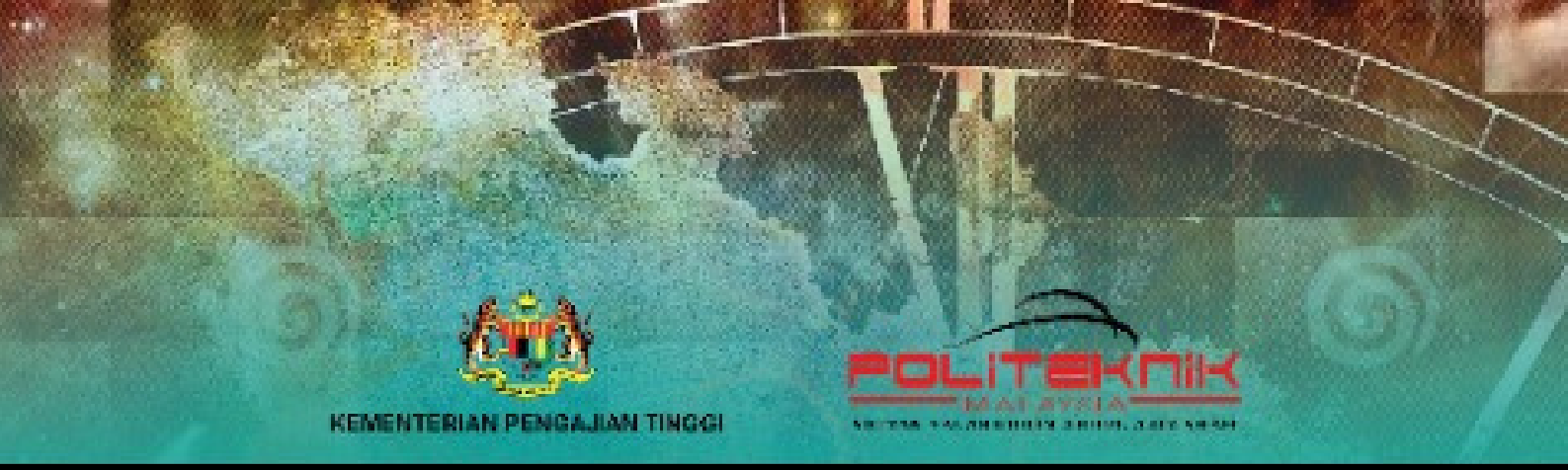

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SEKAPUR SIRIH

Assalamualaikum warahmatullahi wabarakatuh dan Salam Sejahtera.

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Penerbitan Diges Akademik PSA ini adalah suatu usaha murni bagi menyokong aspirasi negara dalam memperkayakan koleksi bahan ilmiah di institusi pengajian tinggi terutamanya dalam bidang Technical and Vocational Education and Training (TVET). Usaha ini juga membuktikan bahawa kita sentiasa responsif dan relevan dalam bidang penulisan, penyelidikan dan inovasi selaras dengan hasrat Pelan Pembangunan Pendidikan Tinggi Negara. Penulisan ini juga diharapkan akan menjadi wadah bagi perkongsian ilmu, pemikiran dan kepakaran di kalangan warga PSA, pihak industri dan komuniti setempat.

Adalah diharapkan agar penulisan dan penerbitan di institusi ini akan terus berkembang sehingga menjadi satu budaya dalam memartabatkan khazanah ilmu negara. Alhirnya, saya mendoakan agar Diges Akademik PSA ini akan dimanfaatkan oleh semua pihak demi kelestarian ilmu dalam sistem pendidikan negara.

Sekian, terima kasih.

Dr. Hj. Mohd Zahari bin Ismail
Pengarah
Politeknik Premier Sultan Salahuddin Abdul Aziz Shah

PRAKATA

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Segala pujian dan kesyukuran ke hadrat Allah S.W.T kerana dengan izin dan limpahan rahmatNya maka Pusat Penyelidikan dan Inovasi (CRI), Politeknik Premier Sultan Salahuddin Abdul Aziz Shah (PSA) telah berjaya menerbitkan Diges Akademik PSA bagi tahun 2021.

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Dr. Hjh. Wan Rosemehah binti Wan Omar
Ketua Pusat Penyelidikan dan Inovasi
Politeknik Premier Sultan Salahuddin Abdul Aziz Shah

ISI KANDUNGAN

FLOOD DISASTER PREPAREDNESS PLANNING

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ABSTRACT

Disaster is an incident that occurs in a sudden way, complicated in nature, ensuing in the loss of lives, damages to belongings or the surroundings as well as affecting the daily activities of the local people. Such incident requires the managing of sources, equipment, frequency, and sizable manpower from diverse corporations in addition to effective coordination and the opportunity of stressful complex moves over a long period. Preparedness is one crucial interest of pre-flood local authorities need to be cognizant of it because those activities are designed to minimize the loss of life and damage. Besides, these disaster incidents are defined to set up the roles and responsibilities of agencies. Preparedness is one important activity of pre-flood local authorities need to focus on it because these activities are designed to minimize loss of life and damage. Preparedness is the main way of reducing the impact of disasters. During a flood any agency needs to provide food and water, preventing disease and disability, repairing vital services such as telecommunications and transport, providing temporary shelter and emergency health care to the flood victim. Lastly is about post-flood planning. Authorities and agencies need cooperation to recover that place. Recovery activities include rebuilding infrastructure, health care and rehabilitation. These should blend with development activities, such as building human resources for health and developing policies and practices to avoid similar situations in the future.

Keywords: Flood disaster, Preparedness planning, Pre-flood, During flood, Post-flood

1. Introduction

Disaster can be defined as a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts that exceeds the ability of the affected community or society to cope using their resources (WCPT, 2016; UNISDR, 2009). According to World Confederation for Physical Therapy, (2007) there are four main types of disasters; natural, environmental emergency, complex emergencies, and pandemic emergencies. The first type is a natural disaster which including floods, hurricanes, earthquakes, and volcano eruptions that have immediate impacts on human health and also causing death and suffering for instance floods, landslides, fires, and tsunamis. The second type of disaster is environmental emergencies including technological or industrial accidents, usually involving the production, transportation of hazardous material, and occurred when the materials are produced, used or transported. The third types of disaster are complex emergencies involving a breakdown of authority, looting and attacks on strategic installations, including conflict situations and war. Finally, disaster types of pandemic emergencies involving a sudden onset of contagious disease that affects health disrupt services and businesses and brings economic and social costs. Jabatan Kebajikan Masyarakat (2014) defines that the Standard Operating Procedure (SOP) for disaster is to give guidelines about the steps to be considered by JKM about the disaster handling management started from preparation phases until the recovery phase and help for disaster are the same with the Policy and Mechanism of the Nation Disaster Management, so that the action to be taken will be accomplished with efficiency, arrangeable, planned and effective. This study is aimed to give awareness about the guidelines for disaster preparedness planning to minimize loss of life and damage, especially for the affected areas.

2.0 Types of Flood

Floods are generally divided into three categories based on the utility's ability to prepare and respond (Maddox, 2014). These categories are storm surges, which occur in coastal ocean areas, flash floods caused by local or regional unusually high rainfall intensities and river flooding caused by significant periods of moisture coupled with moderate to intense rainfalls over long durations.

2.1 Storm Surges

Storm surges are a phenomenon of hurricanes that are a danger to coastal utilities. These types of events often have several days of warning allowing the utility to prepare. The extent of the surge is related to the position of the high tide at the time of hurricane landfall. In this type of flooding the water surge is accompanied by very strong winds, and the combination of wind and saltwater that inundates utility facilities will like to destroy them completely. Physical protection of electrical components is the best form of protection.

2.2 Flash Floods

Doppler radar is one of the instruments that The National Weather uses to predict flash floods. Doppler radar is accurate to the street level. This ability allows the Weather Service to provide more accurate flash flood warnings. Flash floods will typically occur within a couple of hours and thus adequate response time will not be available to a utility. Like any flood threat, the best approach is physical protective measures.

2.3 River Flooding

River flooding is predicted by establishing the likely peak elevation (flood crest) reached by a river by the National Weather Service. Under normal conditions, river flooding can be predicted several days in advance. Where antecedent moisture conditions are high and localize rainfall is predicted to be heavy and continuous, river flooding may quickly change to a flash flood.

3.0 Disaster Management

Disaster shall be handled according to the stages as follows:

i. "**Disaster Management Level I**" is the management and control of the occurrence of disasters occurring in the area and it can be dealt with effectively by the agencies involved in disaster management at the district level either without external assistance or with limited external assistance.

ii. "**Disaster Management Phase II**" is the management and control of disaster events that occurred in more than one area in the same country, which requires the mobilization of resources at the state level with the help of the center limited.

iii. "**Disaster Management Phase III**" is the management and control of disaster events that occurred in more than one state or complex nature that require coordination and mobilization of resources at the center Stage or with foreign aid.

Disaster management level is dependent on the assessment of the Disaster Management Committee at the District level, State or Centre. The evaluation shall be based on the following elements:

i. The complexity and magnitude
ii. The destruction and damage
iii. The ability of financial resources, manpower and equipment
iv. Expertise
v. Aid
vi. The duration of the reaction

3.1 Committee and Mechanisms for Disaster Management

To manage disasters in stages at the set, Disaster Management Committee shall be established as follows:

i. **District Disaster Management Committee (DTCP) – for Disaster Level 1**

DTCP is chaired by the District Officer / Mayor / Chairman of Perbadanan Labuan/ President of Putrajaya Corporation. While the police chief is the Disaster Operations Commander and District Fire Officer is the deputy commander of disaster operations. DTCP comprises all major rescue agencies, aid agencies, support agencies, and voluntary bodies in charge of providing assistance and rehabilitation to victims of the disaster. District Social Welfare Officer to the DTCP as the agency responsible for providing relief and rehabilitation to the victims.

ii. **The State Disaster Management Committee (JPBN) – for Disaster Phase 2**

Chaired by the Honorable JPBN State Secretary / Secretary General of Federal Territories and Urban Wellbeing. State Police Chief Commander and Director of Disaster Operations as Deputy Commander of the State Fire Disaster Operations. JPBN comprises all major rescue agencies, aid agencies, support agencies, and voluntary bodies in charge of providing assistance and rehabilitation to victims of the disaster. Director of Social Welfare State / Federal Territory to JPBN as the agency responsible for providing relief and rehabilitation to the victims.

iii. **National Disaster Committee (JPBP) – for Disaster Level 3**

JPBP is chaired by the Minister appointed by the Prime Minister. Director of Internal Security and Public Order of the Royal Malaysia Police (PDRM) as the Disaster Operations Commander and Deputy Director of Operations Malaysian Fire and Rescue Department (BOMBA) as Deputy Commander of disaster operations. JPBP comprises all major rescue agencies, aid agencies and support agencies as well as voluntary bodies in charge of providing assistance and rehabilitation to victims of the disaster. Secretary-General of the Ministry of Women, Family and Community Development and the Director of Social Welfare to JPBP.

4.0 Alert / Warning for Flood Occur

Alert/warning indicates the onset of a Flood for which a warning system is essential. This system may be public announcement through radio, television, media social, SMS for floods.

i. **Departments Authorized to Issue Warning**

The district administration is the prime agency responsible for issuing the warning

ii. **Flood warning**

Malaysia Metrological Department, Central Water Commission and State Irrigation Department.

iii. **Important Elements of Warning**

a) All warning systems and technologies are maintained in working condition and checked regularly.
b) Communities in Flood-prone areas are made aware of the warning systems.
c) An alternate warning system must be kept in readiness in case of technical failure.
d) Only the designated departments/officers will issue the warning.
e) The warning should to the extent possible be clear about the severity, the time frame, area that may be affected.
f) Warning statements should be conveyed in a simple, direct and nontechnical language and incorporate day-to-day usage patterns.
g) The do and don'ts should be communicated to the community to ensure appropriate responses.
h) Warning statements should not evoke curiosity or panic behavior. This should be in a professional language devoid of emotions.
i) Rumor control mechanisms should be activated.
j) All relevant departments and organizations should be alerted.
k) Once a warning is issued, it should be followed up by a subsequent warning to keep the people informed of the latest situations.

5.0 FLOOD DISASTER PREPAREDNESS PLANNING

5.1 Pre-Flood Planning

Pre-flood activities include actions to identify flood-prone areas where utility infrastructure is located and reducing the risk in the event of a flood disaster. Planning and preparation to encounter the flood are vital to ensure the full measurement has been taken when the event takes place.

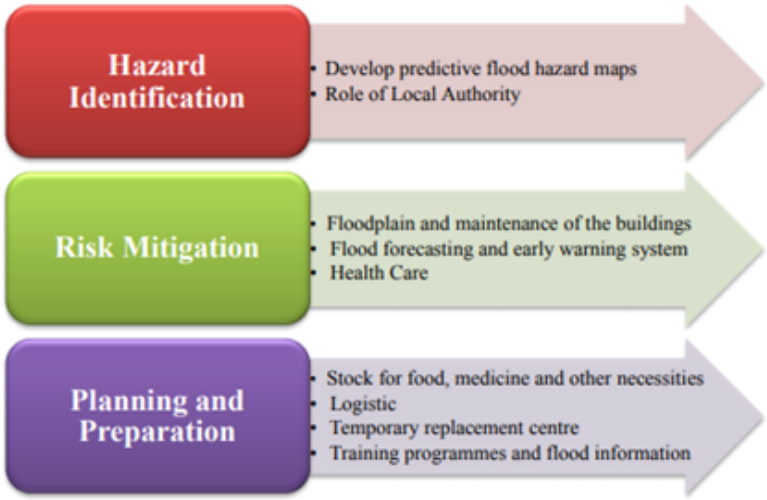

Figure 1.0: Pre-flood planning

5.2 During-Flood Planning

Flood victims need to check-in/ register their personal information to a person in charge (PIC) at the safe shelter to make the Search and Rescue (S&R) mission much easier for the team. The information is very useful to the S&R team to know the exact location and condition of the affected area. During the flood period, meetings on coordination of the various operations were held daily where the meeting is more on arrangement for S&R, goods distribution, volunteer members, agencies and other organization and at the meantime, this meeting also to give a latest updated on the current situation at the flood area.

Checklist for Assessing Preparedness for Flood	
Search and rescue	To trace and locate people who are physically trapped and distressed, people living in low lying areas and on river banks and affected by flood, to rescue these persons, move them to the safer locations identified in advance and to organize further care for the rescued.
Relief co-ordination	To co-ordinate the first stage response to the shelters by establishing contact with the Shelter Control Room, civil society organizations and NGOs and organize the distribution of assistance in terms of food, water, medicines, temporary shelter materials, blankets, household kits, candles and so on in a fair and equitable manner.
Early warning and communication	To ensure that: a) The warning of the impending disaster reaches every single household, thereby allowing people to take timely action to protect their lives and property b) Accurate information is provided regularly as events unfold. c) Information flows quickly and reliably toward affected areas
Water	To make available safe drinking water to humans and livestock.
Sanitation	To ensure that the minimum basic facilities such as temporary toilets and common bathing units are constructed near the relief camp, that these facilities and the surroundings are kept clean, garbage disposed, dead bodies cremated and the normal drainage systems function smoothly.
First aid and health	To provide primary health care to the ill or injured until more advanced care is provided and the patient is transported to a hospital
Evacuation and shelter management	To help and construct/identify, maintain and make repairs to the flood shelters, to evacuate people on receipt of a warning and to make all the necessary arrangements to accommodate evacuees during a flood.

Figure 2.0: Checklist for Assessing Preparedness for Flood

5.3 Recovery and Reconstruction after Floods

Most people's goal in disaster recovery is to restore household, business, and government activity to the "normal" patterns that existed before the disaster struck. To do this, they typically assume they must restore the buildings and infrastructure as they were before the disaster. Three relatively distinct types of social units should be considered in disaster recovery: households, businesses, and government agencies. Households and businesses focus primarily on their recovery but government agencies must address the recovery needs of the entire community.

The recovery process involves both activities that were planned before disaster impact and those that were improvised after disaster impact. Thus, it is more useful to think of disaster recovery in terms of four aspects: disaster assessment, short-term recovery, long-term reconstruction, and recovery management. The table below has been simplified for easier understanding.

	DISASTER RECOVERY ASPECT		
1.0	**DISASTER ASSESSMENT**	**3.0**	**LONG-TERM RECONSTRUCTION**
	1. Community assessment 2. Damage assessment 3. Further assessment		1. Reconstruction of The Disaster Impact Area *- Building construction practices* *- Infrastructure resilience* *- Hazard source control and area protection* *-Land-use practices & Environmental recovery* 2. Economic Recovery 3. Psychological Recovery
2.0	**SHORT-TERM RECOVERY**	**4.0**	**RECOVERY MANAGEMENT**
	1. Impact area security 2. Housing Recovery 3. Infrastructure restoration 4. Debris management 5. Emergency demolition 6. Donations management 7. Disaster assistance		1. Agency notification and mobilization 2. Mobilization of recovery facilities and equipment 3. Internal direction and control 4. External coordination 5. Public information 6. Recovery legal authority and financing 7. Administrative and logistical support 8. Documentation

Figure 3.0: Disaster recovery aspect

5.0 Conclusion

In a conclusion, each organization needs to set up one Standard Operating Procedure (SOP). Standard Operating Procedure (SOP) for flood is important because it is a guideline for the people or community from various phases whether Local, District or State. SOP for each category is different because they have a different mechanism. SOP for each phase like Local, District, and the State also different because the people focusing on it. As an example, flood is one natural disaster that always happened at the East Coast of Peninsular Malaysia, so each local authority should play their role to prepare the SOPs for pre-flood, during-flood and post-flood. So, through the guideline of SOP people and authorities, whether from Local, District and State know their role and know what to do when a disaster happens.

