

Proceeding of

# Aceh Development International Conference

## ADIC 2010

Universiti Putra Malaysia  
March 26<sup>th</sup> – 28<sup>th</sup>, 2010

<http://www.adic2010.yolasite.com>



**ADIC 2010**  
Persatuan Pelajar Aceh  
PPA-UPM

ISBN 978-967-5742-00-2



9 789675 742002

Jointly Organized by :



Persatuan Pelajar  
Aceh  
(PPA)-UPM



Ikatan Masyarakat  
Aceh Malaysia  
(IMAM)



Pemerintahan Aceh



Center for International Affairs  
(CIA)-UPM

# **PROCEEDING OF ADIC 2010**

**ACEH DEVELOPMENT INTERNATIONAL CONFERENCE 2010**

26 – 28 March 2010

Auditorium Hall, Faculty of Engineering, Universiti Putra Malaysia

Jointly Organised by

CENTRE OF INTERNATIONAL AFFAIRS - UNIVERSITI PUTRA MALAYSIA  
PERSATUAN PELAJAR ACEH – UNIVERSITI PUTRA MALAYSIA  
IKATAN MASYARAKAT ACEH MALAYSIA (IMAM)

## **ORGANIZING COMMITTEE OF ADIC2010**

### **PATRON**

Vice Cancellor of UPM  
President, The Aceh Club Malaysia

### **DIRECTED BY**

Director, Centre for International Affairs of UPM  
President, Persatuan Pelajar Aceh – UPM

### **Chairman**

Muhammad Sayuti Fadhil

### **Co. Chairman**

Azhari Muhammad Syam  
Muhammad Sabri

### **Secretary**

Rahmat Fadhil  
Faisal Abnisa

### **Treasury**

Annisa Soraya

### **Proceeding Affairs**

Dandi Bachtiar  
Azhari Muhammad Syam, Rahmat Fadhil, Muhammad Sayuti Fadhil

### **Venue Affairs**

Muhammad Yasar  
Zulhilmi, Asrilah, Syaiful Bahri, Khairul Fajri Muhamed, Rosnina, Asnawi, Ahmadallah, Azhar

### **Seminar & Documentation Affairs**

Muhammad Yusuf  
Armiyanti, Rahmawati, Syukriah, Sri Lianda, Lukman Hakim, Fuad, Samsul Bahri, Yusrini Marita, Ridwan Arifin,  
Riki, Hajrul, Afriani

### **Transportation & Accommodation Affairs**

Safrihsyah Syarief  
Muhammad, Rusla Razali, Husna, Darmawati, Agustinawati, Muhammad Dayyan, Khairi, Affan Ramli,  
Ratna Sari, Mukhlisien, Radhiah Zakaria

## ADVISORY COMMITTEE OF ADIC2010

Prof. Dr. Ir. T.M. Indra Mahlia    Prof. Ir. Dr. Mohd. Sapuan Salit  
Universiti Malaya (UM)    Universiti Putra Malaysia (UPM)  
Malaysia    Malaysia

Prof. Dr. Hasanudin    Prof. Dr. Ir. Hasanudin Z. Abidin  
Universitas Syiah Kuala (Unsyiah)    Institut Teknologi Bandung (ITB)  
Indonesia    Indonesia

Prof. Dr. Syahrizal Abbas    Dr. Syafiie  
Institut Agama Islam Negeri (IAIN) Ar-Raniry    Universiti Putra Malaysia (UPM)  
Indonesia    Malaysia

Assoc. Prof. Dr. Sabri Abd. Majid    Assoc. Prof. Puan Sri Nila Inangda Manyam Keumala  
Universiti Islam Antarabangsa (UIA)    Universiti Malaya (UM)  
Malaysia    Malaysia

## Message from the Chairman, ADIC2010 Organizing Committee

Assalaamu'alaikum Warahmatullaahi Wabarakaatuh



I greatly privilege to welcome all the authors, participant and delegates who are participating in the Aceh Development International Conference (ADIC) 2010. The ADIC hold from 26<sup>th</sup> to 28<sup>th</sup> March 2010.

The ADIC2010 appears to be one of the amount big international events to have been hosted by PPA-UPM (Acheh Students Association UPM). There is no doubt that such a big event will pay attention from many reputable academicians, researchers as well as practitioners and professionals from all over the world.

The technical committee has received more than 121 abstracts and after initial reviewing process, it has accepted to be presented 90 full papers in the conference from more than 5 countries. The conference presentations are divided into 4 parallel sessions delivering during the 2-days conference whereas there are three important keynote speakers who deliver their speeches during the first day of conference.

The related and update topics which connect to the scientific and social research and development in this conference are divided into 15 topics, namely, concept of development based on Islamic studies, rural and urban planning, development of education, culture and custom, Design on Public Facilities and transportation system, planning on housing, offices and community services, development of management system and international relationship, development of infrastructure, telecommunication and advance technology, agriculture and food technology, poultries and veterinaries, fishery, offshore and onshore, tourism and promotion, computerize and IT, environmental, industries and automotive engineering, economic, banking and related, women, family and kids, healthy and other related topics in the area of new issue for Acheh development in future.

Finally, let me convey my sincere gratitude to the members of the all committee for the hard work to make ADIC 2010 possible as such an international level event. Hopefully, this conference will be a great success and fruitful event for sharing and exchange of knowledge for Acheh in future.

Thank you.

**Muhammad Sayuti Fadhil**  
Chairman,  
ADIC2010 Organizing Committee

## **PREFACE**

The Aceh Development International Conference 2010 provides a good opportunity for sharing the information, knowledge and experiences amongst the scientist, practitioners, researchers and other professional in related fields in rebuilding Aceh issues. The conference also being an indicator to measure the progress of development activities in whole of Aceh and in all of affected sectors primarily public sectors which collapsed by the Tsunami.

