in Palm Cake

No. Akaun : 203/PTEKIND/671193

s.k. Dekan Penyelidikan  
Pelantar Sains Fundamental  
Pejabat Pelantar Penyelidikan  
Universiti Sains Malaysia

Dekan  
Pusat Pengajian Teknologi Industri  
Universiti Sains Malaysia

Timbalan Dekan  
(Pengajian Siswazah & Penyelidikan)  
Pusat Pengajian Teknologi Industri  
Universiti Sains Malaysia



Ketua Pustakawan  
Perpustakaan Hamzah Sendut  
Universiti Sains Malaysia

Penolong Bendahari Kanan  
Unit Kumpulan Wang Penyelidikan  
Jabatan Bendahari  
Universiti Sains Malaysia

Pegawai Sains  
Pelantar Sains Fundamental  
Pejabat Pelantar Penyelidikan  
Universiti Sains Malaysia

Disampaikan satu salinan laporan akhir projek untuk simpanan Perpustakaan

Mohon kerjasama pihak puan untuk menguruskan penutupan akaun projek selewat-lewatnya pada **31 Disember 2011** dan mohon kemukakan satu salinan penyata kewangan terakhir ke Pejabat ini untuk tujuan rekod

Kod Projek : FRGS/FASA1-2009/(BIDANG)/(NAMA IPT)/(NO.RUJ. KPT)

BORANG FRGS – P3(R)

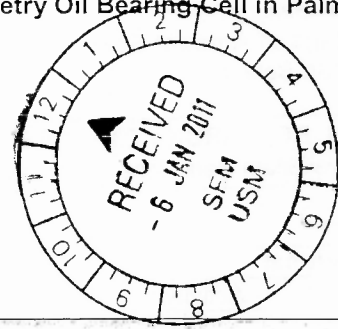


**FINAL REPORT**  
**FUNDAMENTAL RESEARCH GRANT SCHEME (FRGS)**  
*Laporan Akhir Skim Geran Penyelidikan Asas (FRGS) IPT*  
*Pindaan 1/2009*

**A RESEARCH TITLE** : A Mass Transfer Mathematical Model for Super and Near-Critical CO<sub>2</sub> Extraction of Palm Oil from stress Analysis of Non Spherical Geometry Oil Bearing Cell in Palm Cake  
*Tajuk Penyelidikan*

**PROJECT LEADER** : Dr. Abbas Mubarak Al-Karkhi  
*Ketua Projek*

**PROJECT MEMBERS** : 1. Prof. Ir Dr. Mohd Omar Ab Kadir  
 (including GRA) 2. Prof. Nik Norulaini Nik Ab Rahman  
*Ahli Projek* 3. En Abu Hanipah Nawi



**PROJECT ACHIEVEMENT** (*Prestasi Projek*)

B			
ACHIEVEMENT PERCENTAGE			
Project progress according to milestones achieved up to this period	0 - 50%	51 - 75%	76 - 100%
Percentage			100%
RESEARCH FINDINGS			
Number of articles/ manuscripts/ books	Indexed Journal	Non-Indexed Journal	
Paper presentations	International	National	
			1
Others (Please specify)			
HUMAN CAPITAL DEVELOPMENT			
Human Capital	Number		Others (Please specify):
	On-going	Graduated	
PhD Student	1		
Masters Student	1		
Undergraduate Students			
Temporary Research Officer		1	
Temporary Research Assistant		1	
<b>Total</b>		<b>4</b>	

**EXPENDITURE** (*Perbelanjaan*)

C	Budget Approved ( <i>Peruntukan diluluskan</i> )	: RM 80, 000.00
	Amount Spent ( <i>Jumlah Perbelanjaan</i> )	: <u>RM 79, 903.10</u>
	Balance ( <i>Baki</i> )	: <u>RM 96.90</u>
	Percentage of Amount Spent ( <i>Peratusan Belanja</i> )	: % 99.88

**ADDITIONAL RESEARCH ACTIVITIES THAT CONTRIBUTE TOWARDS DEVELOPING SOFT AND HARD SKILLS**

(Aktiviti Penyelidikan Sampingan yang menyumbang kepada pembangunan kemahiran insaniah)

D

International		
Activity	Date (Month, Year)	Organizer
(e.g : Course/ Seminar/ Symposium/ Conference/ Workshop/ Site Visit)		
National		
Activity	Date (Month, Year)	Organizer
(e.g : Course/ Seminar/ Symposium/ Conference/ Workshop/ Site Visit)		

**PROBLEMS / CONSTRAINTS IF ANY** (*Masalah/ Kekangan sekiranya ada*)

E

**RECOMMENDATION** (*Cadangan Penambahbaikan*)

F

**RESEARCH ABSTRACT – Not More Than 200 Words**(*Abstrak Penyelidikan – Tidak Melebihi 200 patah perkataan*)

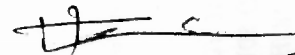
G

The mass transfer mathematical model uses mechanic approach by evaluating stress analysis of non spherical oil bearing cell. The stress distribution along the oil bearing cell will be integrated with the mass transfer phenomena for the examination of oil concentration distribution along the axis of the oil bearing cell. The study was conducted by considering one dimensional problem in a cylindrical coordinate. For simplicity purposes, study was conducted by considering, Static load and Dynamic load.