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References

Brampton Small Business Enterprise Centre. (2012). What is Standard Operating Procedure (SOP).

Jabatan Kebajikan Masyarakat . (2014). Peraturan Tetap Operasi Pengurusan Bencana Tahun 2014/2015. Shah Alam: Jabatan Kebajikan Masyarakat.

Jamaludin, W. F. (2007). Disaster Preparedness in Malaysia. Kuala Lumpur.

Maddox, I. (2014). The Risks of Hazard; Three Common Types of Flood Explained. Retrieved November 12,2015,fromIntermap:http://www.intermap.com/risks-of-hazardblog/three-common-types-of-flood-explained

Umar, C. M. (2007). Disaster Mitigation Support and Management in Malaysia. Kuala Lumpur.

World Confederation for Physical Therapy. (2007). What is Disaster Management. Retrieved November 13, 2015, from World Confederation for Physical Therapy: http://www.wcpt.org/disaster-management/what-is-disaster-management

World Confederation for Physical Therapy (2016). The role of physical therapists in disaster management. Retrieved July 20, 2021 from https://world.physio/sites/default/files/2020-06/Disaster-Management-Report-201603.pdf

PENGHASILAN INOVASI PENANDA KESELAMATAN SEMENTARA (MAD) BAGI KEGUNAAN PENYELENGGARAN JALANRAYA

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ABSTRAK

Penanda keselamatan sementara adalah merupakan satu penanda yang digunakan semasa membuat kerja-kerja selenggara di jalanraya dalam tempoh yang ditetapkan. Selain kerja-kerja selenggara, penanda sementara atau temporary signage ini juga digunakan dalam situasi kecemasan seperti kemalangan dan bencana alam. Mengikut laporan kemalangan yang dikeluarkan oleh Jabatan Forensik Jabatan Kerja Raya dan Polis Diraja Malaysia, bilangan penyumbang kemalangan yang tertinggi adalah disebabkan oleh penanda (signing and marking) tidak berfungsi dengan baik. Sehubungan dengan itu, kajian ini bertujuan untuk menghasilkan satu penanda sementara di jalan raya atau Multi Alert Function Device bagi membantu pengguna mengesan dengan lebih awal tanda - tanda bahaya risiko kemalangan di jalan raya khususnya bagi jalan berlubang. Penghasilan penanda menggunakan plastik jenis HDPE berukuran 0.45m (Tinggi) x 0.3m (Lebar) x 0.02m (Tebal). Kepingan plastik disambung dengan menggunakan engsel bagi memudahkan kepingan plastik yang disambung agar mudah dilipat apabila digunakan. Produk ini diuji dengan membuat ujian jarak penglihatan pada laluan sepanjang 65km. Hasil kajian didapati bahawa produk ini mudah dikesan oleh pengguna sepanjang laluan yang dikaji berbanding dengan dengan jalan yang tiada penanda sementara disediakan. Kajian ini disimpulkan bahawa penanda keselamatan sementara ini boleh digunakan sebagai tanda amaran khususnya pada keadaan terdapatnya lubang di jalanraya. Disamping itu, tanda jalan ini dapat digunakan bagi memaklumkan pengguna sebagai memberi panduan bahawa terdapatnya potensi risiko bahaya ke hadapan dan sekaligus mengelakkan kemalangan.

Kata kunci: penanda keselamatan sementara, MAD, mudah alih, jalan raya , pengguna

1.0 Pengenalan

Keselamatan jalanraya adalah aspek terpenting kepada penguna jalanraya sebagai medan pengangkutan utama di seluruh dunia. Kemajuan ekonomi dan pembangunan yang sistematik beserta peningkatan populasi penduduk telah meningkatkan lagi penggunaan jalanraya yang secara tidak langsungnya mengakibatkan kesesakan lalu lintas dan kemalangan [1]. Terdapat pelbagai faktor yang menyumbang kepada peningkatannya kadar kemalangan di jalanraya, antaranya adalah disebabkan oleh faktor kecuaian sikap pemandu, keadaan persekitaraan (keadaan jalan) dan kenderaan. Daripada aspek keadaan jalanraya,faktor kurangnya papan tanda (signing and marking) merupakan antara risiko yang berpotensi tinggi penyebab berlakunya kemalangan [2]. Tanda jalanraya (highway signs) merupakan kaedah yang mmbolehkan pihak utiliti menyampaikan peraturan, amaran, panduan dan maklumat jalanraya yang diperlukan oleh pemandu untuk menavigasi jalan mereka [3]. Selain itu bagi meningkatkan keselamatan jalanraya, antara pendekatan yang digunakan termasuklah aspek penyelenggaran jalan. Program ini melibatkan kerja-kerja kecil seperti penurapan lubang, pemotongan rumput, penyelenggaraan perabot jalan dan pembersihan saliran [1]. Bagi melaksanakan kerja-kerja selengaraan jalan, penanda keselamatan sementara keselamatan sering digunakan.

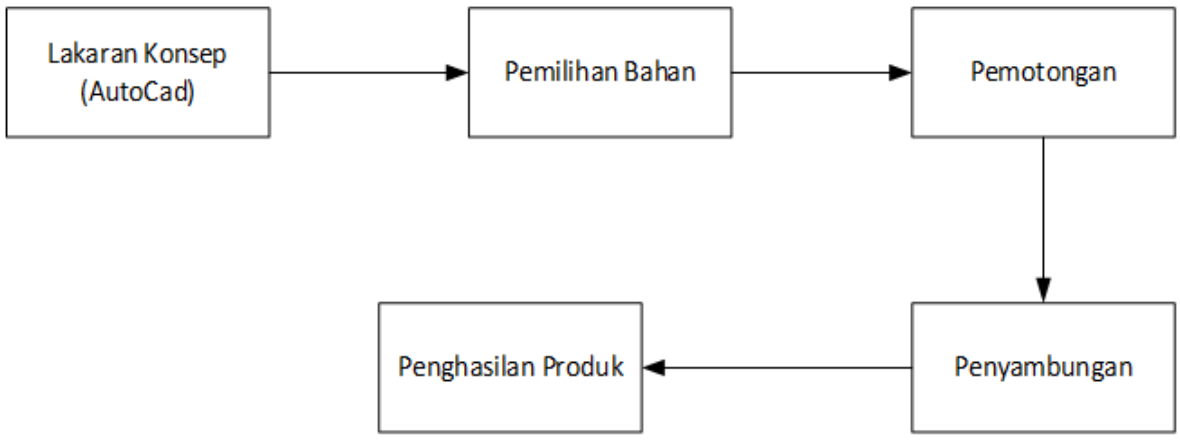
Penanda keselamatan sementara atau temporary safety sign ini merupakan tanda jalanraya yang digunakan semasa menjalankan kerja-kerja pengoperasian besar seperti pembinaan dan penyelenggaraan jalan raya, kerosakan jalan dan laluan kecemasan serta apabila berlakunya kemalangan [4]. Apabila sesuatu operasi dijalankan, penanda keselamatan sementara yang digunakan perlu mudah dilihat atau mudah dikesan oleh pengguna jalanraya yang melewati sesuatu laluan. Dalam erti kata lain, penanda keselamatan sementara yang digunakan adalah untuk memaklumkan secara tidak langsung kepada pengguna jalan raya akan risiko bahaya tertentu yang berkemungkinan bakal dihadapi ketika operasi sedang dijalankan. Penanda keselamatan sementara hendaklah diletakkan dalam kedudukan di mana ia akan menyampaikan mesej (signal) yang paling berkesan dan peletakan itu mesti disesuaikan dengan reka bentuk lebuh raya dan penjajaran (Alignment). Penanda hendaklah ditempatkan dengan posisi tertentu supaya pengguna mempunyai masa yang mencukupi untuk bertindak atau mengawal kenderaan dengan keadaan selamat. Mengikut peraturan umum penanda perlu diletakkan di sebelah kiri leburaya. Reka bentuk penanda keselamatan sementara mempunyai beberapa jenis seperti bentuk bulat, bentuk segi empat tepat dan bentuk berlian. Warna oren atau merah yang digunakan untuk latar belakang, warna hitam digunakan sebagai simbol dan mesej. Penanda sementara perlu memasang retroreflective strip untuk membantu memperlihatkan penanda pada waktu malam. Sebagai contohnya, penanda keselamatan sementara seperti Advance Warning Sign yang di gunakan oleh pihak lebuhraya untuk memberi amaran kepada pengguna bahawa kerja-kerja penyelenggaraan sedang dijalankan. Penanda keselamatan sementara ini berukuran 1.2m x 0.8m supaya agar ia mudah dilihat. Keseluruhan reka bentuknya diperbuat daripada bahan besi supaya ianya tahan lasak.

Selain itu, penanda keselamatan sementara yang lain seperti kon lalu lintas (traffic cone) juga sering digunakan oleh pihak lebuhraya untuk membahagi jalan-jalan tertentu apabila berlaku proses penyelenggaraan lebuhraya atau kesesakan lalu lintas . Kon ini berukuran minimum 0.45m x 0.23m dan maksima ketinggian 0.9m bertujuan untuk memudahkan pengguna melihat kon tersebut. Kon ini diperbuat daripada "Polyvinyl Chloride (PVC)" , supaya ia mudah di kendalikan dan tahan lasak. Di samping itu, ada juga penanda sementara Red warning triangle sign yang digunakan oleh pengguna apabila kenderaan mereka rosak di atas jalan raya . Penanda sementara ini berbentuk segi tiga dan berukuran sekitar 0.4m . Penanda keselamatan sementara ini mudah dibawa ke mana-mana kerana saiznya yang kecil . Penanda sementara ini juga diperbuat dari pada "Polyvinyl Chloride (PVC)" ini supaya ia mudah di kendalikan dan tahan lasak. Walaupun demikian, mengikut kajian lepas terdapat beberapa masalah apabila menggunakan kon biasa sebagai penanda sementara seperti mudah retak, cepat rosak, ketinggian kon yang tak sesuai dan ringan serta tak tahan lama. Bagi menambahbaik penanda keselamatan sementara ini, satu kajian inovasi telah dijalankan menggunakan gabungan bahan daripada kepingan besi dan plastik tahan lasak (HDPE) bagi mengukuhkan kon penanda keselamatan sementara ini. Kajian ini bertujuan untuk menggantikan kon lalu lintas sedia ada dengan kon versi baru yang ditambahbaik bagi mengurangkan masalah kesesakan di jalan raya dan mengurangkan risiko sedia ada di kawasan kerosakan jalan ataupun kemalangan.

2. Metodologi Kajian

2.1 Lakaran konsepdan penghasilan peranti Multifunction Alert Device (MAD)

Lakaran konsep peranti MAD dihasilkan sebelum alat prototaip dibangunkan. Dalam mereka bentuk, saiz produk merupakan elemen sangat penting sebelum produk ini dihasilkan . Saiz bagi produk ini ketika 0.45m (Tinggi) x 0.3m (Lebar) x 0.02m (Tebal) . Lakaran menggunakan AutoCAD yang lengkap. Secara keseluruhan, penghasilan produk penanda sementara ini menggunakan carta alir seperti ditunjukkan dalam Rajah 1.



Rajah 1: Carta Penghasilan Produk

2.2 Penghasilan peranti MAD yang telah diubahsuai (Prototaip)

Komponen yang terdapat dalam MAD ialah plastik jenis HDPE , (Door Hinger) . Pemilihan bahan yang terdapat pada penanda sementara MAD adalah berlainan dengan penanda sementara sedia ada. Lakaran menggunakan AutoCAD yang lengkap seperti dalam Rajah 1a. Penghasilan produk MAD ini adalah untuk menambahbaik atau memperbaharui penanda sementara sedia ada dari segi penyimpanan , ketahanan karat , berat , bahan yang digunakan dan keupayaan menutup lubang (Potholes) di atas jalan raya. Berdasarkan penilaian yang dijalankan menunjukkan MAD mempunyai pelbagai kelebihan berbanding penanda sementara yang sedia ada. Reka bentuk MAD ini juga dapat mengurangkan penggunaan ruang yang dan boleh dibawa kemana-mana sahaja kerana MAD ringan dan boleh dilipat.

2.3 Ujian jarak penglihatan (Sight Distance Test)

Ujian jarak pengalihatan pengguna ini dilakukan bertujuan untuk mengetahui tahap penglihatan pengguna tehadap penggunaan MAD . Ujian ini juga dilakukan bagi mengetahui kebolehan MAD menutup lubang (Potholes) di jalan raya .Selain itu ujian ini memerlukan perhatian yang berterusan ketika ujian dijalankan oleh kerana rekod yang diambil hanya jumlah kenderaan melalui sesuatu lokasi ujian . Jadual 1 menunjukkan lokasi yang dilakukan dan tempoh masa yang tetapkan. Rekabentuk kelajuan kenderaan adalah mengikut rujukan kepada Arahan Teknik Jalan ditunjukkan pada Rajah 2.

Jadual 1: Lokasi ujian jarak penglihatan

Lokasi	Jalan Saujana Indah 1, Taman Perindustrian Saujana Indah Ttdi Jaya, 40150 Shah Alam, Selangor.	Persiaran Pasak Bumi, Bukit Jelutong Industrial park Section U8, 40150 Shah Alam, Selangor.
Masa	4 jam	4 jam
Jarak penglihatan	65 meter	65 meter
Rekabentuk kelajuan	50 km/jam	50 km/jam

Table 1 : Minium Stopping Sight Distance

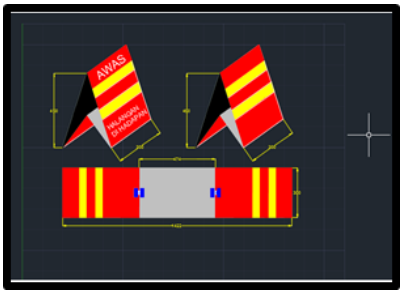
Design Speed (km/hr)	Min. Stopping Sight Distance (m)
20	20
30	30
40	45
50	65
60	85
80	140
100	205
120	285

RAJAH 2: ARAHAN TEKNIK (J) 10-86 A GUIDE TO THE DESIGN OF CYCLE TRACK [5]

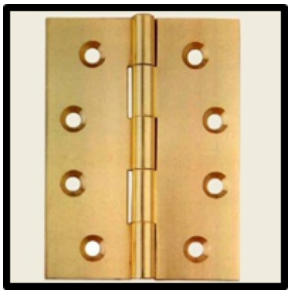
3. Keputusan dan Perbincangan

3.1 Lakaran konsep multifuntion alert device (MAD)

Lakaran konsep MAD ditunjukkan pada Rajah 3a. Semasa membuat pemilhan bahan , komponen yang terdapat dalam penanda sementara MAD ialah plastik jenis HDPE dan engsel sepert dalam Rajah 3b dan Rajah 3c. Pemilihan bahan yang yang digunakan untuk pembuatan MAD adalah berlainan dengan penanda sementara sedia ada . Produk penanda sementara MAD boleh dilipat dengan kemas dan mudah digunakan. Pemilihan bahan yang tepat akan membuat produk lebih kemas dan baik.



RAJAH 3A: LAKARAN KONSEP



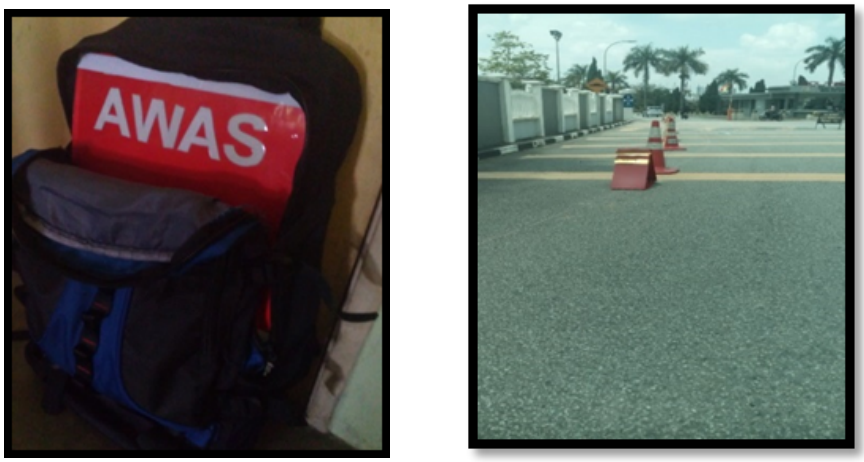
RAJAH 3B: ENGSEL

RAJAH 3C: PLASTIK HDPE

3.2 Prototaip peranti multifunction alert device

Rajah 4 menunjukkan peranti amaran sedia ada yang digunakan di jalan raya. Peranti tersebut terdiri daripada " advance warning sign", " kon keselamatan" dan " triangle warning sign". Fungsi ketiga-tiga peranti sedia ada ini digabungkan menjadi satu dan gabungan fungsi tersebut ada pada peranti MAD sebagai penanda amaran, keterlihatan, dan saiz yang ditetapkan. Peranti MAD yang telah dihasilkan adalah seperti ditunjukkan pada Rajah 5.