Hopefully, through this International conference, the beneficial outcomes will be attained for the sustainability development of Aceh province in the future. Last but not least, the editors team congratulate for all of participants, especially the authors who spent their time for joining this International event.

Thank you.

### **Editor Team**

Dandi Bachtiar  
Azhari Muhammad Syam  
Muhammad Sayuti  
Rahmat Fadhil

## LIST OF CONTENT

Preface	i
Advisory Committee of ADIC2010	ii
Organizing Committee of ADIC2010	iii
Message from Chairman of ADIC2010, Organizing Committee	iv
Message from President of Aceh Club Malaysia	v
List of Content	vi

### Education

1	<i>Lisa Agustina, Nor Aishah Buang, Muhammad Hussin and Mazren Tikusan</i> PERSEPSI PELAJAR TERHADAP PENDEKATAN PEMBELAJARAN SECARA PROBLEM-BASED LEARNING ( PBL) DALAM KURIKULUM TINGKAT SATUAN PENDIDIKAN	1
2	<i>Abdul Halim, Hasan, Muhibuddin, Burhanuddin Yasin, Lilia Halim, T. Subahan and Kamisah Osman</i> THE EXISTENCE OF SCIENCE AND TECHNOLOGY CULTURE AMONG MALAYSIAN AND ACEHENESE STUDENTS	13
3	<i>Mujiburrahman</i> PENDIDIKAN BERASASKAN BUDAYA: KAJIAN PELAKSANAAN SYARI'AT ISLAM DAN PENGARUHNYA TERHADAP BUDAYA SEKOLAH ACEH	18
4	<i>Anzaruddin Ahmad</i> MENGEMBALIKAN STATUS ACEH SEBAGAI HUB PENDIDIKAN ISLAM DI NUSANTARA : DARI PERSPEKTIF RAKYAT MALAYSIA	31
5	<i>Heri Priyanto</i> ACEH EDUCATION SYSTEM: CAN SITUATIONAL LEADERSHIP STYLE IMPROVE STUDENTS' LEARNING PROCESS?	40
6	<i>Widharto</i> BIODIVERSITY CONSERVATION AND ENVIRONMENT EDUCATION IN INDONESIA: THE SPECIFIC ROLE OF AGRICULTURAL UNIVERSITY LIBRARY IN ASSISTING THE CONSERVATION PROGRAMS FOR NAD	48

## **Politics**

- 7 *Fachrul Razi* 57  
PEMBANGUNAN DAN INTEGRASI POLITIK DI ACEH PASCA MOU HELSINKI: PERSPEKTIF PARTAI  
ACEH (PA)
- 8 *Erman Anom and Indrawadi Tamin* 72  
JURNALISME BEBAS DAN BERTANGGUNG JAWAB DAN DEMOKRATISASI DI ACEH

## **Laws and Qanun**

- 9 *Zulkifli Daud and Sanep Ahmad* 81  
IMPLIKASI PELAKSANAAN QANUN ACEH NO. 7/2004 TERHADAP KEPATUHAN MEMBAYAR ZAKAT  
PENDAPATAN MELALUI INSTITUSI FORMAL PUNGUTAN ZAKAT (BAITALMAL)
- 10 *Ridwan Hasan* 91  
ISLAMIC THEOLOGY AGAINST TO AQIQAH BIRTH OF THE BABY: (PERSPECTIVE OF THE TRADITION  
AND THE ISLAMIC CULTURE IN THE TERRITORY OF NANGGROE ACEH DARUSSALAM)
- 11 *Abidin Nurdin* 97  
SUMBER LEGITIMASI DAN PERAN MPU DALAM PROSES LEGISLASI QANUN SYARI'AT ISLAM DI  
ACEH
- 12 *Muslim Zainuddin* 108  
PERTIMBANGAN HAKIM DALAM MEMUTUSKAN PERKARA KHALWAT PADA MAHKAMAH  
SYAR'IYAH ACEH
- 13 *Asnawi Abdullah* 122  
HEALTH QANUN AND HEALTH SECTOR REFORM IN ACEH
- 14 *Bastiar Muhammad Taib* 130  
PANDANGAN DOSEN STAIN MALIKUSSALEH LHOKSEUMAWE TERHADAP PENERAPAN QANUN  
JINAYAH: ANALISIS PRO-KONTRA TERHADAP PENERAPAN HUKUMAN RAJAM DI PROVINSI ACEH
- 15 *Fauzi Saleh* 142  
PENERAPAN SYARIAT ISLAM DI ACEH: EKSISTENSI SYARI'AT DALAM ADAT MEUKUTA ALAM
- 16 *Abdul Wahid* 156  
PERANAN LEMBAGA ADAT DALAM MENDUKUNG PELAKSANAAN SYARI'AT ISLAM DI ACEH

