



1. **Nama Ketua Penyelidik:** Mohamad Suhaimi Jaafar, Prof.

*Name of Research Leader*

Profesor Madya/  
*Assoc. Prof.*

Dr./  
*Dr.*

Encik/Puan/Cik  
*Mr/Mrs/Ms*

2. **Pusat Tanggungjawab (PTJ):** School of Physics

*School/Department*

3. **Nama Penyelidik Bersama:** Lakshmanan Palaniappan, Prof Madya

*Name of Co-Researcher*

4. **Tajuk Projek:** Ultrasonic Characterisation of a Major Milk Pollutant on Diabetic Health

*Title of Project*

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5. **Ringkasan Penilaian/Summary of Assessment:**

	Tidak Mencukupi <i>Inadequate</i>		Boleh Diterima <i>Acceptable</i>	Sangat Baik <i>Very Good</i>	
	1	2		3	4
i) <b>Pencapaian objektif projek:</b> <i>Achievement of project objectives</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
ii) <b>Kualiti output:</b> <i>Quality of outputs</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
iii) <b>Kualiti impak:</b> <i>Quality of impacts</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iv) <b>Pemindahan teknologi/potensi pengkomersialan:</b> <i>Technology transfer/commercialization potential</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
v) <b>Kualiti dan usahasama :</b> <i>Quality and intensity of collaboration</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
vi) <b>Penilaian kepentingan secara keseluruhan:</b> <i>Overall assessment of benefits</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

## 6. Abstrak Penyelidikan

(Perlu disediakan di antara 100 - 200 perkataan di dalam **Bahasa Malaysia dan juga Bahasa Inggeris**. Abstrak ini akan dimuatkan dalam Laporan Tahunan Bahagian Penyelidikan & Inovasi sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti & masyarakat luar).

### *Abstract of Research*

*(An abstract of between 100 and 200 words must be prepared in Bahasa Malaysia and in English).*

*This abstract will be included in the Annual Report of the Research and Innovation Section at a later date as a means of presenting the project findings of the researcher/s to the University and the community at large)*

Lactose is the dominant carbohydrate in milk and  $\alpha$ -Lactalbumin is one of the major milk proteins. Their role in the synthesis and metabolism of milk are obvious. The present study is intended to investigate the nature of lactose and  $\alpha$ -Lactalbumin and their influence in carbohydrate (lactose) metabolism of the diabetic health. The bacterial colony in the surroundings of livestock is found to influence the whole process of synthesis and metabolism of lactose. Hence, based on the outcomes of the study, few recommendations were made for the proper maintenance of livestock that can yield milk of proper constituents, thereby control the onset of diabetes mellitus incidence in human beings.

The present study declares that the onset of Type-II diabetes mellitus in human beings is not due to the metabolic disorder of the human system but due to the impaired constituents of the diet especially the milk food. This fact is established by the ultrasound, spectroscopic and polarimeter studies and few suggestions were made so as to maintain the proper constituents of milk food.

## 7. Sila sediakan laporan teknikal lengkap yang menerangkan keseluruhan projek ini.

[Sila gunakan kertas berasingan]

*Applicant are required to prepare a Comprehensive Technical Report explaining the project.*

*(This report must be appended separately)*

Of the two types of diabetes mellitus incidence in human beings, Non Insulin Dependent Diabetes Mellitus or Type II is the most popular and is characterized by the fact that the body cells are starved of glucose despite its very high concentration around it, i.e. scarcity in plenty. Wide survey of literature and statistics show that it is the resistance of the receptor cells and not the insufficient insulin form the basis of the onset of the disease. Further the statistics show that the disease is area sensitive and almost 90% of the Asian diabetic patients are affected by the lactose intolerance and not by the glucose directly [1]. The main source of this carbohydrate is the milk food. Thus the pollution of milk food and its consequences leads to the misconception as the onset of diabetes mellitus in the Asian individuals.

Many reports are available that the blood glucose level of fresh diabetic patients are not always high but is high when they take milk food. Further, the unprocessed cow milk rather than other milk is found to keep blood glucose level well within the normal range. Thus the glucose molecules obtained from the lactose of processed milk samples are not acceptable by the body cells. To ensure this observation, and to find the remedial measures, various physical methods are attempted. As physical methods are more sensitive they can be used along with chemical methods to ensure the obtained results.