Rajah 4: Penanda sementara sedia ada yang terdiri daripada advance warning sign, kon keselamatan dan triangle warning sign



Rajah 5: Penanda Sementara MAD yang mudah diaplikasikan di jalanraya

Perbandingan penanda sementara sedia ada dan penanda sementara MAD pada Jadual 2. Peranti sedia ada sememangnya memerlukan penambahbaikkan bagi memastikan ianya dapat memberi keselesaan kepada pengguna.

	Penanda sedia ada	**Penanda sementara MAD**
1.	 Sukar dibawa	 Mudah dibawa dan disimpan
2.	 Sukar dilihat	 Mudah dilihat
3.	 Mudah pecah dan rosak	 Tahan lasak

Jadual 2. Perbandingan antara penanda sementara sedia ada dengan penanda sementara MAD

3.3 Analisis data ujian jarak penglihatan

Rajah 6 menunjukkan ujian jarak penglihatan yang diuji kepada pengguna jalanraya. Gambar (a) dan (b) menunjukkan kenderaan melalui jalan berlubang yang tidak mempunyai tanda amaran seperti penanda sementara di Jalan. Pengguna jalanraya tidak menyedari kemungkinan terdapat adanya kerosakan jalan seperti jalan lubang dan sebagainya. Manakala pada gambar (b), jalan raya berlubang telah diletakkan penanda sementara MAD. Secara tidak langsung, pengguna jalanraya akan menyedari risiko bahaya tersebut dan berupaya untuk mengelakkan kemalngan. Dapatan dapat ditunjukkan dalam Jadual 3 dan jadual 4. Hasil daripada ujian yang telah dijalankan menunjukkan bahawa pengguna jalanraya dapat melihat peranti sementara MAD dengan jelas pada jarak telah dikaji berdasarkan rujukan Arahan Teknik (J) 10-86 A Guide To The Design Of Cycle Track . Hal ini bermakna keberkesan MAD memberi amaran kepada pengguna akan AWAS LUBANG berjaya dikesan awal oleh pengguna jalanraya di kawasan lokasi ujian.

a) Kenderaan melalui jalan berlubang

b) Kenderaan melalui jalan berlubang

c) Penanda Sementara MAD diletakkan bagi kawasan jalan berlubang

Rajah 6 Ujian Jarak Penglihatan (Sight Distance Test) mengikut situasi (a), (b) dan (c)

Masa (min)	Jalan berlubang		Peranti sementara MAD	
	Nampak	Tidak Nampak	Nampak	Tidak Nampak
0	2	1	3	-
30	1	-	2	-
60	3	2	4	-
90	3	-	2	-
120	1	2	3	-

Jadual 3: Ujian jarak penglihatan di lokasi 1

Masa (min)	Jalan berlubang		Peranti sementara MAD	
	Nampak	Tidak Nampak	Nampak	Tidak Nampak
0	4	-	4	-
30	3	-	2	-
60	5	1	3	-
90	4	-	3	-
120	3	1	5	-

Jadual 4: Ujian jarak penglihatan di lokasi 2

Selain itu, kelebihan penanda sementara MAD dengan penanda sementara yang lain ditunjukkan pada Jadual 5.

Ciri-ciri	Multifunction Alert Device (MAD)	Safety cone	Triangle Warning Sign	Advance sign
Tinggi	0.45m	0.7m	0.4m	1.2m
Berat	1.04 kg	4 kg	0.7kg	11 kg
Bahan	HDPE	PVC	PVC	Besi
Penggunaan ruang	Sedikit	Banyak	Sedikit	Banyak
Tahan karat	Tidak mudah Karat	Tidak mudah karat	Tidak mudah karat	Senang karat
Tahan lasak	Tahan lasak	Tidak tahan lasak	Tidak tahan lasak	Tahan lasak
Harga	RM 79.90 /pc	RM 28.00 /pc	RM 36.90 /pc	RM360.00
Boleh lipat	Boleh	Tidak	Boleh	Boleh
Boleh menutup ubang	Boleh	Tidak	Tidak	Tidak

Jadual 5: Perbandingan Penanda Sementara MAD dengan Penanda Sementara Sedia Ada

4. Kesimpulan

Kajian ini dapat disimpulkan kepada beberapa perkara berikut;
-Penanda keselamatan sementara MAD ini dapat berfungsi sebagai penanda amaran bahaya kursusnya kepada pengguna jalanraya yang melalui kawasan jalanraya yang mempunyai kerosakan jalan berlubang.
-Produk ini mudah untuk disimpan dan menjimatkan ruang penyimpanan yang selama ini telah menjadi masalah pada penanda sementara yang sedia ada.

Ciri-ciri yang terdapat pada penanda keselamatan sementara MAD ini adalah menjimatkan kos perbelanjaan , tenaga dan masa pengguna daripada segi pengangkutan, penyelenggaraan dan penyimpanan produk.

Penghargaan

Penulis merakamkan penghargaan kepada Jabatan Kejuruteraan Awam, Politeknik Sultan Salahuddin Abdul Aziz Shah atas kerjasama dan kemudahan makmal serta bantuan teknikal yang diberikan.

Rujukan

[1] M. N. Mustafa, Overview of Current Road Safety Situation in Malaysia. terdapat, 2010.
[2] M. F. Musa, S. Asmah, H. Id, and N. Mashros, "The impact of roadway conditions towards accident severity on federal roads in Malaysia," PLoS One, vol. 15, no. 7, pp. 1–12, 2020.
[3] FHA, Maintenance of signs and sign supports: A guide for local highway and street maintenance personnel. U.S. Department of Transportation, 2010.
[4] F. Ezanee and M. Ghazali, "Operational Risks for Highway Projects in Malaysia," Int. J. Hum. Soc. Sci., vol. 5, no. 1, pp. 22–25, 2010.
[5] JKR, A Guide on the Design of Cycle Track. Public Works Department Malaysia, 1986.

A REVIEW OF MyCREST AS A TOOL FOR BUILDING PERFORMANCE EVALUATION

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ABSTRACT

The development of new building is increasing year by year; therefore, it is important to have a proper building performance hence maintaining the building performance towards sustainability. This paper discussed about Malaysian Carbon Reduction and Environmental Sustainability Tool or MyCREST, one of the building performance evaluations that focus on improving awareness of construction carbon emission and reducing the emission and environment impact of a project. Event MyCREST have eleven (11) main criteria of MyCREST (pre-design, infrastructure and sequestration, energy performance impact, occupant and health, lowering embodied carbon, water efficiency factor, social and cultural sustainability, demolition and disposal factor, sustainable and carbon initiative, demolition and disposal factor, waste management and reduction and sustainable facility management), this paper only critically discuss in energy performance impact (energy management), occupant health (IEQ), social and cultural sustainability (workplace productivity) and sustainable and carbon initiative (sustainable development).

Keywords: MyCREST, building performance evaluation, sustainability, green buildings, operation and maintenance

1.0 Introduction

Climate change commonly known as global warming is the term used for the changes recorded in the temperature on and within the earth's atmosphere (carbonfootprint, 2018). According to (UNDP, 2007) Malaysia is among the top 30 carbon dioxide emitters in the world and has been among the other contributors towards the ultimate climate change. The impact of climate change is not limited to a certain region but to the entire earth which will cause the shift of weather pattern. There are some natural indicators that shows that our earth is undergoing global warming, for instance the rise of air temperature over land and oceans, the decrease in level of Artic Sea ice, disappearance of glacier ice and rise in the sea level. The greenhouse effect is shown in Figure 1.

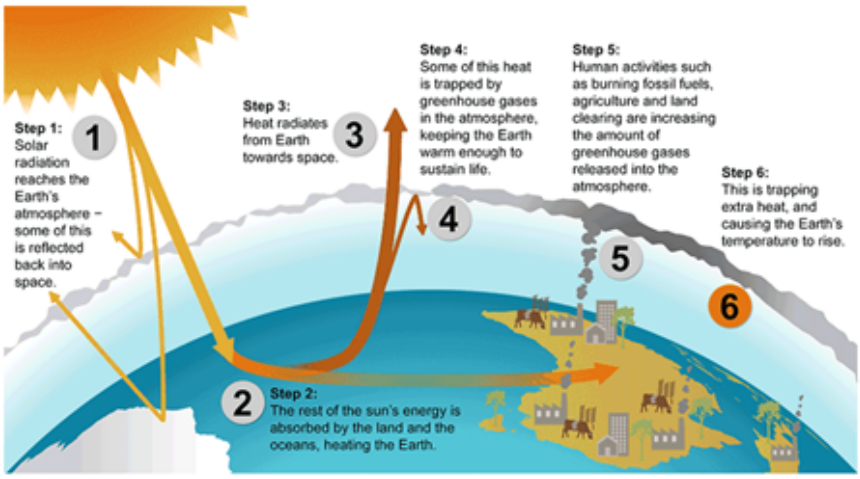

Figure 1: Greenhouse Effect (Australian Department of the Environment and Energy (2018))

Intergovernmental Panel on Climate Change (IPCC) highlighted that building sector as the segment with the largest mitigation potential. It is assessed that both existing and new buildings have the potential to diminish energy consumption and carbon outflow to a critical level using current technologies, equipment, administration frameworks and arrangements. According to (CIDB, 2018) the building sector's energy consumption is estimated to grow by 60% to 90% from the year 2005 to 2050. Therefore, by integrating sustainable and environmental management will help in controlling the carbon emission and energy consumption. This paper will review about MyCREST, one of the building performance evaluation that focus on improving awareness of construction carbon emission and reducing the emission and environment impact of a project.

2.0 MyCREST vs Traditional Project Approach

There are different definitions among the world about the carbon footprint and carbon impact of buildings, products and services. Widely, the objective is approaching a more comprehensive appraisal towards the carbon impact of buildings. MyCREST creates its own principles, primarily criteria and definitions promoted by the Carbon Trust United Kingdom, PAS 2050 standards, Building Research Establishment UK and as far as possible, lessons learnt from international green buildings standards such as LEED and BREEAM (CIDB, 2016). This conversion in accentuation is reflected in the criteria in MyCREST, which vary from to the ordinary design, construction and operation processes and to a few degrees, a diverse accentuation on the typical green building rating systems found. These can be outlined as Table 1 below:

TRADITIONAL DESIGN APPROACH	INTEGRATED MyCREST APPROACH
Involvement of the project members is limited to their trade and specialization.	Project members are included right from start of the project to draw inputs that will help to shape the design and planning process.
Project gets more intensive as it progresses. Less time is spent at the early stages.	Project starts off intensively with pre-design requirements and time spent on meetings, charrettes and discussions.
Decisions are made typically by a few stakeholders such as owners, architects and contractors.	Decisions made by a team. Brainstorming sessions, research and iterative discussion are held among as many stakeholders as possible before decisions are made.
A linear process is adopted.	The whole system and life cycle thinking approach are adopted.
The focus is to reduce up-front capital costs.	The project team aims towards reducing long-term operation & maintenance costs.
Systems are considered in isolation and often result in over- designing/over-sizing.	Total building performance is used to assess how each system affects one another to deliver the optimum design and performance must be verified by monitoring.
Project members undertake limited responsibilities.	All team share equal responsibilities and work together to solve problems.
The linear process ends when construction of the project is completed.	This approach emphasizes on the long-term performance of the building and users' satisfaction through commissioning, post occupancy evaluation surveys and energy audits.

Table 1: Traditional vs MyCREST Project Approach (CIDB, 2016)

3.0 MyCREST Award and Rating Classification

MyCREST aims to improve the lives of Malaysians by promoting, developing and implementing sustainable construction system in the industry (CIDB, 2017). MyCREST rating framework symbolizes a five-tier framework beginning from one star to most 5-star rating that can be accomplished. Table 2 below show between percentage score and MyCREST star rating.

MyCREST RATING	Percentage SCORE (%)
★★★★★	80-100
★★★★	70 – 79
★★★	60 – 69
★★	50 – 59
★	40 – 49

Percentage score = (Total score) / (max score available) x 100

Table 2: MyCREST Star Rating (CIDB, 2016)

There are three sorts of certification grant at each stage which are Design, Construction and Operation and Maintenance. Project that passes all three certifications can qualify to be granted with the Carbon-reduced Award Label. If one of the three certifications is left out, the project should only get the independent certification. On the off chance that one of the three certifications is cleared out, the venture ought to as it were getting the autonomous certification. As it were ventures that pass all three certifications can qualify for the Carbon-reduced Award Label.

3.1 MyCREST Award and Rating Classification

Table 3 as indicated below is the calculation for the final score in design stage.

Total score for Air Conditoned Building					**136 points**		
Max Cr Point	82	Max Ci Point	39	Max S Point	14	IN Point (Bonus)	7
OR							
Total score for Non-Air Conditioned Building					**108 points**		
Max Cr Point	39	Max Ci Point	55	Max S Point	14	IN Point (Bonus)	7

Table 3: Traditional vs MyCREST Project Approach (CIDB, 2016)

For healthcare project, the calculation must include as show in Table 4.

PLUS (+)	
Elective Building- Healthcare	**6 points**

Table 4: Calculation for the Final Score in Design Stage at Healthcare Project (CIDB, 2016)

3.2 Construction Award

Table 5 below is the calculation for the final score in construction stage.

Total score for Air Conditoned Building							**128 points**
Max Cr Point	86	Max Ci Point	29	Max S Point	13	IN Point (Bonus)	7
OR							
Total score for Non-Air Conditoned Building							**98points**
Max Cr Point	45	Max Ci Point	41	Max S Point	13	IN Point (Bonus)	7

Table 5: Calculation for the Final Score in Construction Stage (CIDB, 2016)

3.3 Operation and Maintenance Award

Table 6 shown the calculation for the final score in operation and maintenance stage.

Total score							115 points
Max Cr Point	73	Max Ci Point	28	Max S Point	14	IN Point (Bonus)	7

Table 6: Calculation for the Final Score in Operation and Maintenance Stage (CIDB, 2016)

Each element in the tool has been designed to be a carbon-based rating. Carbon Reduction 'Cr' points are those that emit carbon and are represented by calculator. It aims to quantify the consumption of carbon. It is very valuable for carbon emission investigation. Carbon Impact 'Ci' points are focuses that will affect carbon emission but may not be calculated while Sustainable 'S' could be a point that does not relate to carbon emission and lessening but has affected on other sustainability matters as shown in Figure 2 below.

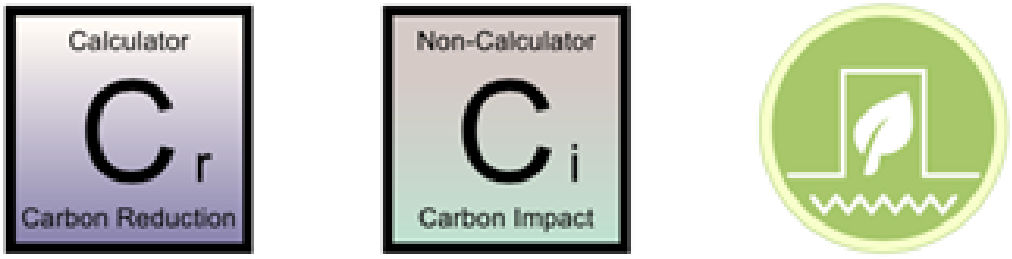

Figure 2: Carbon-based Identification (CIDB, 2016)

4.0 MyCREST Tools

MyCREST combined three tools to construct a scoring method to evaluate a building certification as shown in Figure 3. MyCREST tools are illustrating on how MyCREST appraisal, identification and grant is given independently to each organization of building lifecycle which is in pre-design stage, construction stage and operational stage (MAMPAN, 2017). MyCREST grants distinctive star rating to the diverse stage of the venture and will grant a generally star rating. Thus, all stage of building cycle will be evaluated and accessed to ensure the sustainability of the building.

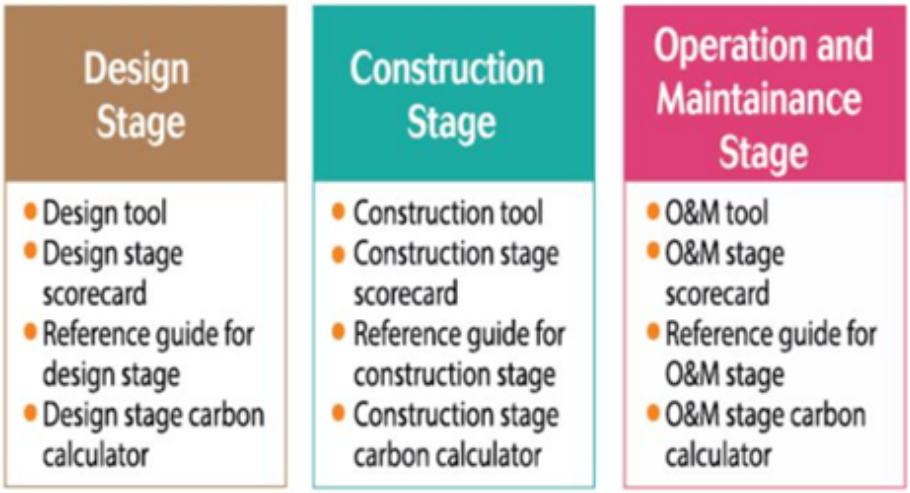

Figure 3: MyCREST Tools (CIDB, 2016)

4.1 MyCREST Assessment Criteria

MyCREST is created to be a very versatile scorecard which consists of three (3) tools; design, construction, operation and maintenance. The MyCREST assessment criteria is used to measure building's performance starting with pre-design to sustainable facility management so that the building continuously sustains. The assessment criteria are divided into eleven (11) sub tools as shown in Figure 4 below.