## **Economics**

- 17 *Shabri Abdul Majid* 169  
EMPOWERISASI PERBANKAN SYARI'AT DI "BUMOE SYARIAT " NANGGROE ACEH DARUSSALAM

18	<i>Ghazali Syamni, Zulkifli and Andria Zulfa</i> ANALISIS PERTUMBUHAN PEMBERIAN KREDIT SEBELUM DAN SESUDAH TSUNAMI PADA PERBANKAN DI KOTA LHOKSEUMAWE	175
19	<i>Dahrinal, Ghazali Syamni and Tarmizi Abbas</i> PENGARUH PEMBERIAN DANA BERGULIR TERHADAP PENDAPATAN PEREMPUAN: STUDI KASUS BALAI PEREMPUAN JAMBO TIMU KEC. BLANG MANGAT KOTA LHOKSEUMAWE	182
20	<i>Ghazali Syamni</i> SOSIAL KAPITAL DAN HUMAN CAPITAL SEBAGAI SALAH SATU FAKTOR PEMBANGUNAN EKONOMI	188
21	<i>Lodi H. Saputra, Ghazali Syamni and Muammar Khaddafi</i> ANALISIS KEBIJAKAN MANAJEMEN PENDAPATAN ASLI DAERAH: KASUS KOTA LHOKSEUMAWE	194
22	<i>Yossi Diantimala and Syamsul Bahri</i> THE EFFECT OF HUMAN CAPITAL, STRUCTURAL CAPITAL, AND CUSTOMER CAPITAL ON BUSINESS PERFORMANCE OF FINANCIAL INSTITUTION IN BANDA ACEH AND ACEH BESAR	203
23	<i>M. Ridha</i> EFEKTIFITAS PENGELOLAAN KREDIT PEUMAKMU NANGGROE DALAM PEMBERDAYAAN USAHA MIKRO DI LHOKSEUMAWE	215
24	<i>Sofyan Syahnur</i> INCOME DISTRIBUTION ISSUE AND DEVELOPMENT PROCESS IN ACEH PROVINCE: AN EMPIRICAL STUDY BY USING A SAM APPROACH	228
25	<i>Muhammad Arifai and Alfiandri</i> THE FACTORS AFFECTING IMPLEMENTATION PERFORMANCE OF FINANCIAL MANAGEMENT IN LOCAL GOVERNMENT	245
 <b>Strengthening of Local Culture</b>		
26	<i>Ari Pahlawi bin Jauhari Ishak</i> THE COMPLEXES OF NORMS AND TRADITION IN ACEH	257
27	<i>Lucky Zamzami</i> ANALYZE OF THEORY CONFLICT IN SEEING CULTURE AND ADAT DEVELOPMENT IN ACEHNESE	271
28	<i>Fauzi Ali Amin and Sanusi M. Syarief</i> STRENGTHEN ADAT COMMUNITY FOR FOREST CONSERVATION	279
29	<i>Adli Abdullah, Sulaiman Tripa and T. Muttaqin Mansur</i> TRADITIONAL WISDOM IN THE MANAGEMENT OF FISHERIES RESOURCES IN ACEH	288

## Religion

- 30 *Muhammad Yusran Hadi* 299  
PENERAPAN SYARIAT ISLAM DI ACEH (KRITIKAN DAN TANGGAPAN)
- 31 *Muntasir* 309  
DAYAH DAN ULAMA DALAM DINAMIKA SOSIO POLITIK MASYARAKAT ACEH
- 32 *Mukhlisuddin Ilyas* 318  
PENDIDIKAN DAYAH MULAI HILANG IDENTITAS
- 33 *Usammah* 326  
ULAMA DAN POLITIK: ANALISIS PEMIKIRAN TGK. H. IBRAHIM BARDAN (ABU PANTON)
- 34 *Muhammad Abdurrahman* 344  
AGAMA SEBAGAI PILAR PEMBANGUNAN ACEH KE DEPAN
- 35 *Hasanuddin Yusuf Adan* 349  
SYARIAT ISLAM DI ACEH: RUANG LINGKUP, PELANGGARAN DAN HUKUMAN

## Psychology and Health

- 36 *Fadilla Oktaviana* 363  
POSITIVE PARENTING, MEANS OF RECONSTRUCTS THE POSITIVE OF PSYCHOLOGY AND MENTAL FOR CHILDREN OF TSUNAMI VICTIMS
- 37 *Safrihsyah Syarief, Jasmadi and Barmawi* 368  
KOHESI KELOMPOK DAN PARTISIPASI PEMELIHARAAN FASILITAS UMUM DI HUNIAN SEMENTARA GAMPOENG TURKI-ISTAMBUL, ACEH BESAR
- 38 *Ai Kustiani, Syahroni and Dyah Raysa Laksitoesmi* 380  
PSYCHOLOGICAL CONDITION RECOVERY EFFORTS CHILDREN POST-TSUNAMI ACEH AQUAPHOBIA SUFFERER THROUGH TELEQUA
- 39 *Siti Rahmah* 386  
PENGALAMAN ANAK TERHADAP TINDAK KEKERASAN DI WILAYAH KONFLIK: STUDI KASUS PADA PANTI ASUHAN DI KABUPATEN ACEH UTARA
- 40 *Ella Suzanna* 396  
PERMASALAHAN IBU MENYUSUI EKSKLUSIF (STUDI KASUS DI DESA MEUNASAH MESJID KOTA LHOKSEUMAWE)

## **Public Service and Infrastructure**

- 41 *Naufal Bachri* 409  
IDENTIFIKASI DIMENSI KUALITAS PELAYANAN PADA RUMAH SAKIT UMUM DI PROPINSI ACEH  
(SUATU PENDEKATAN PENGEMBANGAN INSTRUMEN)
- 42 *Zulkarnain* 418  
AN ANALYSIS OF QUALITY OF WORKING LIFE: RELATION TO CAREER DEVELOPMENT AND  
DEMOGRAPIC FACTORS ON PUBLIC SERVICE EMPLOYEE
- 43 *Naufal Bachri, Ahmad Azmi M. Ariffin and Azhar Haji Ahmad* 428  
IDENTIFYING THE DOMINANT FACTOR OF EDUCATIONAL SERVICE QUALITY OR THE FACULTY OF  
ECONOMICS AT MALIKUSSALEH UNIVERSITY
- 44 *Muhammad Subhan and Ahmad Bashawir Abdul Ghani* 441  
FORMULASI STRATEGI PENGEMBANGAN PELABUHAN ACEH: SATU KONSEP
- 45 *Rita Komalasari* 458  
THE DEVELOPMENT OF THE ACEHNESE LIBRARY POST-TSUNAMI
- 46 *Yossi Diantimala* 466  
SERVICE QUALITY IN PUBLIC SECTOR: AN ANALYSIS OF MINIMUM SERVICE STANDARD (SPM)  
APPLIED IN ACEH PROVINCE
- 47 *Yunita Arafah, Sylvia Agustina and Irin Caesarina* 475  
REVITALIZATION OF HERITAGE AREAS IN DOWNTOWN BANDA ACEH AS INTERCONNECTED PUBLIC  
OPEN SPACES BASED ON LINKAGE SYSTEM