As the constituents of milk forms the central theme of the present study, milk from various sources (natural and synthetic) were used. Varieties of milk samples were collected and their constituents were chemically analyzed. Using chemical methods (with DNS solution), the protein and carbohydrate were separated out. These separated samples were subjected to ultrasonic, polarimeter and ultraviolet studies and results are given in Tables 1 to 4.

Experiment was performed in specific steps. First pure  $\alpha$ -lactalbumin and lactose were purchased from Aldrich Chemical Company and used. Secondly lactose and lactalbumin that are separated from natural cow-milk were used. Thirdly, synthesized milk powders were used. The values of artificial samples closely matches with those obtained from chemical company where as the natural samples deviate much. The results were analyzed and are attributed to the presence of microorganism such as bacteria in the natural milk samples. It is interesting to note that artificial milk samples with or without bacteria are found to be distinctly different.

Finally pure glucose values were obtained. Lactose from the natural and artificial samples was hydrolyzed properly to give glucose. It is found that the glucose values obtained for natural samples matches with standard values where as artificial samples show deviations. On addition of bacterial colony to artificial samples and on hydrolysis same match reappears. Thus the milk samples with bacterial colony were found to be safe and necessary. It is advised to generate bacterial colony along with milk processing.

Further the experiment was done before and after adding 10 million live *L.acidophilus* bacteria to selected cow milk samples. As regards no bacteria content, raw cow milk is having higher ultrasonic velocity compared to lactose because of removal of the protein fraction from milk. The ultrasonic velocity for separated lactose solution from cow milk has higher value than pure lactose powder that may be due to addition of Millon's reagent in milk. The ultrasonic velocity exhibits linear temperature dependence for both cow milk and lactose samples. Once the bacterial culture was added, sound velocity is found to be in increasing trend with increasing time due to the favorable culture of bacteria. *L.acidophilus* growth starts at the moment it is been added through the milk. The rise in ultrasonic velocity represents the production of lactic acid by the *L.acidophilus*. The ultrasonic velocity tends to increase linearly until 1 hour. After 1 hour, the bacterial activity might slow down, and as a result, the ultrasonic velocity level remains constant.

Most bacteria prefer a growth environment with a pH of about 7, i.e. neutrality [2]. Cow milk pH is 6, *L.acidophilus* in milk produce acid and continues to do so until the pH of the milk falls to 5. Fermentation occurs when *L.acidophilus* break down sugars and carbohydrates to produce alcohol, carbon dioxide and lactic acid. When milk becomes acidic, the protein in the milk will break down [3]. The end products of fermentation ultimately change taste and texture of food [4]. *L.acidophilus* growth shows a specific pattern comprising consecutive stages [5].

From the data obtained from Digital Polarimeter and UV-Vis Spectrophotometer, the amount of lactose that getting from both equipments is different. The percentage of lactose that obtained from UV-Vis Spectrophotometer is less than the percentage that obtained from Digital Polarimeter. The differences in observed readings were attributed to the exposure of sample to light, use of light sensitive DNS solution etc. However the observation of polarimeter and spectrophotometer unanimously support the view as obtained by sound velocity.

It is concluded that presence of bacteria such as *L.acidophilus* in milk is found to be favoring the breakdown process of lactose into glucose in a systematic way, thereby yielding acceptable glucose structure. When there is no bacteria in milk, the obtained glucose is having some malfunction and the body cannot accept it. Hence it is recommended from this project that livestock are to be nurtured in natural environment that aids bacterial growth and activity.

**Table 1: Ultrasonic velocity of cow milk with and without L.acidophilus**

Cow milk	Before addition of L. acidophilus		Addition of 10 million live L. acidophilus (after 60 minutes)	
	u (ms <sup>-1</sup> )	P-delay	u (ms <sup>-1</sup> )	P-delay
A	1540	0.05	1561	0.06
B	1562	0.07	1580	0.08
C	1564	0.07	1585	0.08

**Table 2: Concentration, lactose and protein content of samples**

SAMPLE	C g/ml	LACTOSE	PROTEIN
A	1.0299	2.3595	9.09
B	1.0300	2.4078	8.53
C	1.0298	2.5636	8.54

**Table 3: Observed rotation,  $[\alpha]_{\text{obs}}$  for three different cow milk samples**

Time (sec)	Observed rotation, $[\alpha]_{\text{obs}}$		
	Sample A	Sample B	Sample C
0	1.317	1.378	1.465
10	1.318	1.379	1.467
20	1.320	1.380	1.468
30	1.322	1.381	1.469
40	1.321	1.380	1.467
50	1.320	1.379	1.466
60	1.320	1.379	1.465
70	1.319	1.378	1.465
80	1.319	1.378	1.464
90	1.319	1.378	1.464
100	1.319	1.378	1.464
110	1.319	1.378	1.464
120	1.319	1.378	1.464