Figure 4: Assessment Criteria of MyCREST (CIDB, 2017)

5.0 Conclusion

Based on the theoretical study conducted on MyCREST, there is room for improvement in order to get more investors and stakeholders to venture into getting MyCREST certification. Firstly, the influence from the government and relevant ministry is essential in promoting the benefits of MyCREST and exercise of tax incentives. Comparing with the other available building performance evaluation tool, MyCREST is a much more comprehensive tool which comprises of 11 criteria in comparing to other tools such as Greenmark which only focuses on 5 main criteria's, this comprehensiveness will make investors and consultants to wonder on how to achieve the requirement of the complex tool. Besides that, investors incentives should be the other point of consideration for CIDB and PWD to attract more investors or stakeholders to tender for MyCREST certification, example CIDB and PWD should come up with a projection based on their previous certified projects to show the savings attained during the operation of the building. This will help stakeholders to further understand that despite the initial cost of the construction is higher compared to a common building but the saving attained during the operation of the building and the emission of carbon footprint will be able to convince them.

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References

Carboonfootprint. (2018). What is Climate Change. Retrieved from https://www.carbonfootprint.com/warming.html

CIDB(2018). Retrieved from http://www.caribank.org/uploads/projects-programmes/special-development-fund/sdf-meetings/negotiation-meetings/Env_Sus_Climate_Change_Agenda.pdf

CIDB Malaysia. (2017). Bina MAMPAN. Malaysia's Sustainable Construction Periodical, 1.

Construction Industry Development Board (CIDB) Malaysia. (2016). Malaysian Carbon Reduction & Environmental Sustainability Tool. Kuala Lumpur: Construction Industry Development Board Malaysia.

Construction Industry Development Board (CIDB) Malaysia. (2017). MYCREST. Retrieved from Retrieved from http://www.cidb.gov.my/index.php/en/bidang-utama/pembinaan-mampan/mycrest

CREAM. (2017). Index and Analyze Green Building Rating Tools Developed in Malaysia, (May).

Department of the Environment and Energy. (2018). Retrieved from http://www.environment.gov.au/climate-change/climate-science-data/climate-science/greenhouse-effect

MAMPAN. (2018). Sustainable Building Initiatives with MyCREST. 3. Retrieved from http://www.cidb.gov.my/images/content/pdf/mycrest-reference-guide/Bina-MAMPAN_Mag_Vol-3-2018.pdf

Mustaffa Kamal, M. F., Mohd Affandi, H., Sohimi, N. E., Abdul Musid, N. H., Mohd Ali, M. R., & Mat Nashir, I. (2019). Malaysian Carbon Reduction and Environmental Sustainability Tool (MyCREST) Qualified Professional Training Assessment. Journal of Technical Education and Training, 11(4). Retrieved from https://publisher.uthm.edu.my/ojs/index.php/JTET/article/view/3142

FOOD SCRAP COLLECTOR

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ABSTRACT

Penggunaan sinki ini sudah tidak asing lagi pada masa kini kerana ia merupakan kemudahan aliran air tidak bersih pada bangunan seperti restoren, hotel, rumah apartment dan lain-lain. Sinki mempunyai pelbagai kegunaan dan tujuan. Sebagai contoh, sinki yang diletakkan di dalam bilik air adalah sinki untuk kegunaan personel seperti aktiviti membersihkan muka manakala sinki yang berada di dapur adalah bertujuan untuk kegunaan aktiviti memasak dan membasuh pinggan. Sinki yang tersumbat dan rosak mendatangkan masalah kepada pengguna seperti air bertakung dan berbau serta menyebabkan aktiviti kebersihan tergendala sehingga mendatangkan kemudaratan kepada kesihatan manusia. Sehubungan dengan itu, satu kajian produk berupa sejenis penapis diperkenalkan bagi menyelenggara masalah sinki tersumbat. Reka bentuk penapis ini diaplikasikan pada sinki dapur sebuah rumah kediaman bagi mengelak perangkap singki daripada tersumbat dan berbau. Tujuan kajian ini adalah untuk menghasilkan penapis yang berfungsi menapis sisa makanan dan air sisa buangan dan dapat menentukan kadar kekeruhan dan bau air. Penapis ini diperbuat daripada acrylic iaitu sejenis bahan plastik yang menyerupai kaca. Ia juga tidak calar dan mudah untuk dicuci sekiranya terkena sisa minyak dan sebagainya. Bahan tapisan yang digunakan dalam rawatan air kotor adalah bahan organik seperti serat batang pasang dan sabut kelapa. Kelebihan bahan-bahan organik ini adalah mampu memerangkap minyak pada saluran sinki dan mudah untuk dicuci. Ujian kekeruhan air juga diuji dengan menggunakan ujian kejernihan air. Hasil ujian didapati bahawa air yang sebelum ditapis adalah lebih kotor berbanding dengan air yang telah ditapis. Ini dibuktikan dengan kekeruhan air adalah lebih jernih berbanding dengan air sebelum ditapis berwarna keperangan.

Keywords: Sinki, Penapis, Acrylic, Bahan Organik, Ujian kekeruhan

1. Pengenalan

Sinki adalah bekas yang digunakan sebagai tempat untuk membasuh tangan atau pinggan mangkuk. Sebuah sinki mempunyai pili air yang mengalirkan air sejuk atau panas yang kadangkala disertakan dengan ciri semburan untuk mencepatkan kadar aliran air. Sebuah sinki juga memiliki alur yang membenarkan air keluar dan kadangkala memiliki tempat penyimpan sabun. Namun, penggunaan yang meningkat menyebabkan masalah sinki tersumbat dan ianya sering terjadi di kalangan pengguna. Hal ini kerana sisa-sisa makanan dan minyak terperangkap dalam sinki telah meyebabkan saluran paip tersumbat. Selain itu, masalah rekabentuk paip dibawah sinki turut menyumbang kerja-kerja penyelenggaraan semakin sukar untuk dilaksanakan (Fred, 2010).

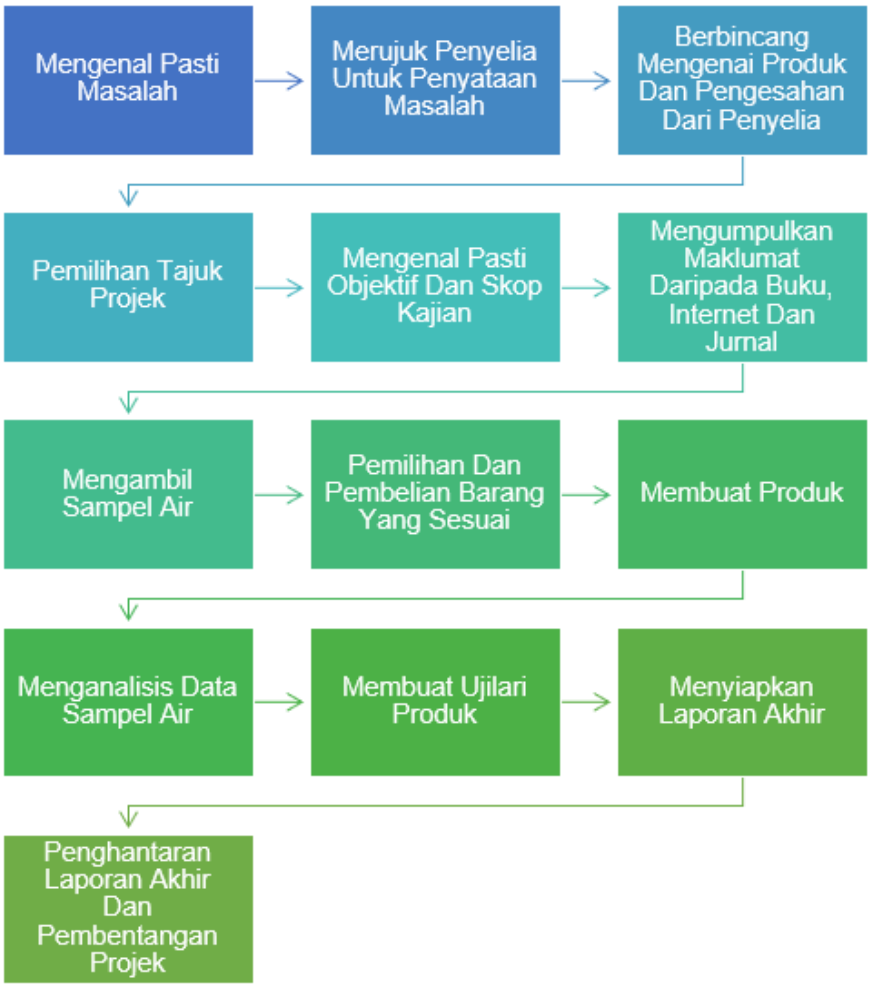
Masalah yang diperolehi daripada kajian awal ini ialah sinki dapur sering berlaku masalah kadar alir air yang disebabkan oleh sisa-sisa makanan yang terlalu banyak terkumpul. Ini menyebabkan sinki tersebut menjadi tersumbat dan mengeluarkan bau yang tidak menyenangkan. Selain itu, sinki yang tersumbat juga akan menggangu kerja-kerja di dapur seperti mencuci pinggan, membersihkan ikan yang disiang & perkara-perkara lain yang berkaitan dengan penggunaan sinki. Oleh itu, kajian ini bertujuan untuk merekabentuk satu produk penapis yang dapat menapis air sisa buangan daripada sinki agar dapat mengurangkan kadar kekeruhan air tersebut sekaligus mengurangkan masalah sinki tersumbat yang disebabkan oleh minyak. Skop kajian untuk projek ini adalah sinki yang ada pada bangunan rumah jenis pangsapuri. Hal ini kerana rumah-rumah pangsapuri masih lagi kekal menggunakan sinki jenis mangkuk ‘s’.

Secara amnya, penggunaan sinki amatlah penting di setiap rumah kediaman kerana ia merupakan keperluan untuk membuang sisa yang telah digunakan untuk memastikan kebersihan di kawasan dapur lebih bersih dan selesa. Kebanyakan masalah sinki tersumbat akibat daripada pembuangan sisa makanan dan minyak secara terus ke dalam sinki dan menyebabkan paip tersumbat. Hal ini kerana sisa-sisa makanan dan minyak tersebut akan tersumbat di dalam “gully trap” serta akan menyebabkan bau yang tidak menyenangkan kepada penghuni rumah tersebut akibat sisa makanan tersebut timbul ke permukaan sinki bersama air yang bercampur dengan minyak. “Gully trap” disediakan untuk mengelakkan bau busuk memasuki bangunan . Perangkap “gully trap” juga disediakan di luar bangunan sebelum menyambung ke saluran pembentong luar (Roger,2011).

2. Metodologi

2.1 Carta alir projek

Carta alir kerja/projek penghasilan projek adalah seperti ditunjukkan dalam Rajah 1. Rangka kerja disusun dengan lebih sistematik agar mudah dicapai pada tempoh masa yang ditetapkan.



Rajah 1: Carta alir penghasilan projek

2.2 Bahan penapis

Bahan organik yang digunakan adalah terdiri daripada medium-medium penapisan seperti berikut;

2.1.1 Sabut kelapa - Sabut kelapa digunakan sebagai medium penapisan yang berfungsi menyingkirkan pepejal terampai di dalam air. Bahan tercemar akan diserap semasa proses rawatan.

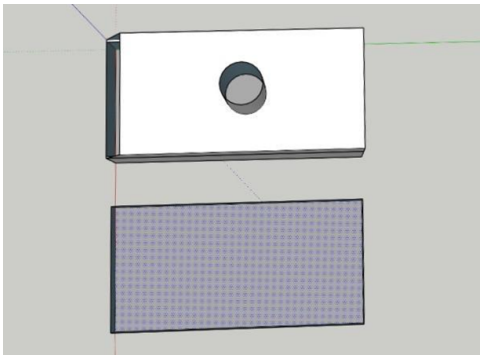
Rajah 2: Sabut kelapa

2.1.2 Batang pisang - Batang pisang yang telah dikeringkan merupakan salah satu bahan yang digunakan sebagai bahan serat yang berupaya menyerap minyak apabila terkandung diatas permukaan air termasuklah air dari sisa domestik.

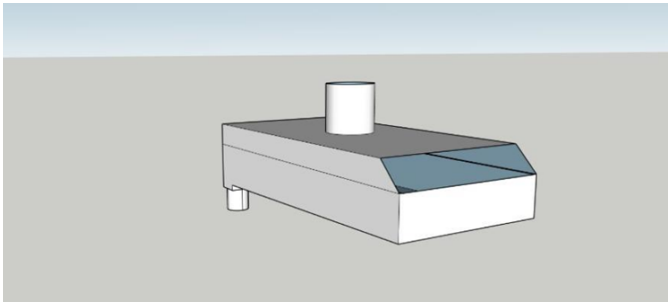
Rajah 3: Batang pisang yang telah kering

2.3 Prototaip penapis

Penapis telah direkabentuk seperti yang ditunjukkan pada Rajah 4 dan Rajah 5. Penapis menggunakan bahan acrylic bagi mengurangkan masalah minyak melekat pada penapis. Penapis dipasang dengan gabungan jaring dan kaca akrilik bagi membina komponen penapis yang direkabentuk.



Rajah 4: Pandangan lakaran daripada atas



Rajah 5: Pandangan lakaran daripada sisi

2.4 Ujian kekeruhan

Air sisa yang telah ditapis diuji dengan menggunakan pendekatan seperti ditunjukkan pada Rajah 6. Selain itu, penelitian tentang keberkesanaan pengurangan kekeruhan air sisa juga dilakukan bagi memastikan air yang dilepaskan dari sinki tidak terlalu kotor serta berminyak. Dengan kaedah ini air sisa akan kurang kotor sebelum ke saluran paip seterusnya.

a) Kekeruhan air sisa mengandungi sisa makanan

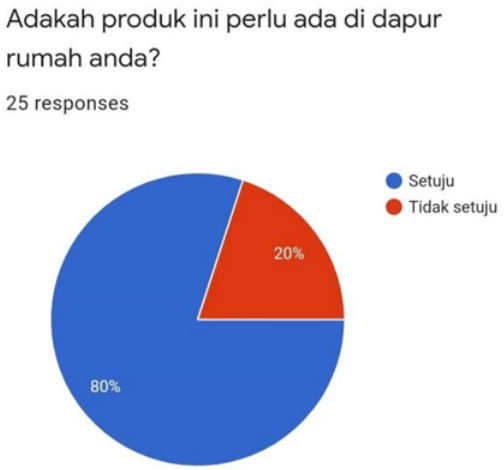
b) Kekeruhan air sisa mengandungi minyak

c) Kekeruhan air sisa mengandungi sisa makanan bersama campuran sisa dan minyak

Rajah 6: Keadaan air sisa yang diuji

3. Perbincangan

Produk “Food Scrap Collector” telah menjalani proses uji kaji dengan menapis sisa buangan makanan, lemak dan minyak. Ujilari produk ini dijalankan di perumahan pangsapuri ilham. Produk adalah stabil dan seimbang apabila proses penapisan dijalankan. Selain itu, masa yang diambil untuk proses penurunan air sisa buangan bersesuaian mengikut jangkaan semasa dijalankan. Antara masalah yang dihadapi oleh para pengguna dapur berdasarkan borang soal selidik yang telah diedarkan, kami dapati mereka kebanyakkan penghuni rumah/pengguna dapur kurang pengetahuan mengenai cara mengatasi masalah sinki tersumbat. Dengan itu, produk ini dapat membantu untuk mengurangkan masalah sinki tersumbat.



Rajah 7: Soalan akhir semasa soal selidik dijalankan pada 25 orang responden

Berdasarkan carta pai di atas, hasil analisis menunjukkan sebanyak 80% sangat setuju produk ini perlu ada si dapur rumah anda dan bagi responden yang tidak setuju 20%

4. Kesimpulan

Objektif utama bagi kajian ini ialah merekabentuk satu alatan yang dapat menapis sisa makanan dan juga mengurangkan minyak dan lemak sebelum terus ke perangkap di bahagian sinki. Setelah ujikaji dilakukan, air sisa buangan daripada sinki didapati lebih kurang berminyak dan kotor. Masa yang diambil untuk menapis sisa buangan sekitar 15 ke 20 saat sahaja. Hasil ujian juga dapat mengurangkan kekotoran air sisa buangan sekaligus dapat mengurangkan masalah sinki tersumbat. Secara keseluruhannya, dengan adanya ‘Food Scrap Collector’ ini ianya dapat mengurangkan sinki tersumbat yang berpunca di dapur rumah. Selain itu, produk ini dapat digunakan pada di setiap rumah dengan mudah dan selesa.