The derivation of governing equation used the combination of theory of elasticity and principles of mass transfer. Theory of elasticity gives the displacement as the product of elastic movement of the cell. While, mass transfer phenomenon is investigated using no net transport equation with its plane velocity is determined using the above displacement. In static load, thickness and force variation effects were illustrated using the determined displacement and stresses equation. From the displacement distribution curve, it showed that displacement is moving towards outer part easily compare to the cell having thicker wall. Stress distribution suggested that the inner core part is always under the pressure. This will means that the oil inside the palm kernel has the tendency to flow outward due to the compression stress occurred at the inner core.

Date :  
Tarikh

Project Leader's Signature:  
Tandatangan Ketua Projek



Assoc. Prof. Dr. Abbas F. M. A.  
School of Industrial Technol  
Universiti Sains Malaysia  
11800 USM, Penang, Mala

**COMMENTS, IF ANY/ ENDORSEMENT BY RESEARCH MANAGEMENT CENTER (RMC)**

(*Komen, sekiranya ada/ Pengesahan oleh Pusat Pengurusan Penyelidikan*)

Name:  
Nama:

Signature:  
Tandatangan:

Date:  
Tarikh:

UNIVERSITI SAINS MALAYSIA  
 JALAN BENDAHARI  
 KUMPULAN WANG FRGS (203)  
 PENYATA PERBELANJAAN PADA 31 JULAI 2010

NAMA PROJEK :  
 A MASS TRANSFER MATHEMATICAL MODEL FOR SUPER AND NEAR-CRITICAL CO2 EXTRACTION OF PALM KERNEL OIL FROM STRESS ANALYSIS OF NON SPHERICAL GEOMETRY OIL BE  
 TEMPOH : 2 TAHUN  
 KETUA PROJEK : DR. ABBAS F. MUBARAK ALKHARKI  
 P.P. TEKNOLOGI INDUSTRI

AKAUN	PTJ	PROJEK	DONOR	PERUNTUKAN PROJEK	PERUNTUKAN TERKUMPUL SEHINGGA THN LALU	PERUNTUKAN SEMASA	TANGUNGAN SEMASA	BAYARAN SEMASA	DEBITAN SEMASA	BAKI PROJEK
111	PTEKIND	671193		22,680.00	41,559.10	-18,879.10	0.00	3,000.00	3,000.00	-21,879.10
221	PTEKIND	671193		3,500.00	0.00	3,500.00	0.00	0.00	0.00	3,500.00
222	PTEKIND	671193		2,000.00	0.00	2,000.00	0.00	0.00	0.00	2,000.00
223	PTEKIND	671193		1,000.00	0.00	1,000.00	0.00	0.00	0.00	1,000.00
224	PTEKIND	671193		1,000.00	0.00	1,000.00	0.00	0.00	0.00	1,000.00
226	PTEKIND	671193		5,000.00	0.00	5,000.00	0.00	0.00	0.00	5,000.00
227	PTEKIND	671193		6,000.00	25,644.00	-19,644.00	0.00	1,100.00	1,100.00	-20,744.00
228	PTEKIND	671193		7,000.00	0.00	7,000.00	0.00	0.00	0.00	7,000.00
229	PTEKIND	671193		2,440.00	5,900.00	-3,460.00	0.00	0.00	0.00	-3,460.00
335	PTEKIND	671193		29,380.00	2,700.00	26,680.00	0.00	0.00	0.00	26,680.00
				80,000.00	75,803.10	4,196.90	0.00	4,100.00	4,100.00	96.90

SENARAI JUMLAH JUMLAH KECIL :

110	EMOLUMEN	22,680.00	41,559.10	-18,879.10	0.00	3,000.00	3,000.00	-21,879.10
220	PERKHIDMATAN DAN BEKALAI	27,940.00	31,544.00	-3,604.00	0.00	1,100.00	1,100.00	-4,704.00
330	ASET	29,380.00	2,700.00	26,680.00	0.00	0.00	0.00	26,680.00
		80,000.00	75,803.10	4,196.90	0.00	4,100.00	4,100.00	96.90