**Table.4: Ultra violet absorbance value of pure lactose for various concentrations**

Concentration, mg/ml	Wavelength, $\lambda$ (nm)	Absorbance
0.10	514.50	0.1233
	473.00	0.0291
0.20	514.50	0.1163
	440.50	0.0321
	428.50	0.0195
0.30	508.00	0.2675
	472.00	0.0343
	443.00	0.0344
	406.50	0.0382
0.40	506.00	0.4237
	485.00	0.0500
	471.50	0.0420
	422.00	0.0363
0.50	504.50	0.6047
	440.00	0.5065
0.60	504.00	0.7766
	482.50	0.0767
	471.00	0.0623
	434.50	0.0493
0.70	504.50	0.9705
	440.50	0.0814
0.80	504.50	1.1490
	443.50	0.0530
0.90	504.50	1.3417
	466.00	0.0707
	450.50	0.0732
	423.00	0.0553
1.00	505.50	1.5138
	479.00	0.0619
	449.50	0.0680
	425.00	0.0466
1.10	506.00	1.6244
	482.00	0.0732
	441.50	0.0724
	436.00	0.0553
	423.00	0.0565

Concentration, mg/ml	Wavelength, $\lambda$ (nm)	Absorbance
1.20	507.00	1.8027
	472.00	0.0697
	440.50	0.0669
	426.50	0.0580
1.30	507.50	1.9426
	454.50	0.0813
	440.00	0.0822
1.40	508.50	2.0626
	466.00	0.0900
1.50	509.00	2.1727
	483.50	0.0992
	424.50	0.0748
1.60	509.50	2.2853
	480.50	0.1078

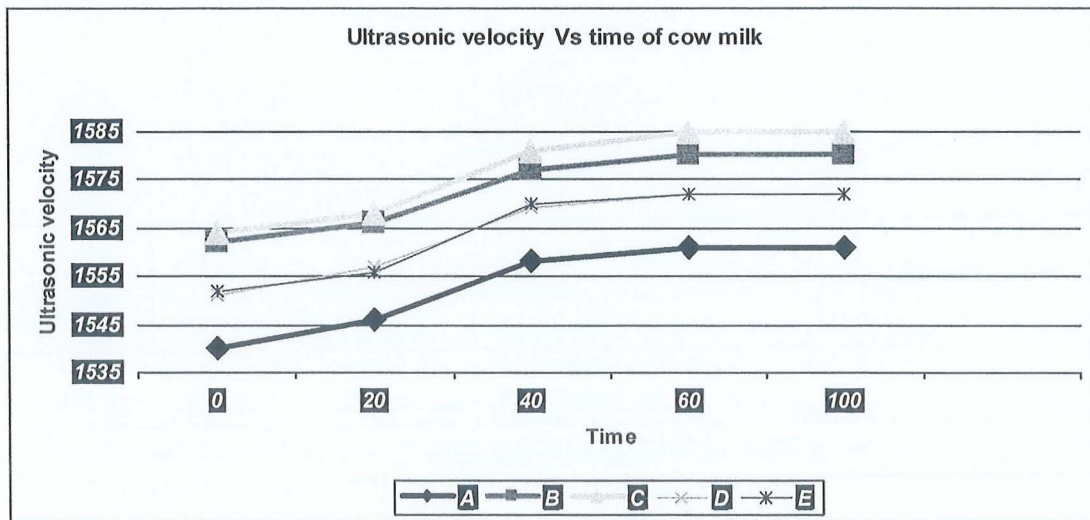


Fig 1: Ultrasonic velocity of cow milk Vs time after live *L.acidophilus* was added.