Penghargaan

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Rujukan

Richard, B and Paul, B. (2018). The Planning Guide To Piping Design. Gulf Professional Publishing. 2018, 3-38.

Fred Hall. (2010). Essential Building Services & Equipment, Fifth Edition. Heinemann Professional Publishing Ltd.

Jemes L.Kittle. (1987). Home Plumbing Made Easy and Illustrated Manual. Tab books Inc, Blue Ridge Summit.

Roger Greeno. (2011). Building Services Handbook, Sixth Edition: ncorporating Current Building& Construction Regulations.UK: Pearson-Longman.

FOPDT Modelling Transfer Function for ASWF Water Filter

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ABSTRACT

Floods are a natural phenomenon that frequently occurs in Malaysia. Flooding will cause water to become cloudy or turbid. In this situation, the supply of clean drinking water is the most affected component. Therefore, many researchers have designed a water filter system to overcome these problems. One of them is used chemical as a purifying agent, or known as coagulant and flocculation process. In this study, the researcher used Aluminium Sulphate as a coagulant agent and an aluminium sulphate water filter (ASWF) pilot plan as a flocculation process. Thus, the ASWF pilot plan will be controlled by an open-loop controller and a discrete plan modelling transfer function be developed in light of, the open-loop controller output. Subsequently, this modelling transfer function can be used to replace the actual plant. Conclusively, ASWF, transfer function model to be coupled with controllers such as PI, PID, MPC, FUZZY etc. for experimental purposes. Furthermore, the result will be evaluated the robustness and efficiencies of controllers to be the best tuning controllers that will be adopted in real-time process control for further investigation.

Keywords: Modelling, Turbidity, Water Filter, Controller, and Coagulant

1. Introduction

Malaysia is a country that often faces the problem of flooding (Zakaria et al. 2017). This is due to the average annual rainfall experienced by Peninsular Malaysia the average rainfall is around 2500 mm per year as recorded by the Malaysian Meteorological Department (Mohammed, Edwards, and Gale n.d.). The history of major floods in 2014 especially on the east coast of the peninsula, left a profound impact on all Malaysians (Akasah and Doraisamy 2015). In addition, the development of human civilization often occurred along the banks of rivers adjacent to water sources for irrigation and domestic users. Furthermore, land-use effects can cause significant changes in the hydrological regime of river basins (Al-Mamun et al. 2016).

Heavy rains coupled with inefficient drainage systems are also believed to be the cause of floods, which can cause specific pollution to drinking water systems, as floodwater carries harmful contaminants to consumers (Nayan et al. 2018). Floods contaminate drinking water through surface water sources, groundwater sources, and distribution systems (Olyaei, Karamouz, and Farmani 2018). The World Health Organization (WHO) produces guidelines on drinking water quality for public health protection to ensure that water safety plans are implemented effectively (Guidelines for drinking-water quality 1997). One of the problems faced by flood victims is obtaining a clean water supply for household needs (Jiang 2011).

There are several types of water filtration systems that can be used to treat sedimentation and turbidity problems. Based on previous research, various approaches of water filtration methods have been used to overcome the problem of clean water supply. For example, there are many forms of water filter elements nowadays, namely cloth (Mondal, Seth, and Biswas 2007), ceramic (Simonis and Basson 2011), carbon (Lou et al. 2014), and sand (Aslan and Cakici 2007). However, the existing set of water filters often used is to use filtering materials such as stone, sand, and cloth, which need to be backwashing rapidly when dirty. To overcome this problem, researchers use the chemical Aluminum Sulphate as a filtering agent to treat water turbidity (Huang et al. 2015).

In some cases, flood water is treated by using a chemical method known as a coagulant and flocculants process. Provided that, this process is accomplished by using a small packet of powdered ferrous sulfate or aluminum sulfate. Although this is a fact, to treating the floodwater, to be

used as portable water which is by using chemicals as a filtration agent. However, this process takes a certain time depending on the level of turbidity and also the quantity of the flood water to be filtered. Since the water filtration from the flood water is time-consuming for the whole process, due to prolong coagulation and flocculation process time (Bello, Hamam, and Djouani 2014). If the chemical dosage is low, the longer time needed to treat the water. On the other hand, with a higher amount of chemicals, the treatment process will be faster but it may cause health concerns to consumers (Aluminium in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality 1998).

With attention to control the coagulant and flocculants process, certainly requires a suitable controller over the process (de Paula et al. 2018). Extensive research has shown that there are various control methods have been proposed by the researchers to treat the floodwater using coagulant and flocculants process (Lu and Peng 2010), however, water filter with On/Off controller is the most popular method used. The past decade has seen the rapid development that, researchers have shown an increased interest in the water treatment process. The literature found that the research work on water treatment is focusing on water treatment plant itself, however, there are several researchers is focusing on coagulant control by using a certain controller such as a PI, PID, Fuzzy, Neural Network, SVM and MPC control technique to control optimum chemical dosage (Onat and Dogruel 2004). However, before you can implement the control system in the plant, it is necessary to model the plant in advance to mimic the behavior of the plant. In this study, researchers are using Matlab software as a simulation to model the plant transfer function of ASWF.

2. Methodology

2.1 Plant Description

ASWF consists of input and output components, in which the turbidity sensor module acts as an input and proportional solenoid valve and water pump as the output. These components are connected to Arduino mega board controlled by the computer as shown in Figure 1. MATLAB software is to monitor and analyze the input and output components. The data acquisition modules are required where Arduino mega card is used as the data acquisition module. Nephelometric Turbidity Unit (NTU) level of water is measured by turbidity sensor at the output stage. To control the amount of aluminum sulphate in the coagulation process, a proportional solenoid valve is used to control the liquid form of aluminum sulfate, that

is mixed with artificial clay water (acting as turbid water). In the flocculation process, the water pump is used to regulate the retention time.

Figure 2 shows the plant for ASWF, the purpose of this plant serves as a turbid water purifier. In addition, the ASWF is designed in two (2) control modes, which allow the system to control manually or automatically.

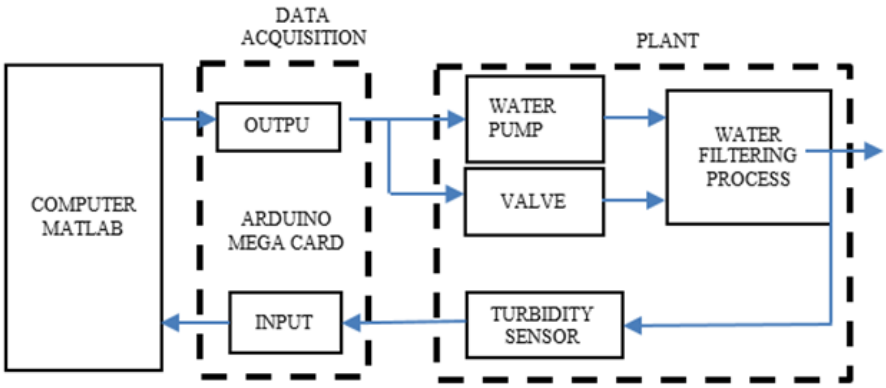

Figure 1: Block Diagram ASWF

Figure 2: ASWF Pilot Plant

2.2 Plant Operation

Floodwater is prone to contamination and needs to be treated if it is to be used as clean water. One method of treatment is by using chemical dosing, i.e. the coagulant process in water filter treatment. For example, inorganic coagulants (e.g., aluminum and iron salts) are used to remove debris and suspended solids in turbid water. In this study, the researcher used aluminum sulfate as a coagulation agent. In addition, the use of aluminum sulfate will effectively reduce the level of turbidity (Antov, Šćiban, and Prodanović 2012). Figure 3 shows the flow of the study ASWF water purification operation. Turbid water is channeled into a mixing tank and aluminum sulfate is added accordingly, this process is called the coagulant process. Then, mixed liquid is pumped to the mixing tank for the flocculation process by aluminum stage filtration. In aluminum staging filtration, Polyvinyl chloride (PVC) pipe measuring in diameter of 50mm x 4 feet is used. Aluminum staged filtration pipes are stacked vertically and connected by five (5) cylindrical tubes. The function of this cylinder is to trap the solid particles suspended at the bottom of the tube, separate the suspended particles and dissolve them from the turbid water by a flocculation process. After completing the five staging tubes, the water was purified as clean water. Finally, the turbidity sensor measures the level of water clarity in the NTU unit.

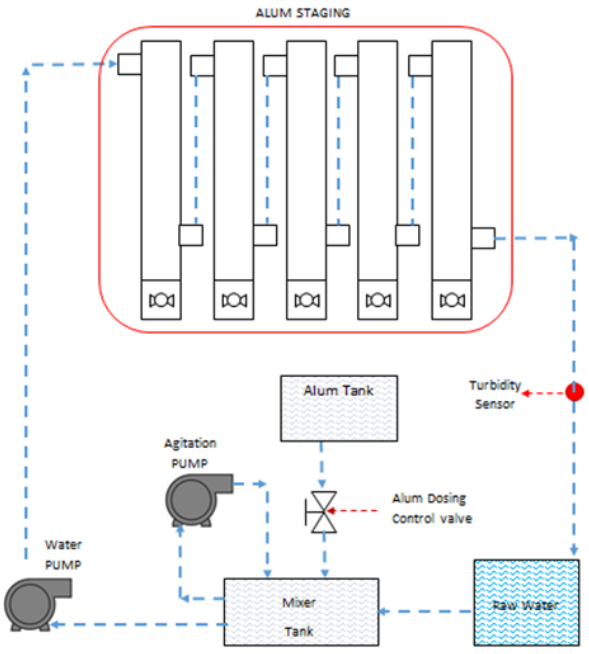

Figure 3: ASWF Schematic Diagram

2.3 FOPDT Model

FOPDT models are still considered a practical and appropriate model in industrial processes although there are various techniques for modeling a process such as a system identification application. Moreover, the FOPDT model offers a simple model structure that makes popular attention among researchers. The simplicity of the FOPDT model's structure is suitable since it has a lower order compared to high order and makes the tuning of the controller method can be carried out in a well-organized manner (Prusty et al. 2015). Three parameters involve in the FOPDT model are gain, time delay, and time constant. FOPDT can be represented and derived as a model structure depending on the input and output data of the measuring system (Yang and Seested 2013). Moreover, the FOPDT model is generated through a reaction curve process where its parameters are easily determined from this technique. The implementation of the FOPDT approximation is the reason why the model is popular in some applications (Rashid et al. 2017). Therefore, it shows that the FOPDT model as a linear model is efficient to be modeled to represent the behavior of the system and can be applied for further analysis in controller design.

The parameter such as gain (K), dead time (θ), and time constant (τ) is used to develop the FOPDT model. Although this model does not fully capture the overall features of some higher-order processes, however, it is often reasonable to describe those parameters of such processes. Several, the FOPDT approach was done by Astrom and Hagglund (Astrom and Hagglund 1995) in the tuning of the PID controller and other researchers used FOPDT in designing the advanced controller such as MPC, Self-tuning FuzzyPID (SFTPID) and others controller(Zhou et al. 2018). In addition, performing a dynamic test with an open-loop experiment at the actual plant will determine the process parameter of the FOPDT model. Moreover, the FOPDT model is used in obtaining the initial controller tuning constants. The parameters of FOPDT are shown in the equation below:

$$\frac{Y(S)}{X(S)} = \frac{Kp\, e^{-\theta s}}{\tau s+1}$$

Where Y(s) is the output process, X(s) is the input, K is the gain of a system, θ is the dead time and τ is the time constant.

2.3.1 Open Loop Control

Notably, the open -loop controller does not affect the input signal associated with the control action, due to not getting any signal to control the input system. Therefore, an open -loop system is not determined by the output signal or the measured condition or "feedback" for comparison with the system setpoint. Although there is load interference on the system, it is beyond the control of the open-loop controller in determining how the process responds to interference, so controller tuning is irrelevant when feedback is disabled (Yaun et al. 2015).The open-loop control for ASWF as shown in Figure 4 produces the reaction output curves and subsequently represents the modeling process as shown in Figure 6. The reaction output curves are probably the most popular output representation in identifying the dynamic model.

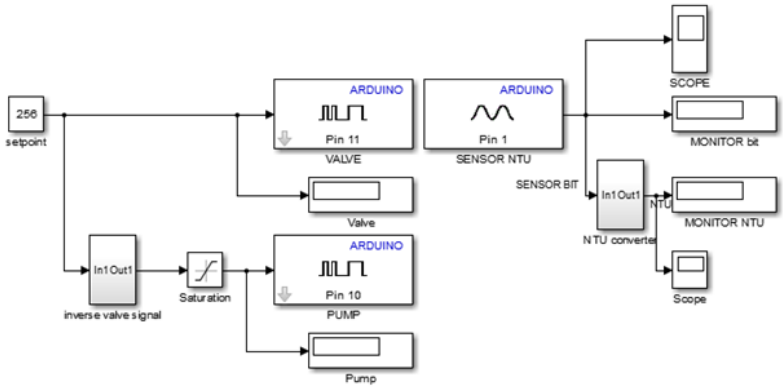

Fig. 4: ASWF Simulink Open-loop Control

2.3.2 Reaction Curves

Three (3) main dynamics of system components such as dead time (θ), gain (k) and time constant (τ) can be identified using the process reaction curve. There are two commonly used techniques in process reaction curves. The first method was adapted from Ziegler-Nichols (1942) in (Ziegler and Nichols 1995), which determined process characteristics based on the maximum slope of the output response relative to the time plot. The second method is based on graphical calculations as shown in Figure 5. Marlin suggests that the second method is preferred because of the difficulty in assessing the maximum slope and the usually larger errors that occur in estimating parameters such as k, τ and θ (Marlin 2015). The second method gives much better performance than the first method, where the second method involves two intersection points (t28 and t63) in the process reaction curve, unlike one intersection point on the first method.

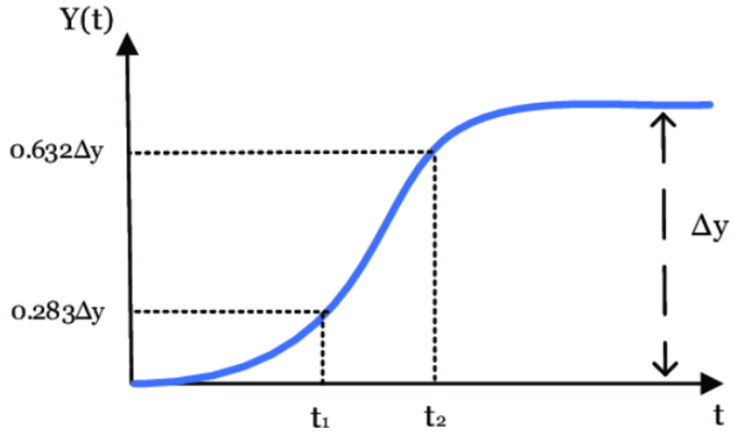

Figure 5: Reaction Curves 2nd Method

2.3.3 Simulation test

Henceforth, step testing is performed by setting specific values of the unit step function as input into the system (Mohammad et al. 2017). In particular, three types of testing techniques for capturing transient response performance, namely step testing, setpoint change, and load disturbance testing. However, in this study, this test has not been implemented to evaluate the durability of the controller performance, but only to design FOPDT modeling for ASWF that can be implemented for future simulation tests.

3.1 Results and Discussions

Particularly in this study, we set a 1023 byte as a setpoint value; indeed this is equivalent to 5V that gives full power for the water pump and proportional solenoid valve in an open-loop test to be operate. Additionally, the turbidity sensor collects the data and sends them as an output result for a reaction curve.

3.2 Reaction Curves

As a result, the reaction curves have been generated from the open loop controller output as shown in Figure 6. Using the graphical calculation extracted from ASWF reaction curves; the parameters of Δy, 0.63Δ, t63%, 0.28Δ, t28% have been determined as follows;

Δy = 1023 – 880 = 143 byte
0.63Δ =90.09 + 880 = 970.09 byte
∴ t63% = 2319 sec

$0.28\Delta = 40.04 + 880 = 920.04$ byte
$\therefore$ t28% = 394 sec

The time constant (τ), dead time (θ); and proportional gain Kp are calculated as shown in Table 1 respectively:

Table 1: Values for constant (τ), dead time (θ); and proportional gain Kp from the reaction curves

Time Constant (τ)	*Dead Time (θ)*	*Gain (Kp)*
= 1.5(t63 – t28)	*= t63% - τ*	*= Δy/Δu*
= 1.5(2319 - 394)	= 2319 – 2887.5	= (143) / (256)
= 2887.5 sec	= 568.5sec	=0.5585.