## **Good Government Management**

- 48 *Asrizal Luthfi* 487  
PELEMBAGAAN DAN INTERNALISASI COMMUNITY BASED DISASTER RISK MANAGEMENT KE  
DALAM KEBIJAKAN DI PROPINSI ACEH
- 49 *Hafas Furqani* 493  
ACEH DAN EKONOMI REGIONAL ASIA TENGGARA: SINERGI *LHEE SAGOE* ACEH DAN IMT-GT
- 50 *Erman Anom* 502  
DEMOKRATISASI DAN SELF GOVERNMENT DI ACEH: Kebijakan yang berkeadilan tentang Gender?
- 51 *Muhammad Subhan* 513  
ACEH DAN PEMBANGUNAN KEPELABUHANAN: PERBANDINGAN ASPEK SEJARAH DAN  
KONTEMPORARI
- 52 *Iskandar Zulkarnaen, Tubagus E. Faturrahman and A. Humam Hamid* 528  
PENGELOLAAN PROGRAM REINTEGRASI PASCA KONFLIK DI ACEH: KEBIJAKAN SETENGAH HATI

## **Agriculture, Fisheries and Natural Resources**

- 53 *Muhammad Yasar, Chamhuri Siwar and Shaharudin Idrus* 545  
KONVERSI LAHAN; SAWAH MENJADI PENGGUNAAN NON PERTANIAN DI KABUPATEN ACEH BESAR  
PROVINSI ACEH, INDONESIA
- 54 *Fahrizal, Yusriana and Rahmat Fadhil* 554  
PENINGKATAN MUTU IKAN TERI ASIN KERING DI ACEH BESAR, NANGGROE ACEH DARUSSALAM
- 55 *Muchlisin Z.A. and Siti Azizah M.N.* 562  
OVERVIEW: SUMBERDAYA PERIKANAN DARAT ACEH TERANCAM
- 56 *Rizal Syahyadi, Zakaria Harun, Sumiani Yusoff and Edi Majuar* 569  
ON-FARM IRRIGATION PERFORMANCE: A REVIEW AND SOME PLEMINARY RESULTS
- 57 *Khoirun Nisa'* 577  
THE CONCEPT OF SIMPLE AND HYGIENIC POULTRY LAUGHTERHOUSE FOR *SERAMBI MEKAH*
- 58 *Abdullah, Djufri and Hasanuddin* 584  
Solusi Ekologis Penyelesaian Konflik Gajah dengan Manusia di Hutan Provinsi Aceh dengan  
Penentuan Kawasan Perlindungan Gajah (*Elephant Sunctuary*)
- 59 *Rusli Yusuf and Abdullah* 595  
PENERAPAN STRATEGI ALTERNATIF PENANGGULANGAN SEMENTARA KONFLIK GAJAH DENGAN  
MANUSIA MENGGUNAKAN METODE EKOLOGI DAN PENDEKATAN KEARIFAN TRADISIONAL DI  
HUTAN GEUMPANG KAB. PIDIE PROVINSI ACEH

## **Information and Communication Technology (ICT)**

- 60 *Nizamuddin, Hidehiro Ishizuka and Muzailin Affan* 605  
THE IMPLEMENTATION OF SPATIAL DATABASE: CASE STUDY SPATIAL DATA OF REHABILITATION  
AND RECONSTRUCTION PROCESS IN ACEH
- 61 *Wahyu Fuadi* 615  
STUDI PERENCANAAN SISTEM INFORMASI AKADEMIK MAHASISWA BERBASIS SMS (*SHORT  
MESSAGING SERVICE*) DI FAKULTAS TEKNIK UNIVERSITAS MALIKUSSALEH
- 62 *Didik Dwi Prasetya* 624  
3D SPACE RACE GAME AS A TOOL FOR RECOVERY CONCENTRATION TO CHILDREN NATURAL  
DISASTER VICTIMS IN ACEH USING JAVA
- 63 *Syaad Padmunthara* 630  
PENGEMBANGAN E-LEARNING DENGAN PENGELOLAAN FASILITAS FORUM SEBAGAI MEDIA  
DISKUSI DALAM MENINGKATKAN MINAT SISWA TERHADAP MATERI ILMU ALAM DI ACEH

64	<i>Muhammad Ashar Pakkawaru</i> RECOMENDATION TO THE CLINICAL INFORMATION SYSTEM ON THE DESIGN OF HEALTH SERVICES USING SMART MEDICAL CARD IN HOSPITAL NAD	636
65	<i>Dedi Rianto bin H. Rahadi</i> IMPLEMENTATION E-GOVERNMENT FOR IMPROVING PUBLIC SERVICES IN PROVINCE NANGGRO ACEH DARUSALAM	642
66	<i>Muhammad</i> PEMODELAN JARINGAN SARAF TIRUAN DAN SET KASAR PADA SET DATA PIMA INDIANS DIABETES	649
67	<i>Taufiq</i> Studi Manajemen Sistem Informasi Akademik Universitas Di Aceh Berbasis Service Oriented Architecture (SOA)	659
68	<i>Herri Setiawan</i> ONE-STOP INFORMATION SYSTEM (SIMTAP) ONE FORM GOOD GOVERNANCE IN NANGGROE ACEH DARUSSALAM	668
 <b>Energy</b>		
69	<i>Syahrir Ridha</i> ACEH TOWARDS AN AUTONOMOUS IN ENERGY CAPABILITY (SWOT ANALYSIS)	677
70	<i>Nelly Safitri</i> RENEWABLE ENERGY PROSPECT AS A SUSTAINABLE ENERGY RESOURCE IN ACEH AFTER TSUNAMI DISASTER	685
71	<i>Mustaqimah, Rini Ariani Basyamfar and Rahmat Fadhil</i> ANALISIS TEKNIS DAN BIAYA OPERASIONAL ALAT PENYULING NILAM DENGAN SUMBER BAHAN BAKAR KAYU DI ACEH BARAT DAYA	695
72	<i>Faisal Abnisa, Wan Mohd. Asri Wan Daud and Jaya Narayan Sahu</i> RESPONSE SURFACE METHOD ON OPTIMIZATION OF BIO-OIL PRODUCTION FROM PALM SHELL	704
73	<i>Saifuddin</i> SIMULATION OF SOLAR CELL FOR INVESTIGATION EFFECT OF SURFACE TEXTURING ON GaAs SOLAR CELL BY USING SILVACO SOFTWARE	716
 <b>Food and Health</b>		
74	<i>Zatil Afrah, Saidatul Husnah, Rachmawati Rusydi and Wahyuni Safitri</i> Ca(IO <sub>3</sub> ) <sub>2</sub> AND NaFeEDTA FORTIFIED SURIMI AS SOLUTION FOR PROTEIN, IODINE, AND Fe DEFICIENCY IN ACEHNESE HOUSEHOLDS	725