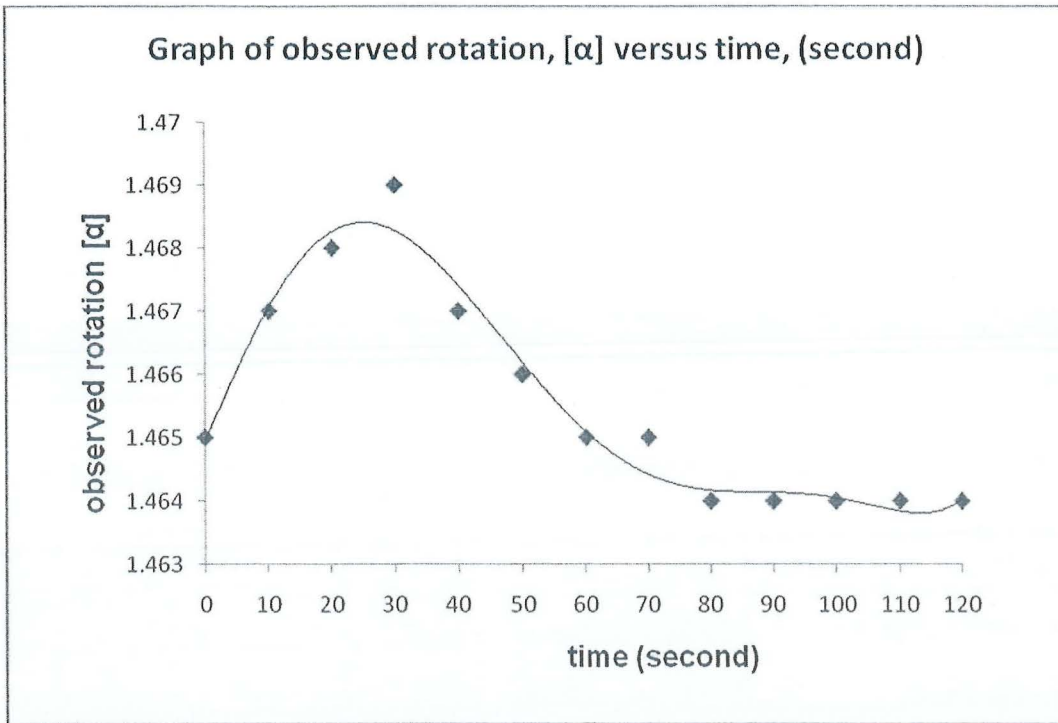


Fig.2: Graph of observed rotation versus time

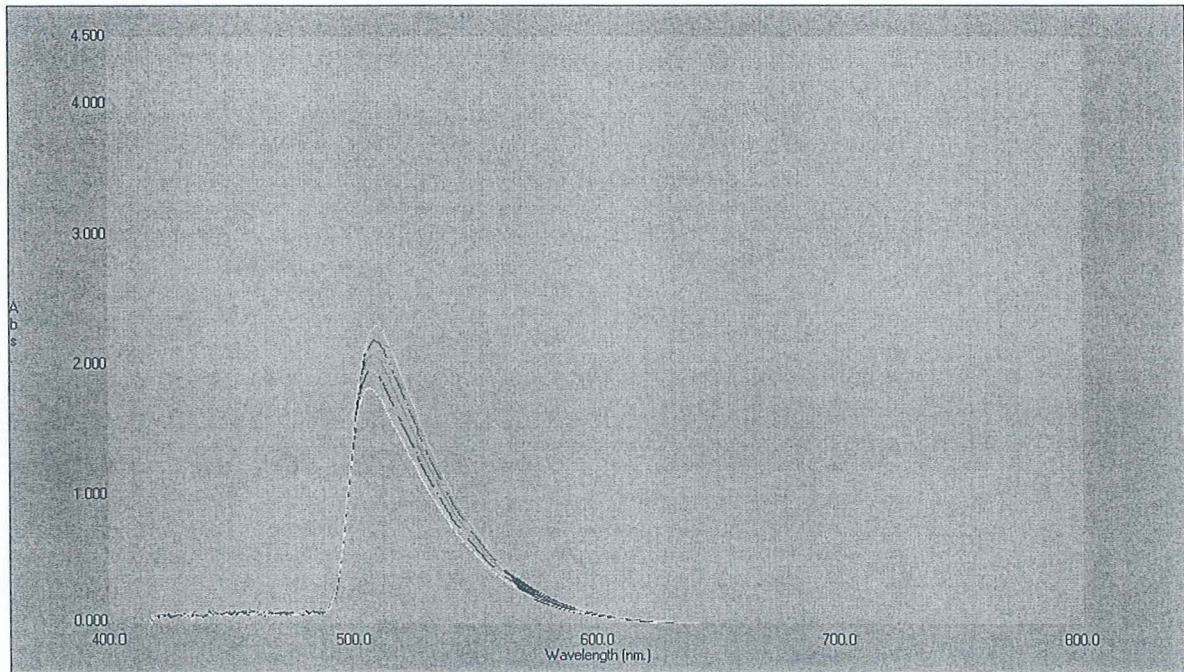


Fig.3: UV-Vis spectrum for pure lactose

1. S.Ramakiarinnan, Medical Biochemistry, W.B.Saunders & Co., Philadelphia.
2. [www.foodsci.uoguelph.ca/dairyedu/micro.html](http://www.foodsci.uoguelph.ca/dairyedu/micro.html)
3. [www.waksmanfoundation.org/labs/mbl/lactic.html](http://www.waksmanfoundation.org/labs/mbl/lactic.html)
4. Salminen, S. and Von Wrigh, Lactic Acid Bacteria, doi:10.1016/S0039-6109(05)70308-X, 1993. Access on 01 Feb 2009
5. Pauline Ebing and Karin Rutgers, Preparation of dairy products Agromisa Foundation and CTA, Wageningen, Sixth revised Ed, Chap. 1 2006. Access on 21 Jan 2009

**Senaraikan kata kunci yang mencerminkan penyelidikan anda:**

*List the key words that reflects your research:*

Bahasa Malaysia

Pencirian Ultrasonik  
Polutan Susu  
Kesihatan Diabetes

Bahasa Inggeris

*Ultrasonic Characterisation*  
*Milk Pollutant*  
*Diabetic Health*

**8. Output dan Faedah Projek**

*Output and Benefits of Project*

(a) \* **Penerbitan Jurnal**

*Publication of Journals*

**(Sila nyatakan jenis, tajuk, pengarang/editor, tahun terbitan dan di mana telah diterbit/diserahkan)**  
*(State type, title, author/editor, publication year and where it has been published/submitted)*

Lakshmanan Palaniappan, **Mohamad Suhaimi Jaafar** and R.Thiyagarajan, The in-vivo study of colonic flora on the synthesis of lactase enzyme, (paper No. USM03), UK-MC conference 2008, University College London, UK.

Palaniappan, Lakshmanan; **Jaafar, Mohamad Suhaimi**, Role of aniline in destructing the 1-propanol + toluene azeotrope, Main Group Chemistry, Volume 8, Number 2, June 2009 , pp. 89-99(11)