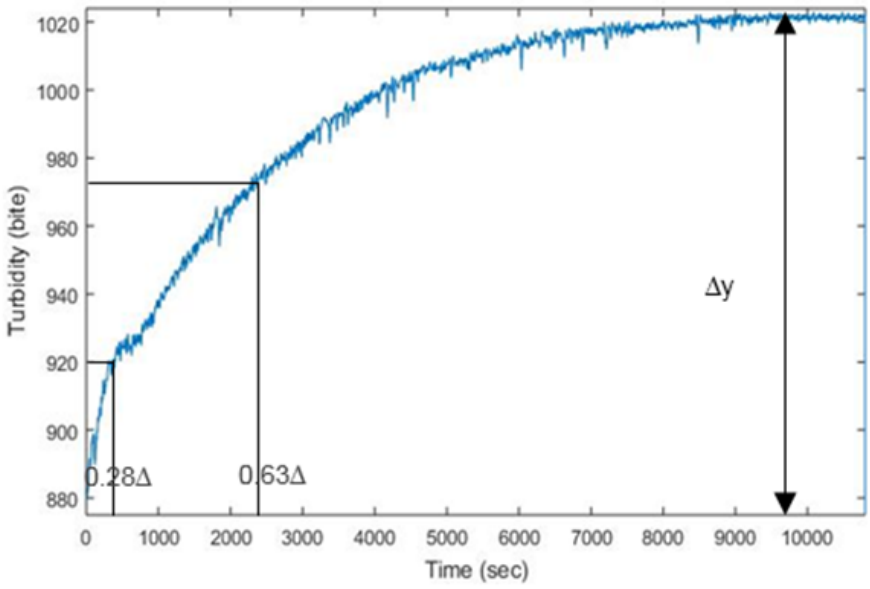

Figure 6: ASWF Reaction Curves

3.3 First Order Plus Dead Time (FOPDT) Modelling

A common empirical description of many stable dynamic processes is a first-order linear system with time delay. The FOPDT model is used to obtain initial controller tuning constants. The effect of the three adjustable parameters of FOPDT is shown in the equation below. Where the following parameters are obtained from the reaction curves shown in Table 1.

Kp = 0.5585, θ = 568.5, τ = 2887.5

The time constant (τ), dead time (θ); and proportional gain Kp are calculated as shown in Table 1 respectively:

Table 1: Values for constant (τ), dead time (θ); and proportional gain Kp from the reaction curves

$$Gp(s) = \frac{Y(s)}{U(s)} = \frac{0.5585\, e^{-568.5s}}{2887.5s + 1}$$

This model is used in Matlab simulation for various types of controllers which represent the process plant. Furthermore, from the FOPDT modeling process of the ASWF pilot plan, the controllers' simulations can be monitored and evaluated respectively.

4. Conclusion

The ASWF is successfully modeled using the FOPDT transfer function model based on the open-loop control technique; indeed the performance is based on transient responses analysis for ASWF. This model will be expanded in designing the controllers that representing a simulation of ASWF. Furthermore, this FOPDT transfer function model can be evaluated the performances among the controllers of PI, PID, FUZZY, Neural Network, MPC etc. for robustness test, including the comparative analysis of step, setpoint change and load disturbance test for future study.

References

Akasah, Zainal Abidin, and Sunitha V. Doraisamy. 2015. "2014 Malaysia Flood: Impacts & Factors Contributing towards the Restoration of Damages." Journal of Scientific Research and Development 2 2(14): 53–59. file:///C:/Users/USER/Dropbox/PhD Journey/Disaster Management Article/2014%5Cnzainal abidin et al%5Cn2014 malaysia flood. impacts & factors contributing towards restoration of damages.pdf.

Al-Mamun, Abdullah et al. 2016. "Impact of Improper Landuse Changes on Flash Flood and River System-A Case of Sg Pusu." ARPN Journal of Engineering and Applied Sciences 11(8): 5372–79.

"Aluminium in Drinking-Water: Background Document for Development of WHO Guidelines for Drinking-Water Quality." 1998. World Health Organization 2: 1–14. http://www.who.int/water_sanitation_health/dwq/chemicals/en/aluminium.pdf.

Antov, Mirjana G., Marina B. Šćiban, and Jelena M. Prodanović. 2012. "Evaluation of the Efficiency of Natural Coagulant Obtained by Ultrafiltration of Common Bean Seed Extract in Water Turbidity Removal." Ecological Engineering 49: 48–52.

Aslan, Sukru, and Hatice Cakici. 2007. "Biological Denitrification of Drinking Water in a Slow Sand Filter." Journal of Hazardous Materials 148(1–2): 253–58.

Astrom, Karl J., and Tore Hagglund. 1995. Instrument Society of America PID Controllers: Theory, Design and Tuning. 2 nd Ed. Triangle Park, NC: International Society of Automation. http://ci.nii.ac.jp/naid/10013391165/.

Bello, Oladipupo, Yskandar Hamam, and Karim Djouani. 2014. "Coagulation Process Control in Water Treatment Plants Using Multiple Model Predictive Control." Alexandria Engineering Journal 53(4): 939–48. http://dx.doi.org/10.1016/j.aej.2014.08.002.

"Guidelines for Drinking-Water Quality." 1997. World Health Organization WHO Geneva 3.

References

Huang, Yuk Feng, Shin Ying Ang, Khia Min Lee, and Teang Shui Lee. 2015. "Quality of Water Resources in Malaysia." In Research and Practices in Water Quality, InTech open. http://www.intechopen.com/books/research-and-practices-in-water-quality/quality-of-water-resources-in-malaysia (March 13, 2017).

iang, Xu Dong. 2011. "Water Reuse Practices and Development in China: A Review." 2011 International Conference on Electric Technology and Civil Engineering, ICETCE 2011 - Proceedings 11: 6392–95.

Lou, Jie Chung et al. 2014. "Analysis and Removal of Assimilable Organic Carbon (AOC) from Treated Drinking Water Using a Biological Activated Carbon Filter System." Journal of Environmental Chemical Engineering 2(3): 1684–90.

Lu, M, and F Peng. 2010. "Correlation Analysis of Flocculation Detection and Control Parameters Based on Multi-Target Tracking." 2010 Second WRI Global Congress on Intelligent Systems: 389–93. http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=5708784.

Marlin, T. 2015. Process Control. 2nd ed. McGraw-Hill.

Mohammad, Nurul Nadia et al. 2017. "Evaluation of Energy Consumption in Small Scale Distillation Pot Based on Integral Control Signal for Real Time Implementation." INTERNATIONAL JOURNAL OF ELECTRICAL AND ELECTRONIC SYSTEMS RESEARCH.

Mohammed, Nurashikin, Rodger Edwards, and Andrew Gale. "Optimisation of Flooding Recovery for Malaysian Universities." In Procedia Engineering 212, Bangkok, Thailand: ScienceDirect, 356–62, 2018. https://www.sciencedirect.com/science/article/pii/S1877705818300596.

Mondal, P K, R Seth, and N Biswas. 2007. "Performance Evaluation of Fabric Aided Slow Sand Filter in Drinking Water Treatment." Journal of Environmental Engineering and Science 6(6): 703–12.

Nayan, N et al. 2018. "Effect of Monsoon Flood to Groundwater Quality in Effect of Monsoon Flood to Groundwater Quality in Kuala." IOP Conf. Series: Earth and Environmental Science 145.

References

Olyaei, Mohammad Ali, Mohammad Karamouz, and Raziyeh Farmani. 2018. “Framework for Assessing Flood Reliability and Resilience of Wastewater Treatment Plants.” Journal of Environmental Engineering 144(9).

Onat, Mustafa, and Murat Dogruel. 2004. “Fuzzy Plus Integral Control of the Effluent Turbidity in Direct Filtration.” IEEE Transactions on Control Systems Technology 12(1): 65–74.

de Paula, Heber M., Marina Sangoi de Oliveira Ilha, Antover P. Sarmento, and Leonardo S. Andrade. 2018. “Dosage Optimization of Moringa Oleifera Seed and Traditional Chemical Coagulants Solutions for Concrete Plant Wastewater Treatment.” Journal of Cleaner Production 174: 123–32. https://doi.org/10.1016/j.jclepro.2017.10.311.

Prusty, Sankata B., Subhransu Padhee, Umesh C. Pati, and Kamala K. Mahapatra. 2015. “Comparative Performance Analysis of Various Tuning Methods in the Design of PID Controller.” IET Conference Publications 2015(CP683): 43–48.

Rashid, Abdul Razak Mohamed, Peer Mohamed Siddikhan, Chinnappan Selvakumar, and Maruthai Suresh. 2017. “The Performance Analysis of PID Controller with Setpoint Filter and Anti Integral Windup for a FOPDT Thermal Process.” Proceedings of 2017 3rd IEEE International Conference on Sensing, Signal Processing and Security, ICSSS 2017 (2): 440–43.

“Safe Drinking Water Is Essential.” 2007. Global Health and Education Foundation, National Academy Of Sciences. www.koshland-science-museum.org/water/html/en/Treatment/Coagulation-Flocculation-technologies.html.

Simonis, Jean Jacques, and Albertus Koetzee Basson. 2011. “Evaluation of a Low-Cost Ceramic Micro-Porous Filter for Elimination of Common Disease Microorganisms.” Physics and Chemistry of the Earth 36(14–15): 1129–34.

Yang, Zhenyu, and Glen T. Seested. 2013. “Time-Delay System Identification Using Genetic Algorithm - Part Two: FOPDT/SOPDT Model Approximation.” IFAC Proceedings Volumes (IFAC-PapersOnline) 3(PART 1): 568–73. http://dx.doi.org/10.3182/20130902-3-CN-3020.00117.

References

Yaun, Xiaoming et al. 2015. “Simulation Research of Hydraulic Turbine Generator under Fuzzy PID Control with Load Disturbance and 100% Load Rejection.” In Proceedings of 2015 International Conference on Fluid Power and Mechatronics, FPM 2015, , 1028–33.

Zakaria, Siti Fairus et al. 2017. “The Development of Flood Map in Malaysia.” In Proceedings of the 3rd International Conference on Construction and Building Engineering (ICONBUILD), AIP Publishing.

Zhou, Yang, Bojin Qi, Shuyu Huang, and Zhongzhen Jia. 2018. “Fuzzy PID Controller for FOPDT System Based on a Hardware-in-the-Loop Simulation.” In 2018 37th Chinese Control Conference (CCC), IEEE, 3382–87. https://ieeexplore.ieee.org/document/8482632/ (April 7, 2019).

Ziegler, J. G., and N. B. Nichols. 1995. “Optimum Settings for Automatic Controllers.” InTech 42(6): 94–100.

PERFORMANCE OF FLY ASH AS GEOPOLYMER BASED MORTAR IN STRENGTH PROPERTIES

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ABSTRACT

Geopolymer concrete/mortar is the typical material used in building construction and cement is replaced by pozzolanic material like fly ash and activated by alkaline solution. The study aims to investigate the potential of using fly ash as geopolymer mortar in fresh and hardened state properties. The performance of geopolymer mortar was compared with the control mortar at curing ages of 28 and 56 days. The tests include the determination of the chemical composition of cement and fly ash using the EDXRF technique, setting time, strength activity index, compressive strength as well as water absorption. The results showed that the fly ash geopolymer mortar provided better performance in strength and durability properties when cured in oven heating. However, geopolymer mortar showed lesser retardation of hydration activity compared to the control sample in setting time at room temperature. It is concluded that the utilization of fly ash is a promising construction product to be used as a sustainable green material for long-term performances.

Keywords: Geopolymer, fly ash, compressive strength, water absorption, EDXRF

1. Introduction

Concrete making material especially the application of cement as the main component of building construction has become man-made material in the world. Due to the increase in worldwide cement production, the emission of greenhouse gases, mainly carbon dioxide (CO2), affects climate change globally. It was estimated that the global cement production grew over 73% between 2005 and 2013 from 2,310 metric tons to 4,000 metric tons which also increased the amount of CO2 emissions subsequently (Mikulčić, Klemeš, Vujanović, et al., 2016). Several efforts have been done to address global warming issues by reducing the utilization of cement with the application of supplementary cementing materials known as geopolymer. These include the application of fly ash, palm oil fuel ash, rice husk ash, granulated blast furnace slag, and metakaolin, as well as the development of alternative binders to Portland cement.

The geopolymer concrete/mortar was introduced to reduce environmental impacts, specifically greenhouse emissions. Geopolymer is known as the reaction of solid aluminosilicate with highly concentrated alkali hydroxide or silicate solution to produce synthetic alkali aluminosilicate material which provides a solution to produce greener construction material for sustainable development (Davidovits, 1991). The properties of geopolymer depend on the raw material selection and processing conditions, whereas it can exhibit a wide variety of properties including high compressive strength, low shrinkage, chemical resistance, fire resistance and low thermal conductivity (Duxson, Fernández-Jiménez, Provis, et al., 2007). Geopolymer with the application of supplementary cementitious material as cement replacement due to their characteristics of pozzolanic properties improves the properties of concrete/mortar at long-term durability (Panesar, 2019). Major industrial waste including fly ash rich in silicon and aluminium in its components has been the subject of many researchers since a few decades ago. Fly ash is a by-product of pulverized coal blown into the fire furnace of the electricity-generating thermal power plant. It was estimated that the total fly ash production in the world was about 700 million tons per year but the utilization was only about 17-20% (Hardjito, Wallah, Sumajouw, et al., 2004). Besides, the generation of fly ash in thermal power plants also contributes to significant environmental defects such as air and water pollution. Upon this matter, a large number of innovative building materials and low-cost construction techniques have been developed and to be applied as construction products (Jain, and Dwivedi, 2014). Even though the usage of geopolymer is still developing in the earlier stage, many application products have been successfully

constructed utilizing geopolymer concrete/mortar (Hassan, Arif, and Shariq, 2020).

Recently, the application of fly ash-based geopolymer has been studied in performances of strength and durability properties (Patankar, Ghugal, and Jamkar, 2014; Wattimena, Antoni, and Hardjito, 2017; Zhuang, Chen, Komarneni, et al., 2016). However, there is less information on the effect of concentration of sodium hydroxide in terms of molarity at the solution to fly ash ratio of 0.44 on compressive strength after a specified period of heat curing of fly-ash based geopolymer mortar. This research thus aims to investigate the performance of fly ash-based geopolymer mortar in high strength properties.

2.0 Experimental Program

2.1 Raw Material Used

2.1.1 Fly Ash

Fly ash, a by-product of burning pulverised coal in a thermal power plant obtained from Kapar, Selangor, was used as the source material. As an attempt to be used as the binder material, the fly ash was sieved by the size of 75 µm for fineness.

2.1.2 Alkaline Activator

The solutions of sodium hydroxide (NaOH) and sodium silicate (NaSiO3) were used as activators in mixing materials. Both solutions had 12 molar concentrations and were readily obtained from the laboratory supplier. Sodium hydroxide is important in alkaline solutions as it plays the main role in geopolymerization.

2.1.3 Ordinary Portland Cement (OPC)

OPC complying BS EN 197-1: 2001 was used throughout the experiment. The characterization of elements present in Portland cement was measured by using an Epsilon3-XL EDXRF spectrometer. The application of the EDXRF technique is fast, economical and fully suitable for the determination of many matrix elements (Budak, Karabulut, Dogan, et al., 1999; Dogan, and Kobya, 2006; Eser, Kahraman, and Demiray, 2014). The chemical composition of cement was analyzed and compared with fly ash samples as shown in Table 1.

2.1.4 Fine Aggregate

Natural river-washed sand complying BS 882:1992 was used as filler material. The size of the sand was passing 2.36 mm and its fineness modulus was 1.92.

2.1.5 Water

The tap water was used for mixing the cement mortar. The w/c ratio used was 0.45.

3.2 Mix Proportions

The sample was prepared in two sets, which are fly ash geopolymer mortar and normal cement mortar as the control sample. The size of the cube used in the study was 50 mm x 50 mm x 50 mm and 12 samples were prepared. The mix proportion is shown in Table 2. The design mixes are added with a superplasticizer (Sp.) to improve the workability of geopolymer mortar.

Table 2: Mix design of geopolymer fly ash (GFAM)

	Fly Ash (g)	Cement (g)	Sand (g)	NaOH (g)	$NaSiO_4$ (g)	Water (g)	Sp. (g)
GFAM	1250	-	3750	138	415	10	25

3.3 Preparation of Geopolymer Mortar

The geopolymer mortar was cast with mixed proportions of sodium silicate, sodium hydroxide, sand, fly ash and superplasticizer. The fine aggregates and the fly ash were mixed dries in a pan mixer for 3 minutes. The alkaline solutions and the superplasticizer were mixed, then added to the solid particle and mixed for another 3 minutes. The fresh fly ash geopolymer mortar had a stiff consistency, dark in color, and was glossy in appearance. After mixing, fresh geopolymer mortar was placed in a mold and well compacted. The geopolymer was cured in an oven by setting the temperature of 70 °C until the testing days.

3.4 Strength Activity Index

The fly ash sample was investigated for its influences on the strength activity index after being mixed with cement. The strength activity index was calculated to determine the pozzolanic properties in a cementitious framework based on ASTM C 311. The mortar cube was prepared using 1:3 proportion of fly ash and sand following ASTM C109. About 20% replacement of cement with fly ash by weight of cement was used in the test sample. The data was recorded as a strength activity index percentage.

3.5 Setting Time

The initial setting time was conducted for both cement and geopolymer paste following ASTM C 191 standard. Each of the samples used Vicat apparatus and the penetration value was determined using the 1 mm needle after 45 minutes and the initial setting time was obtained.