75	<i>Faisal Abdurrahman, Babji A.S., Senafi S. and Othman O.</i> EFFECT OF ENZYME ACTIVITY OF SELECTED FRUITS EXTRACTS ON THE QUALITY OF BUFFALO MEAT	735
76	<i>Dewi Yunita, Yusriana and Rahman Jaya</i> STUDY OF FERMENTATION AND NON FERMENTATION METHOD EFFECTS ON THE QUALITY OF COCOA BEANS AND THE INCOME LEVEL OF COCOA FARM IN ACEH	742
<b>Engineering Science and Technology</b>		
77	<i>Maizuar Mahyiddin</i> NEW ACEH RAILWAY ROUTE : PROBLEMS AND CHALLENGES	753
78	<i>T.M. Ridwan, M. Fauzan, Maizuar M. and Suhaimi</i> STUDI PERBANDINGAN RESPON INELASTIK BANGUNAN SISTEM RANGKA BERPENGAKU KONSENTRIK TIPE D TERHADAP SISTEM RANGKA PEMIKUL MOMEN DI NANGGROE ACEH DARUSSALAM	759
79	<i>Miftah Hazmi and Rico Sihotang</i> RANCANGAN RUMAH TAHAN GEMPA YANG EKONOMIS BAGI KORBAN PASCAGEMPA DI ACEH	768
80	<i>Susilah</i> PENERAPAN MODEL KULANDAISWAMY UNTUK PERAMALAN DEBIT BANJIR PADA DAS CIKAPUNDUNG GANDOK BANDUNG INDONESIA	774
81	<i>Syamsul Bahri and Hilmi bin Mahmud</i> POTENTIAL OF RICE HUSK ASH (RHA) IN IMPROVING DURABILITY AND PROVIDING LONGER SERVICE LIFE OF HIGH PERFORMANCE CONCRETE STRUCTURES IN ACEH	785
82	<i>Ashfa</i> REVIEW OF LAND USE IN IMPLEMENTING SPATIAL PLAN	794
83	<i>Abdul Jalil</i> STUDY STABILIZATION OF MIXTURE OF PALM KERNEL SHELL DUST WITH CLAY BY USING DIRECT SHEAR TEST	801
84	<i>M. Sayuti, M, Suraya, S, Sulaiman, S, B.T.H.T. Baharudin, and M.K.A. Arifin</i> PROCESSING AND CHARACTERISATION OF PARTICULATE REINFORCED ALUMINIUM -11.8 % SILICON MATRIX COMPOSITE	811
85	<i>Syukriah, Norhamidi Muhamad and Mohd. Nizam Ab Rahman</i> DEVELOPMENT OF A REPLACEMENT MODEL AND APPLICATION OF PRODUCTION MACHINES IN MANUFACTURING COMPANIES	818
86	<i>Rahmat Fadhil, Johari Endan, Farah Saleena Taip dan Muhammad Salih bin Hj Ja'afar</i> TEKNOLOGI SISTEM AKUAKULTUR RESIRKULASI UNTUK MENINGKATKAN PRODUKSI PERIKANAN DARAT DI ACEH: SUATU TINJAUAN	826

87	<i>Azhari and Robiah Yunus</i> SYNTHESIS OF VEGETABLE ALKYL ESTERS BY USING ALKALINE CATALYST IN THE PRESENCE OF ALCOHOL DERIVATIVES AS EXCESS REACTANT	834
88	<i>Mohd. Iqbal, Juniza Md Saad, Ho Wei Seong and Mohd Fairuz Bin Mohd Yusoff</i> THE DEVELOPMENT OF BELT DRIVING SURVEILLANCE MOBILE ROBOT	842
89	<i>Dandi Bachtiar and S.M. Sapuan</i> THE OPPORTUNITY OF SUGAR PALM FIBRES IN THE REINFORCING FIELDS OF POLYMER COMPOSITES	847
 <b>Disaster Handling Management</b>		
90	<i>Tiolina Evi and Lucia Tri Istiyowati</i> DISASTER RECOVERYPLANNING (DRP) PASCA TSUNAMI DI DAERAH ACEH	855

## **PROCESSING AND CHARACTERISATION OF PARTICULATE REINFORCED ALUMINIUM -11.8 % SILICON MATRIX COMPOSITE**

Sayuti<sup>\*</sup>, M, Suraya, S, Sulaiman, S, B.T.H.T. Baharudin, and Arifin, M.K.A

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

\*Email: [tgk\\_sayuti@yahoo.co.uk](mailto:tgk_sayuti@yahoo.co.uk)

### **Abstract**

This paper describes and discusses the processing and characterization of titanium carbide particulate reinforced aluminium-silicon alloy matrix composite. In this regard, titanium carbide particulate reinforced LM6 alloy matrix composites were fabricated by carbon dioxide sand molding process with different particulate weight fraction. Tensile tests and scanning electron microscopic studies were conducted to determine the maximum load, tensile strength, modulus of elasticity and fracture surface analysis have been performed to characterize the morphological aspects of the test samples after tensile testing. Hardness values are measured for the quartz particulate reinforced LM6 alloy composites and it has been found that it gradually increases with increased addition of the reinforcement phase. The tensile strength of the composites increases with the increase in addition of quartz particulate.