L.Palaniappan and V.Velusamy, Compositional analysis of alpha-lactalbumin, American Journal of Biochemistry & Microbiology. DOI: 10.3923/ajbmb.2011.

Lakshmanan.Palaniappan, and S.Nithyanandham, Acoustical studies on some disaccharides (sucrose, lactose, maltose) in aqueous media at room temperature, Journal of Metals, Materials and Process, Vol.No. 20(3), 2008, page 203-208.

R. Thiyagarajan, **Mohamad Suhaimi Jaafar** and L. Palaniappan, Ultrasonic Study of the Self-Association of Aniline in Ethanol-Cyclohexane Mixtures, Journal of Physical Science, Vol. 18(2), 81-88, 2007

Lakshmanan.Palaniappan, and S.Nithyanandham, Ultrasonic study of adsorption in disaccharide metabolism, Journal of Applied Acoustics, Vol.No. 71(8), 2010, pages 754 – 758.

Arul G., **Jaafar M.S.** and Palaniappan L., Effect of Isomerism in the Dipolar Interaction of Benzene with Butanol, Acta Phys. – Chim., 2008, 24(1):41-46 ISSN: 1000-6818

L. Palaniappan, **M S Jaafar** and M Z Jafri, Dipolar interaction of pyridine with isomeric butanols, Main Group Chemistry, 7, No. 1, (2008): 31-42, Taylor & Francis, USA, ISSN: 1024-1221

Remsen Maizan Ramli, **M. S. Jaafar**, N. E. Ismail, Hend A. A. Saltani, A. L. Ahmad, and M. Yahaya Bermakai, Fetal Biometry of Head Circumference for Malaysian Pregnant Women, AIP Conf. Proc. 1250, 285 (2010)

N. Adam, R. M. Ramli, and **M. S. Jaafar**, Fetal Biometry Studies of Malaysian Pregnant Women and Comparison with International Charts, AIP Conf. Proc. 1250, 393 (2010)

Ramzun Maizan Ramli, **M.S. Jaafar**, Wan Salwani Jaafar, Assessment of Fetal Biparietal Diameter in Pregnant Malaysian Women and Comparison with other Studies, Malaysian Journal of Obstetrics & Gynaecology, 2008, Jan-June; Vol. 8, No.15 : 9-19