3.6 Compressive Strength

The sample of mortar for both types was tested in a compressive strength machine to determine the compressive strength at 28 days and 56 days of curing age, respectively. The test complied with BS EN 12390-3:2009. The average of three values was taken as the strength value for all batches.

3.7 Water Absorption

This test was conducted to determine the percentage of moisture content in the samples. Water absorption measurements were carried out according to ASTM C140-03. The percentage absorption was calculated using the equation: Absorption (%) = [(W2 – W1)/ W1] ×100, where W1 = weight of specimen after complete drying at 105°C, W2 = final weight of the dry surface sample after immersion in water for at least 24 hours.

3.0 Results and Discussions

3.1 Characterization of Elemental Concentration

Elemental concentrations in Portland cement and fly ash samples are shown in Table 1. The determination of major and trace elements present in cement-based composites followed the validation of the EDXRF procedure by Mijatović, Terzić, Pezo, et al. (2019). It was observed that high percentages of Ca in cement samples were due to the presence of limestone (CaCO3) used as raw material in cement production.

Table 1: Concentration of elements with EDXRF analysis

Major Element	Portland Cement (%)	Fly ash (%)
Si	2.1	12.129
Al	0.497	6.285
Fe	2.476	5.321
Ca	49.01	4.814
Mg	0.201	0.165
S	0.496	658.4 (ppm)
K	0.384	0.921
Ti	0.123	1.808
P	-	0.412
Mn	973.2 (ppm)	545.7 (ppm)
Sr	-	0.521
Trace element		
Cr	12.1 (ppm)	263.4 (ppm)
Zn	447.5 (ppm)	181.2 (ppm)
Cu	-	237.1 (ppm)
As	-	-
Ni	-	303.6 (ppm)
Pb	-	122.5 (ppm)

As for the fly ash samples, it was found that large amounts of Si concentration were determined, followed by Al, Fe, and Ca in chemical analysis. Silica was the main constituent of the structural skeleton of the reaction product of geopolymer especially in the alkaline activation of the ashes. High reactive silica content was involved in the formation of high amount of alkaline aluminosilicate gel that developed high mechanical strength in geopolymer products. Besides Si, silica ion, Al was also considered important. The main product of the geopolymer was a polymeric chain consisting of silica and alumina which shared the oxygen ion bond and usually expressed as Si/Al ratio. The high amount of Si/Al ratio increased the compressive strength of geopolymer product (Chindaprasirt, De Silva, Sagoe-Crentsil, et al., 2012; Fernández-Jiménez,

and Palomo, 2003; Wattimena et al., 2017). Meanwhile, the relative elemental abundance in fly ash was found to be in the order of Ni > Cr > Cu > Zn > Pb. These concentrations were the results of product residue depending on the types and composition of coal, combustion process and efficiency of emission of control device (Dogan, and Kobya, 2006).

3.2 Effect of Fly Ash on Strength activity index

Figure 1 shows the compressive strength at 7 days. It was observed that the strength activity index for fly ash mortar was 98.1 %. This was due to the fineness of fly ash that contributed to the significance of pozzolanic activity that affected the mortar at early strength.

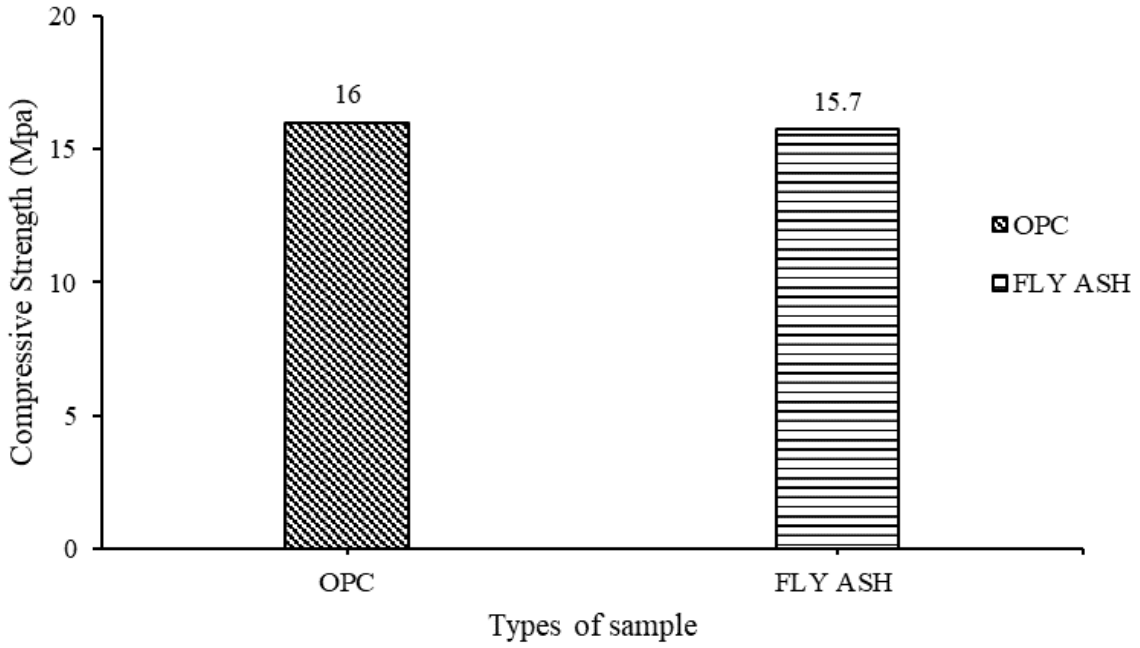

Figure 1: Comparison of strength activity index between OPC and fly ash mortar

3.2 Effect of Fly Ash Geopolymer Mortar in Initial Setting Time

The graph of the initial setting time is shown in Figure 2. It was observed that the fly ash paste sample had the highest value of penetration of 24 mm compared to cement paste which was 11 mm at room temperature. Setting time behavior mostly depended on the chemical compound of fly ash particularly the content of calcium oxide (CaO). Compared to the cement, calcium content percentage was much lower in fly ash samples, resulted in slow hydration rate. According to Wattimena et al. (2017), fly ash geopolymer which contains some amount of CaO does not need any heat to start the hydration reaction. Similar results were obtained by previous research which showed that fresh fly ash geopolymer paste did not harden at room temperature for at least one day (Hardjito, Cheak, and

Lee Ing, 2008). This attributed that fresh fly ash geopolymer paste had a slow hydration process without exposure to thermal temperature.

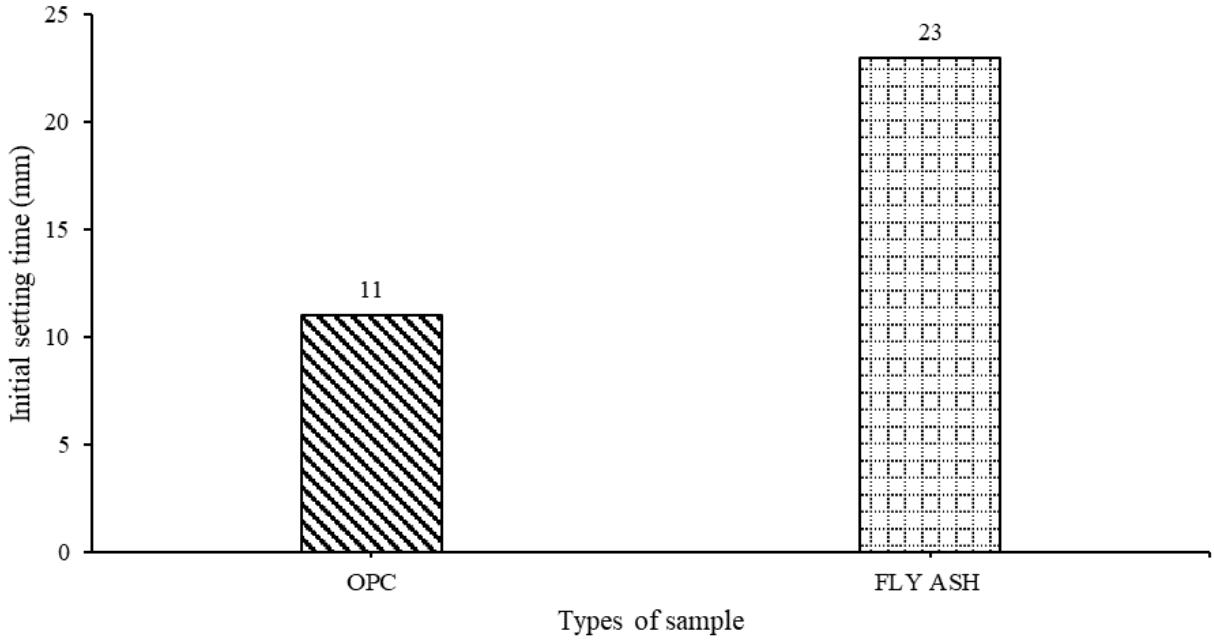

Figure 2: Comparison of initial setting time between cement and fly ash geopolymer paste

3.3 Effect of Fly Ash Geopolymer Mortar in Compressive Strength

The compressive strength tests of both types of samples were performed at 28 and 56 days as shown in Figure 3. The highest compressive strengths of 48.75 MPa and 70.55 MPa were produced from the fly ash geopolymer mortar at 28 and 56 days, respectively. It was also observed that the compressive strength of geopolymer mortar increased with increase in the test period up to 56 days. The geopolymer mortar increased the rate of gain of strength by approximately 45% at 56 days due to the effects of temperature curing conditions on the samples. According to Patankar et al. (2014), the suitable temperature for making geopolymer mortar is between 60 °C and 90 °C. However, the curing regime of over 120 °C heating temperatures would develop a crack on the geopolymer surface which subsequently produces a significant loss in strength. In this test, it was concluded that oven heating at 70 °C was sufficient enough to achieve strength for the geopolymer mortar sample.

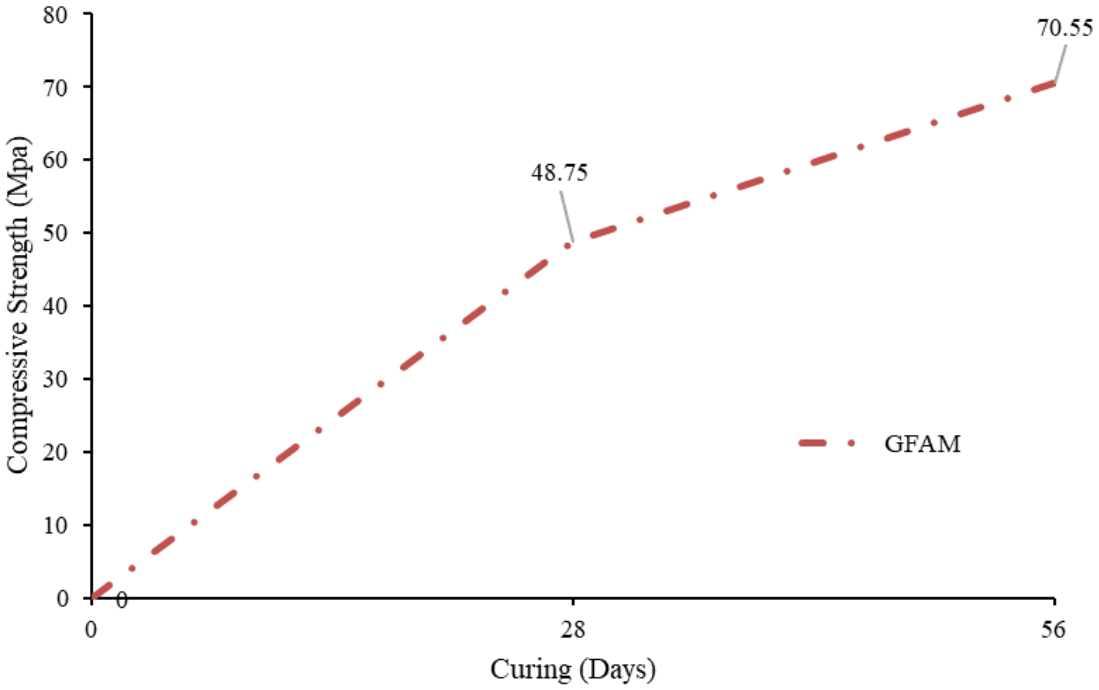

Figure 3: Results of compressive strength of geopolymer mortar at 28 and 56 days

3.4 Effect of Fly Ash Geopolymer Mortar in Water Absorption

Figure 4 shows the results of water absorption for both specimens. It was observed that the result of the water absorption test for geopolymer fly ash was 0.44%. This was due to possible polymerization results-producing geopolymer mortar which was less porous and had a permeable matrix.Water absorption was important to indicate the permeability and the degree of reaction for geopolymer mortar. The lower the water absorption the higher the resistance to water infiltration and towards environmental damage (Ahmari, and Zhang, 2012; Mostafa, 2010).

4.0 Conclusion

Based on the results obtained in the experimental investigation, the following conclusions are drawn:

1. The fineness of fly ash contributes to the strength activity index up to 98.1% when mixed with cement.
2. The reduction in rate of hydration reactivity in fly ash geopolymer paste occurs at room temperature.
3. The fly ash geopolymer shows high strength properties in oven heating curing.
4. The fly ash geopolymer mortar shows lower water absorption compared common cement mortar.

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

Ahmari, S., and Zhang, L. (2012). Production of eco-friendly bricks from copper mine tailings through geopolymerization. Construction and Building Materials, 29, 323–331. https://doi.org/10.1016/j.conbuildmat.2011.10.048

Budak, G., Karabulut, A., Dogan, O., and Levent, M. (1999). X-ray fluorescence analysis of trace elements in Mazi mountain ore. Journal of Trace and Microprobe Techniques, 17(3), 309–314.

Chindaprasirt, P., De Silva, P., Sagoe-Crentsil, K., and Hanjitsuwan, S. (2012). Effect of SiO2 and Al2O3 on the setting and hardening of high calcium fly ash-based geopolymer systems. Journal of Materials Science, 47(12), 4876–4883. https://doi.org/10.1007/s10853-012-6353-y

Davidovits, J. (1991). Geopolymers-inorganic polymeric new materials. Journal of Thermal Analysis, 37(8), 1633–1656.

Dogan, O., and Kobya, M. (2006). Elemental analysis of trace elements in fly ash sample of Yatağan thermal power plants using EDXRF. Journal of Quantitative Spectroscopy and Radiative Transfer, 101(1), 146–150. https://doi.org/10.1016/j.jqsrt.2005.11.072

Duxson, P., Fernández-Jiménez, A., Provis, J. L., Lukey, G. C., Palomo, A., and Van Deventer, J. S. J. (2007). Geopolymer technology: The current state of the art. Journal of Materials Science, 42(9), 2917–2933. https://doi.org/10.1007/s10853-006-0637-z

Eser, A., Kahraman, E., and Demiray, M. (2014). Comparison of atomic absorption spectroscopy and energy dispersive X-ray fluorescence spectrometer methods for chemical analysis. Asian Journal of Chemistry, 26(20), 6982–6988. https://doi.org/10.14233/ajchem.2014.17645

Fernández-Jiménez, A., and Palomo, A. (2003). Characterisation of fly ashes. Potential reactivity as alkaline cements. Fuel, 82(18), 2259–2265. https://doi.org/10.1016/S0016-2361(03)00194-7

Hardjito, D., Cheak, C. C., and Lee Ing, C. H. (2008). Strength and Setting Times of Low Calcium Fly Ash-based Geopolymer Mortar. Modern Applied Science, 2(4), 3–11. https://doi.org/10.5539/mas.v2n4p3

References

Hardjito, D., Wallah, S. E., Sumajouw, D. M. J., and Rangan, B. V. (2004). On the development of fly ash-based geopolymer concrete. ACI Materials Journal, 101(6), 467–472. https://doi.org/10.14359/13485

Hassan, A., Arif, M., and Shariq, M. (2020). A review of properties and behaviour of reinforced geopolymer concrete structural elements- A clean technology option for sustainable development. Journal of Cleaner Production, 245. https://doi.org/10.1016/j.jclepro.2019.118762

Jain, M., and Dwivedi, A. (2014). Fly ash – waste management and overview : A Review Fly ash – waste management and overview : A Review. Recent Research in Science and Technology 2014, 6(1)(january), 30–35. Retrieved from http://recent-science.com/

Mijatović, N., Terzić, A., Pezo, L., Miličić, L., and Živojinović, D. (2019). Validation of energy-dispersive X-ray fluorescence procedure for determination of major and trace elements present in the cement based composites. Spectrochimica Acta - Part B Atomic Spectroscopy, 162, 105729. https://doi.org/10.1016/j.sab.2019.105729

Mikulčić, H., Klemeš, J. J., Vujanović, M., Urbaniec, K., and Duić, N. (2016). Reducing greenhouse gasses emissions by fostering the deployment of alternative raw materials and energy sources in the cleaner cement manufacturing process. Journal of Cleaner Production, 136, 119–132. https://doi.org/10.1016/j.jclepro.2016.04.145

Mostafa, N. Y. (2010). Investigating the Possibility of Utilizing Low. Ceramics, 54(Mcl), 160–168.