**Keywords:** characterisation; tensile; Hardness.

### **Introduction**

Industrial technology is growing at a very rapid rate and consequently there is an increasing demand and need for new materials. Particulate reinforced composites constitute a large portion of these new advanced materials. The world of tomorrow will probably involve a synergistic mix of materials rather than the replacement of one material by other. In pursuit of this, the last few decades have witnessed unprecedented developments of harder metals and alloys. Among these are the categories of composite materials, the metal matrix composites (MMCs) which are increasingly being used in the automobile, aircraft, and space industries. As a result, worldwide attention has been focused on the processing and fabrication of these materials because of both manufacturing costs and performance. These composite materials also offer outstanding properties such as high strength-to-weight ratio, high torsional stiffness, good corrosion resistance and good tolerance characteristics and versatility to the designer [1].

The choice of the processing method depends on the property requirements, cost factor consideration and future applications prospects. The choice of the processing method depends on the property requirements, cost consideration and future applications prospects. The advantage of processing composites by casting technology leads to near-net shape manufacturing which is a simple and cost-effective process [2]. Incorporation of hard second phase particles in the alloy matrices to produce MMCs has also been reported to be more beneficial and economical [2,3,7] due to its high specific strength and corrosion resistance properties. In the past, various studies have been carried out on metal matrix composites. SiC, TiC, TaC, WC, B<sub>4</sub>C are the most commonly used particulates to reinforce in the metal or in the alloy matrix or in the matrices like aluminium or iron, while the study of silicon dioxide reinforcement in LM6 alloy is still rare and scarce.

However, very limited studies have been reported and so the information and the data available on the mechanical properties and fracture surface analysis are scarce and hence make this study a significant one. In this investigation quartz particulate reinforced LM6 alloy matrix composites test samples fabricated and processed by casting method are chosen [4,5]. So in this research work the parameter of different percentage of SiO<sub>2</sub> particulate addition in the LM6 alloy matrix is examined to study the mechanical behavior and fracture surface characteristic used tensile testing of the processed specimens. In this study, tensile testing and Scanning Electron Microscopy are employed to evaluate the maximum load, Young's modulus, tensile strength and to characteristic the morphological features of the fracture surfaces in titanium carbide (TiC) - particulate reinforced LM6 alloy composites after the tensile testing.

## Methodology

### Materials preparation

The materials used in this work were Aluminium LM6 alloy as the matrix and TiC as reinforcement particulates with different percentages. The tensile test specimens were prepared according to ASTM standards B 557 M-94 [6]. The main materials used in this project were Aluminium LM6 alloy as a matrix material and TiC (titanium carbide) as a particulate reinforced added in different percentages based on weight. Sodium silicate and CO<sub>2</sub> gas is used to produce CO<sub>2</sub> sand mould for processing composite casting. The aluminium alloy, LM6, was based on British standards that conform to BS 1490-1988 LM6.

The mechanical, thermal and electrical properties of LM6 are shown in the Table-1. Alloy of LM6 is actually a eutectic alloy having the lowest melting point that can be seen from the Al-Si phase diagram. The main composition of LM6 is about 85.95% of aluminium and 11% to 13% of silicon. The details of the LM6 alloy composition is shown in Table-2. Titanium carbide (TiC) materials are compounds of a titanium metal and carbon. Metal carbides are also known as hard metals. Metal carbides have high hardness and high hot hardness which makes them useful for cutting tools, forming dies and other wear applications. Metal carbides often used a cobalt, nickel or intermetallic metal bond between grains (cemented carbides) which results in increased toughness compared to pure carbides or ceramics. Titanium carbide is often used as an addition to tungsten carbide cutting tools [8]. The mesh size of titanium carbide particulate is -325mesh 98% and the average particle size equal to 44 microns (µm).

Table 1. The Mechanical, Properties Of LM6

PROPERTIES	VALUES
Density (g/cc)	2.66
Tensile strength, Ultimate (MPa)	290
Tensile strength, Yield (MPa)	131
Elongation %; break (%)	3.5
Poissons ratio	0.33
Fatigue strength (MPa)	130
Machinability	30
Shear strength (MPa)	170
Hardness ( BHN)	50
Modulus of elasticity (N/sq.mm)	71000

Table 2. COMPOSITION OF LM6 (%)

Chemical constituents	wt.%
Al	85.95-87.95
Cu	0.1
Fe	0.6
Mg	0.1
Mn	0.5
Ni	0.1
Pb	0.1
Si	10-13
Sn	0.05
Ti	0.2
Zn	0.1

### Fabrication of composites

Only one type of pattern was used in this project and the procedure for making the pattern involves the preparation of drawing, selection of pattern material and surface finishing. Carbon dioxide moulding process was used to prepare the specimens as per the standard moulding procedure. Quartz-particulate reinforced MMCs were fabricated by casting technique. Four different weight fractions of TiC particle in the range from 0.2, 0.6, 1 and 2 %wt are used. An induction furnace was used to melt the aluminium alloy and TiC was mixed in it after the alloys attains the liquid state. The main concern was to maintain the temperature while transferring the molten metal to the mould and hence to ensure the quality of the cast product. The metal handling equipment used to transfer the molten metal also depends on the mould size and quality of cast being cast. Figure 1 and 2 shows the LM6 ingots and processing and LM6 ingot.