(b) **Faedah-faedah lain seperti perkembangan produk, pengkomersialan produk/pendaftaran paten atau impak kepada dasar dan masyarakat.**

*State other benefits such as product development, product commercialisation/patent registration or impact on source and society.*

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\* Sila berikan salinan/*Kindly provide copies*

(c) **Latihan Sumber Manusia**

*Training in Human Resources*

i) Pelajar Sarjana:

*Graduates Students*

(Perincikan nama, ijazah dan status)

*(Provide names, degrees and status)*

Nurul Zahirah Binti Noor Azman, MSc (MedPhy) Graduated: 2009

Radiation Studies of Lactose Content in Polluted Cow Milk Samples

Nor Zakiah Binti Yahaya, MSc (MedPhy) Graduated: 2009

Spectrophotometric Studies of Lactose Content in Polluted Cow Milk Samples

Nik Noor Ashikin Nik Ab Razak, MSc (MedPhy) Graduated: 2009

Effect of Lactobacillus Acidophilus on the Ultrasound Velocity of Cow Milk Samples

Husaini bin Salleh, MSc (MedPhy) Graduated: 2007,

Construction of Training Breast Phantoms for Diagnostic Ultrasonography

Ernee Sazlinayati Binti Othman, MSc (MedPhy) Graduated 2008,

Foetal Growth Assessment During Normal Pregnancy in Malaysian Women

Juliana Binti Mohd Radzi, MSc (MedPhy), Graduated 2009

Malaysian Foetal Head Biometry: Reference Equations and Comparison with other Charts

Masha'el Saud H Alharbi, MSc (MedPhy) Graduated: 2009

Characterization of Blood Samples Using Ultrasound

Nur Asyikin Binti Ahmad Nazri, MSc (MedPhy), Graduated: 2009

Development of Liver Phantom for Ultrasonography Imaging

ii) Lain-lain: Ramzun Maizan Ramli, PhD (Graduated 2010)

Development of Nomogram for Malaysian Pregnant Women

*Others*



**Tandatangan Penyelidik**

*Signature of Researcher*

29<sup>th</sup> July 2013

**Tarikh**

*Date*

**Komen Jawatankuasa Penyelidikan Pusat Pengajian/Pusat**

*Comments by the Research Committees of Schools/Centres*

berdasarkan laporan yang disertakan penyelidikan telah dijalankan dengan jayanya.

Tutup geran.

*[Signature]*

5/5/13

*[Signature]*

TANDATANGAN PENERUSI  
JAWATANKUASA PENYELIDIKAN  
PUSAT PENGAJIAN/PUSAT

*Signature of Chairman*  
[Research Committee of School/Centre]

30/7/2013

Tarikh  
Date

UserCode: MNIZAM / USMPGLIVE / PFIZIK

Program Code: Votebook9100

Current Program : Votebook (Header)

Current Date : 25/09/2013 11:43:55 AM

Version: 15.03, Last Updated at 03/12/2012

DB: 13.02, 9/27/2010 VB: 13.01, 3/14/2011

Switch Language : English /Malay

Wildcard : eg. Like 100%, Like 10%1, Like %1

Element 1:

Element 2:

Element 4:

Element 5:

Year:

Detail	Excel	Budget Rule	Budget Control	Account Description	Budget Account Code	Roll over	Budget	Cash Received	Advanced	Commit	Actual	Available	Percentage
Detail	Excel	374	T	Projek Jangka Pendek Penang	304.111.0.PFIZIK.638085	2,354.65	0.00	0.00	0.00	0.00	0.00	2,354.65	0.00%
		374	T	SubTotal		2,354.65	0.00	0.00	0.00	0.00	0.00	2,354.65	0.00%
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Detail	Excel	375	T	Projek Jangka Pendek Penang	304.222.0.PFIZIK.638085	500.00	0.00	0.00	0.00	0.00	0.00	500.00	0.00%
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Detail	Excel	375	T	Projek Jangka Pendek Penang	304.228.0.PFIZIK.638085	100.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00%
Detail	Excel	375	T	Projek Jangka Pendek Penang	304.229.0.PFIZIK.638085	-501.50	0.00	0.00	0.00	0.00	0.00	-501.50	0.00%
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		9999		GrandTotal		500.34	0.00	0.00	0.00	0.00	0.00	500.34	0.00%