Figure 1. LM6 ingots



Figure 2. Casting process

### Tensile testing

Tensile test was conducted to determine the mechanical properties of the processed TiC particulate reinforced LM6 alloy composites. Test specimens were made according to ASTM standard B57 M-94. Figure 3 tensile Specimen as ASTM standard. A 100 KN servo hydraulic INSTRON 8500 UTM was used to conduct the tensile tests. The test samples were subjected to a tensile load and the mechanical properties were determined. Hence, the tensile strength, and Young's modulus values

were calculated. A thin flat material with a constant rectangular cross-section was mounted and gripped in the INSTRON 8500 UTM testing machine and it was monotonically loaded in tension while recording the load. The test coupon strain was monitored for accuracy with displacement transducers where the stress-strain response of the material can be determined and hence the modulus of elasticity can be calculated. Figure 4 and 5 shows the specimens before and after testing.

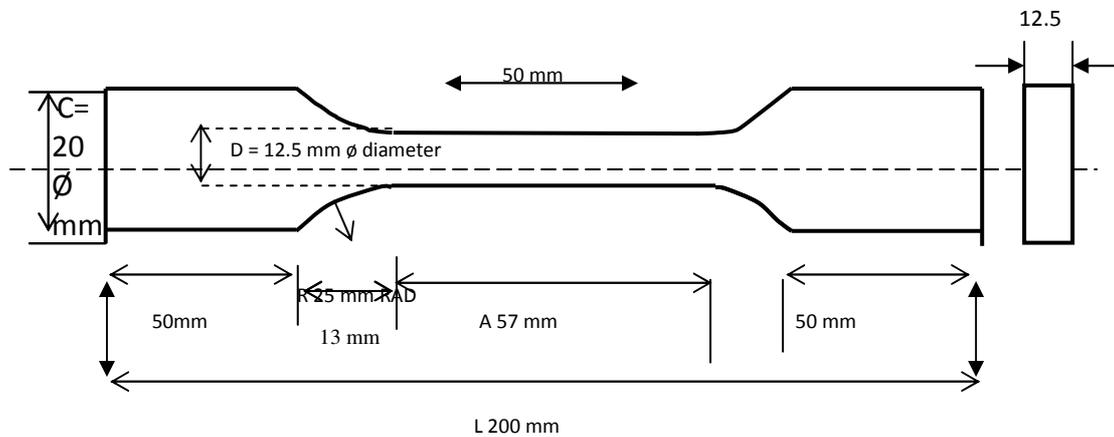


Fig.3. Tensile test specimen

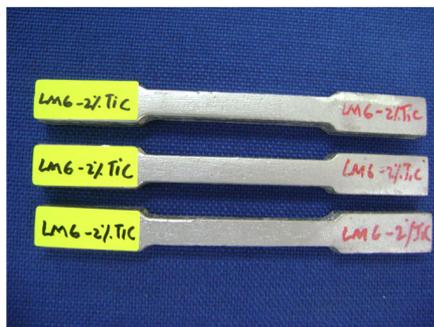


Figure 4. Specimen before testing

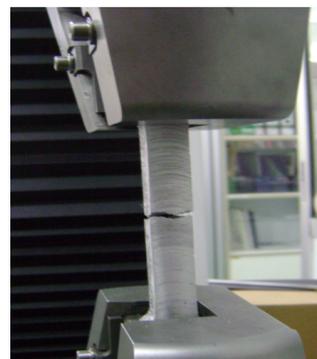


Figure 5. Spesimen after testing

### Scanning electron microscopy

Scanning Electron Microscope (SEM) using Hitachi S-3400N variable pressure microscope with Inca 300 Energy Dispersive X-ray (EDX) and model 8500 INSTRON UTM testing machines are used to test the tensile specimens of TiC particulate reinforced LM6 alloy matrix composites and its fracture surfaces are analyzed after tensile testing. Results and data obtained from the tensile tested samples are correlated with the reported mechanical properties for each weight fraction of TiC percentage addition to the LM6 alloy matrix.

### RESULT AND DISCUSSION

The tensile testing of the samples was performed based on the following specifications and procedures according to the ASTM standards.

Type of testing : Tensile test  
 Crosshead speed : 2.00 mm/minute  
 Grip distance : 50.000 mm  
 Specimen distance : 50.000 mm  
 Temperature : 24<sup>0</sup> C

The Table 3, shows the effect of TiC on tensile strength and young modulus of the composite. The tensile properties of the LM6/TiC MMC for four different weight fractions at ambient temperature reveals an increases in tensile strength and modulus with increase in reinforcement content in the LM6 alloy matrix. The graph plotted between the average tensile strength and modulus or elasticity values variation in percentage weight of TiC particulate addition to LM6 alloy indicated that both the properties increases with increase of TiC particulate. The increases of tensile strength and young modulus of the TiC particulate reinforced LM6 alloy composite with increased addition in weight fraction of TiC particulate is explained as follow with reference to the Figure 6 and 7. The increase in tensile strength may be due to the TiC particles acting as barriers to dislocations in the microstructure. This dislocation increases the dislocation density, which provides a positive contribution to strength of the composite. This result was well supported and evidenced from the literature citation [9,10].

Table 3. Tensile properties of MMC containing various amounts reinforcement content.

wt% of TiC	Tensile Strength (MPa)	Young modulus (MPa)
0	116.0743	1881.246
0.2	123.9025	7011.749
0.6	130.9343	1935.583
1	133.9486	1876.223
2	135.8325	5853.59

The examine fracture surface of an LM6 matrix composite surfaces exhibit a brittle cleavage fracture mechanism. The fracture surface of the grain refined composite showed broken Aluminium and TiC particles (Figure 8 - 12) and well-attached particles within the dimples, indicating rather good interface cohesion between matrix and reinforcing particles.

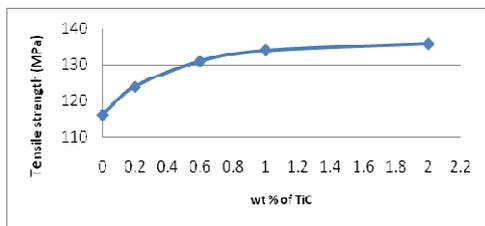


Fig. 6 Average tensile strength versus weight fraction of TiC

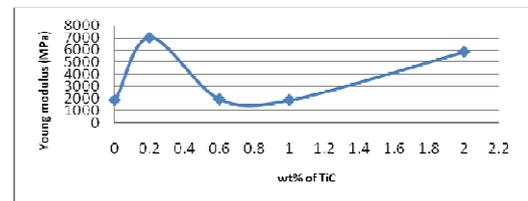


Fig. 7 Average young modulus versus weight fraction of TiC

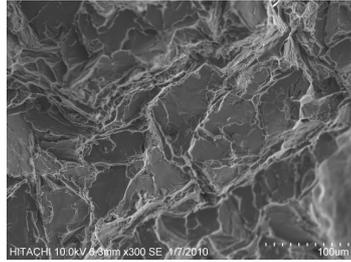


Fig. 8 Fractograph of LM6 at  
Fractograph of LM6 at 300X  
magnification

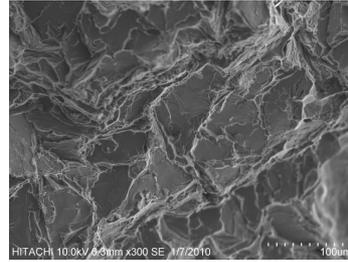


Fig. 9 Fractograph of 0.2% TiC in  
matrix composite at 300X  
magnification

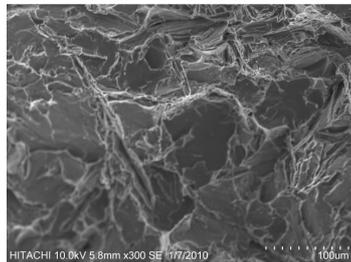


Fig. 10 Fractograph of 0.6% TiC in  
matrix composite at 300X  
magnification

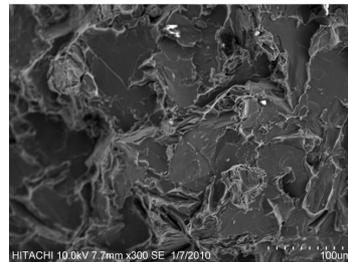


Fig. 11 Fractograph of 1% TiC in  
matrix composite at 300X  
magnification

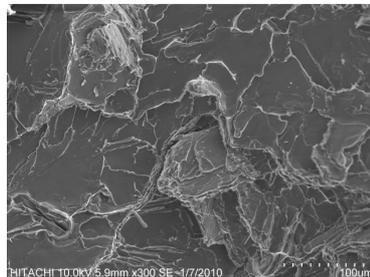


Fig. 12 Fractograph of 2% TiC  
in matrix composite at 300X  
magnification

## Conclusion

In this experimental study, quantification of strength, Hardness and fracture surface morphological aspects of quartz-silicon dioxide particulate reinforced LM6 alloy matrix composites test specimens after tensile testing are described. Based on the experimental evidence from this research work the following conclusions are drawn:

1. The split tensile strength and young's modulus values increased gradually as the titaniumcarbide content in the composite increased by weight fraction. The reason for this mechanical behavior is due to the dominating nature of the compressive strength of the Titanium carbide particulate reinforced in the LM6 alloy matrix.

2. The hardness value of the silicon dioxide reinforced LM6 alloy matrix composites is increased with the increased addition of titanium carbide particulate in the matrix and it is well supported.
3. The mechanical behavior of the processed composite had a strong dependence on the weight fraction addition of the second phase reinforcement particulate on the alloy matrix

### **Acknowledgment**

The authors would like to express their deep gratitude and sincere thanks to the staff and laboratory technicians of the Department of Mechanical and Manufacturing, Universiti Putra Malaysia for their help with the experiments.

### **References**

1. K. C. Ramesh and R. Sagar, Fabrication of Metal Matrix Composite Automotive Parts, *Int J Adv Manuf Technol* (1999) 15:114–118
2. A.Burr, J.Y. Yang, C.G. Levi and F.A. Leckie, The strength of metal matrix composite joints, *Acta metallurgica et materialia Pergamon Press*, 43/9 (1995) 3361-3373.
3. A.J. Clegg, Precision casting processes, pergamon press 1991.
4. A.K. Kau, Mechanics of composite materials, CRC Press Boca Raton, New York, USA, 1997.
5. A.L. Kheng Hooi, Thermal analysis of two and three-gate sand casting mould, Thesis Master UPM 2001.
6. American Society for Testing and Material, Annual Book of ASTM Standards, USA, 1999.
7. Chadwick, G. Production, properties and applications of metal matrix composites, *Developments in the science and technology of composite materials*, ECCM4, Fourth European Conference on Composite Materials, 1990.
8. Global spec, <http://www.globalspec.com/reference/3769/Titanium-Carbide-TiC>, march 10, 2010.
9. D.D.Himbeault, R.A.Varin and K.Piekarski, "Tensile properties of titanium carbide coated carbon fibre-aluminium alloy composite' butterworth & co Publisher LTD, Volume 20, number 5, september 1989.
10. Woei-Shyan Lee and Wu-Chung Sue, "Dynamic Impact and Fracture Behaviour of Carbon Fiber Reinforced 7075 Aluminum Metal Matrix Composite" *Journal of Composite Materials* 2000 34: 1821-184



**M. Sayuti** was born on August 30, 1972 in Luengdaneun, Matang Glumpang Dua, Bireuen, Aceh- Indonesia. He obtained his Bachelor's degree in Industriall Engineering, Universitas Malikussaleh Lhokseumawe Aceh - Indonesia and Master in Mechanical Engineering, Universiti Putra Malaysia. And now is a PhD student of Mechanical Engineering, Universiti Malaysia Putra. His current specialization is in the field of Metal Matrix Composite (MMC).