Panesar, D. K. (2019). Supplementary cementing materials. Developments in the Formulation and Reinforcement of Concrete. Elsevier LTD. https://doi.org/10.1016/B978-0-08-102616-8.00003-4

Patankar, S. V., Ghugal, Y. M., & Jamkar, S. S. (2014). Mix Design of Fly Ash Based Geopolymer Concrete. Advances in Structural Engineering. Advances in Structural Engineering: Materials, Volume Three. https://doi.org/10.1007/978-81-322-2187-6

Patankar, S. V, Ghugal, Y. M., and Jamkar, S. S. (2014). Effect of Concentration of Sodium Hydroxide and Degree of Heat Curing on Fly Ash-Based Geopolymer Mortar. Indian Journal of Materials Science, 1.

References

Umniati, B. S., Risdanareni, P., and Zein, F. T. Z. (2017). Workability enhancement of geopolymer concrete through the use of retarder. AIP Conference Proceedings, 1887(September). https://doi.org/10.1063/1.5003516

Wattimena, O. K., Antoni, and Hardjito, D. (2017). A review on the effect of fly ash characteristics and their variations on the synthesis of fly ash based geopolymer. AIP Conference Proceedings, 1887(September). https://doi.org/10.1063/1.5003524

Zain, H., Abdullah, M. M. A. B., Hussin, K., Ariffin, N., and Bayuaji, R. (2017). Review on Various Types of Geopolymer Materials with the Environmental Impact Assessment. MATEC Web of Conferences, 97. https://doi.org/10.1051/matecconf/20179701021

Zhuang, X. Y., Chen, L., Komarneni, S., Zhou, C. H., Tong, D. S., Yang, H. M., ... Wang, H. (2016). Fly ash-based geopolymer: Clean production, properties and applications. Journal of Cleaner Production, 125, 253–267. https://doi.org/10.1016/j.jclepro.2016.03.019

SMART WINDOW

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ABSTRACT

Kebanyakan kemalangan yang berlaku di dalam rumah adalah disebabkan kebakaran. Di akhbar atau berita di televisyen kebanyakan kes kematian yang berpunca dari kebakaran adalah kerana mangsa terperangkap di dalam bangunan. Ini kerana kebanyakan pemilik bangunan memasang penghadang pada tingkap. Penghadang yang dipasang menyebabkan tingkap tidak boleh dijadikan sebagai laluan kecemasan. Dalam kajian kami, asap menjadi punca kematian, tiada laluan alternative lain selain pintu. Tujuan penghasilan produk ini adalah menyediakan bukaan pada bangunan supaya asap dikurangkan. Seterusnya, tingkap dijadikan laluan keluar ketika kebakaran dan mengesan kehadiran asap/gas dengan lebih cepat. Pengumpulan data melalui kaedah kuantitatif dapat dikumpul dengan menggunakan platform Google Form. Melalui kaedah kualitatif pula, data dapat didapati melalui kaedah kajian lapangan iaitu temubual pegawai bomba dan kajian perpustakaan iaitu penyelidikan bahan-bahan bercetak. Hasil kajian projek ini didapati bahawa smart window dapat mengurangkan masalah kebakaran dengan cekap. Ini terbukti dengan 50.4 % responden sangat setuju terhadap produk perlu diaplikasikan pada setiap rumah. Kesimpulannya, produk ini berpotensi untuk mengurangkan masalah terperangkap semasa kebakaran dan boleh mengurangkan kadar kemalangan. Antara penambahbaikan projek yang boleh dilakukan adalah peningkatan kepekaan sensor untuk mengesan kehadiran gas atau asap. Seterusnya, meningkatkan kelajuan motor yang mampu memberikan daya yang tinggi terhadap pergerakan tingkap.[1] Penulisan abstrak yang ringkas dan padat

Kata kunci: Kemalangan, bukaan, kecemasan, laluan alternative, sensor

1. Pengenalan

Smart Window dicipta untuk mengurangkan jumlah asap yang terperangkap didalam bangunan. Dengan wujudnya teknologi ini, masa yang diambil oleh asap untuk memenuhi ruang di dalam bangunan adalah secara drastik. Smart Window didatangkan dengan sensor asap yang berfungsi untuk membuka tingkap secara automatik apabila asap dikesan. Hal ini akan menyebabkan asap dapat keluar dari bangunan dan secara tidak langsung kadar asap didalam bangunan dapat dikurangkan. Objektif kajian ini ialah mengesan kehadiran asap dengan lebih cepat dengan menggunakan sensor yang efektif. Skop kajian ialah tertumpu pada sebuah bangunan satu tingkat berukuran 1200 kaki persegi yang mengunakan tingkap jenis swing window yang berukuran 90cm x 60cm. Dengan terhasilnya produk inovasi smart window ini, dapat mengurangkan masalah kematian disebabkan asap semasa kebakaran.

2.0 Metodologi

Perancangan kerja mengenai metodologi yang ingin diaplikasikan ke atas sistem yang telah dibangunkan, keperluan perkakasan dan perisian, pendekatan terhadap rekabentuk dalam membangunkan sistem dan justifikasi kepada metodologi yang dipilih serta perancangan kerja bagi tujuan perlaksanaan sistem. Kesemua perkara tersebut adalah penting ketika melakukan kajian bagi memastikan keberkesanan projek.

2.1 Komponen

Komponen ini dibahagikan kepada dua bahagian iaitu bahan lekapan tingkap dan komponen elektronik. Bagi bahagian lekapan tingap, pemasangan bingkai tingkap memerlukan proses fabrikasi, pencanaian dan pemotongan besi. Bagi bahagian elekronik pula, penyambungan litar elektronik bagi Smart Window memerlukan proses sistem programming dan kemahiran yang tinggi oleh rakan kolaborasi.

i) Bahagian Lekapan Tingkap
- Tingkap berengsel
- Besi hollow
- Spray

ii) Bahagian Elektronik
- Linear Actuator 12v 750N 700mm
- Arduino Uno R3
- Single Channel 12v Relay Breakout Board
- RCSwitch10-RC Controlled Relay Switch
- MQ-2 Smoke Detection Sensor

2.2 Proses fabrikasi projek

Pelaksanaan projek Smart Window ini difabrikasikan dengan beberapa pelaksanaan untuk membentuk dan menghasilkan apa yang telah didrafkan pada carta alir proses reka bentuk. Antara langkah-langkah bagi menghasilkan projek ini ialah:

i) Merangka rekabentuk bingkai bagi tingkap yang telah tersedia.

ii) Mengukur dimensi tingkap untuk menghasilkan bingkai tingkap yang sempurna.

iii) Pemilihan jenis besi yang kukuh yang dapat menampung berat tingkap tersebut.

iv) Setelah membuat pengukuran dan pemilihan besi, kerja kerja-pemotongan besi dilakukan menggunakan mesin pemotong besi

v) Setelah selesai, besi yang telah dipotong mempunyai kesan pemotongan besi atau lebihan besi. Mesin pencanai digunakan untuk menanggalkan kesan serpihan yang tertinggal pada besi yang telah dipotong bagi kelihatan kemas.

vi) Seterusnya, besi-besi yang telah dipotong tadi dicantumkan menggunakan mesin kimpalan MIG mengikut bentuk yang telah dirancang dan direka

vii) Mesin grinder tangan digunakan bagi melicinkan atau mencantikkan lagi bahagian permukaan yang telah dikimpal. Akhir sekali, setelah kesemuanya selesai, proses pengujian dijalankan bagi mendapatkan data yang lengkap

Rajah 1: Ujilari projek yang telah dipasang dengan kompenen elektronik

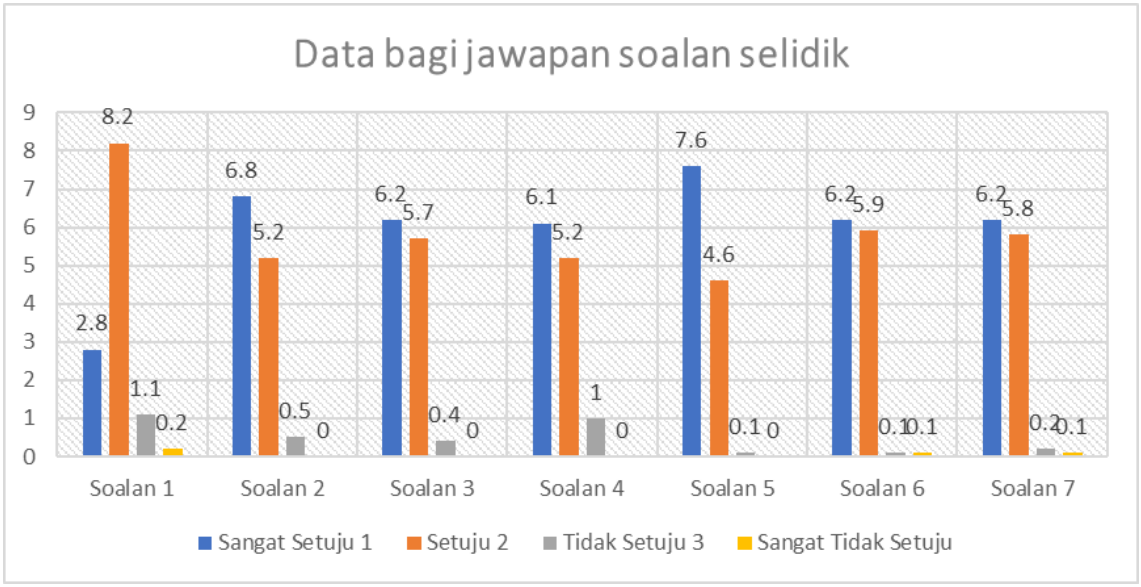
2.3 Instrumen soal selidik

Tujuan soal selidik dihasilkan bagi mengetahui tinjauan tahap kepuasan pengguna terhadap penghasilan produk smart window ini. Teknik pensampelan adalah menggunakan teknik pensampelan kebetulan. Teknik ini mudah digunakan dan responden didapati secara sukarela (Kamarul Sukri, 2015). Sebanyak 7 soalan telah dikemukakan dan diukur dengan mengguunakan skala likert dengan pecahan soalan seperti berikut;

1. Latarbelakang demografi responden
2. Pendapat responden
3. Dapatan

3.0 Analisis Data

Analisis yang dilakukan ini adalah berkaitan dengan dapatan kajian yang diperolehi iaitu mengandungi interpretasi yang merangkumi keseluruhan ruang lingkup mengenai objektif kajian yang telah dikemukakan. Sehubungan dengan itu, perbincangan dalam analisis ini akan menumpukan kepada menjawab kesemua persoalan kajian yang telah dikemukakan di dalam Metadologi Kajian yang melibatkan soal selidik responden dan temu bual. Dapatan soal selidik ini dibahagikan kepada dua bahagian iaitu mengenai latarbelakang responden dan pendapat responden terhadap penghasilan smart window. Borang soal selidik ini diagihkan khususnya kepada penghuni kawasan kejiranan TTDI Jaya dan sampel saiz adalah seramai 123 orang.



Rajah 2: Data responden hasil daripada soal selidik produk smart window yang telah diedarkan

Hasil daripada perlaksanaan pengagihan borang soal selidik dan pengumpulan data analisis yang telah dibuat, secara purata 98% responden amatlah menyokong penghasilan projek Smart Window ini. Kajian ini mencapai objektif dan sasarannya.

4.0 Perbincangan

Bagi projek Smart Window, ujilari projek yang telah dipasang dengan kompenen elektroniktelah dilakukan mengikut kepekaan sensor pengesan asap/gas. Tingkap ini juga boleh terbuka secara automatik jika sensor kebakaran mengesan kehadiran gas atau asap sehingga AQI (Air Quality Index) menunjukkan bacaan lebih dari 150. Bagi menutup semula tingkap, suiz manual atau aplikasi 'BLYNK' boleh digunakan. Seterusnya, Smart Window juga boleh dikawal secara manual iaitu dengan menggunakan suis. Keberkesanan projek ini juga dapat dilihat melalui bukaan tigkap yang terbuka selepas mengesan kehadiran gas/asap. Masa yang diambil bagi tingkap ini terbuka ialah 50 saat dengan kapasiti 1500N, panjang stroke 200mm dan voltan adalah sebanyak 12VDC. Melalui kesemua spesifikasi berikut tingkap ini mampu terbuka seluas 90o.

5.0 Kesimpulan

Hasil kajian dapat disimpulkan bahawa Smart Window dapat mengurangkan jumlah asap yang terkumpul di dalam rumah ketika berlakunya kebakaran. Produk ini dapat mengesan kehadiran asap/gas dengan cekap dan boleh dijadikan sebagai laluan kecemasan alternatif selain daripadapintu utama.

Penghargaan

Penulis merakamkan penghargaan kepada Jabatan Kejuruteraan Awam, Politeknik Sultan Salahuddin Abdul Aziz Shah atas kemudahan makmal yang disediakan.

Rujukan

Kamarul Sukri Mat The (2015). Kaedah Pensampelan. Dicapai secara online pada 26 Julai 2020 di https://www.slideshare.net/wmkfirdaus/pensampelan

Standart Industri Pembinaan (CIS), CIS 2: 1998 Standart Perumahan Kebangsaan bagi Perumahan Kos Rendah Rumah Pangsa, Kemasan dan lekapan yang minimum, 31.

Uniform Building By-Law (UBBL) 1984, By Law 39, Natural Lighting and Ventilation , 28

ROLLING MAT MACHINE

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ABSTRACT

Malaysia is a country where the majorities are Muslims. Therefore, they need to take the responsibility to ensure the comfort, cleanliness, and safety of the congregation by adding prayer rooms using roll mats. During the fasting month, prayer mats are in high demand because Muslims come to the mosque to pray. The problem faced is to repack the mat after the ceremony or prayer because the mats are numerous. If barehanded, many tasks are encountered, such as bending when rolling, untidy rolls, and taking time to complete one roll. Hence, our project's invention reduces the risk of back pain, saves time, and the mat rolls' neatness. This rolling mat machine's innovation facilitates mosques and schools' work because of that with little effort. First, insert the mat into the iron chopsticks and switch on the electric motor. Once the mat is rolled up, open the door connected to the mat chopsticks to bring the mat roll out of the iron chopsticks. Finally, we get a neat and tidy mat roll effortlessly. The school agreed that the project could reduce students' time when repacking the mat after the ceremony. An enhancement for our project is the type of motor that is suitable for use. Initially, we planned to use a fan motor, but it failed to activate the roller chain because its voltage was too low. Thus, we treasure a higher voltage motor like my1016z motor.

Keyword: Automatic Rolling Mat Machine

1.0 Introduction

Malaysia is a multicultural and multiconfessional country whose official religion is Islam. As of the 2010 Population and Housing Census, 61.3 percent of the population practices Islam; 19.8 percent Buddhism; 9.2 percent Christianity; 6.3 percent Hinduism; and 3.4 percent traditional Chinese religions. The uses of mats in mosques or schools are very high because most Muslims use mats in mosques to perform worship. As of Friday, the use of mats intensely increased because it is the day for Muslims to perform prayers. Schools also used mats as a way to avoid dirt from student's clothes. The reason is, students are sitting on the walking path. In schools, many mats are used because the number of students and activities at the school are more than in the mosque. In this growing age, we have been inspired to simplify mats' work by creating a mat roller machine. But the creation of these mattresses has come to fruition when looking at mosque or prayer room users who find it challenging to roll mats. Besides, we also want to reduce the damage rate to the mats that are not rolled up neatly and are left untidy.

As we know, the process of rolling mats might take time and energy, especially at the waist. These works are often done by young people because the older cannot endure the pain in the waist due to age factors. Women also feel a bit burden when doing this work. The mattress roll is also a little messy because the mats are not as heavy as the carpet. The mass of the mat is lighter than the carpet. Therefore, this project's primary purpose is to reduce labor, save time, speed up the work process, and have a good and organized mattress roll. By creating a rolling mat machine, all of the problems that we faced can be solve. An enhancement for our project is the type of motor that is suitable for use. Initially, we plan to use a fan motor, but it failed to activate the roller chain because its voltage was too low. Thus, we treasure a higher voltage motor like my1016z motor.

2.0 Methodology

The rolling mat machine employed project methodology, as illustrated in Figure 3.1. Before starting with the project design, we collected data by survey from the Polytechnic Sultan Abdul Aziz Shah (PSA) students. The research is conducted using the Google Form method. The data obtained are used to improve the design and function. The questionnaire used consisted of a 5-point type format (1 = strongly disagree to 5= strongly agree) divided into 3 sections. The first part examines the personal information that was gender, age, and positions.

In the survey, we conducted that on 50 persons that were 35 males and 15 females. Then, there was the majority of 18-25 ages' response the research. The positions were including the students and the Muslims and prayers. The second part is about the design acceptance of our product. From the result, they strongly agree that our product must be lighter so it can be suitable for all of us, even the ages and genders. Next, they are also strongly agreeing that our product can help to lower the risk of injuries. The third part is about overall opinions, design improvement suggestions. They have given some opinions that we can innovate it to become automatic, that need to use the apparatus is motor to save the time and energy. The data collected and analyzed so that we can get ideas on the product. The data collected were used to improve our product and make a little change.

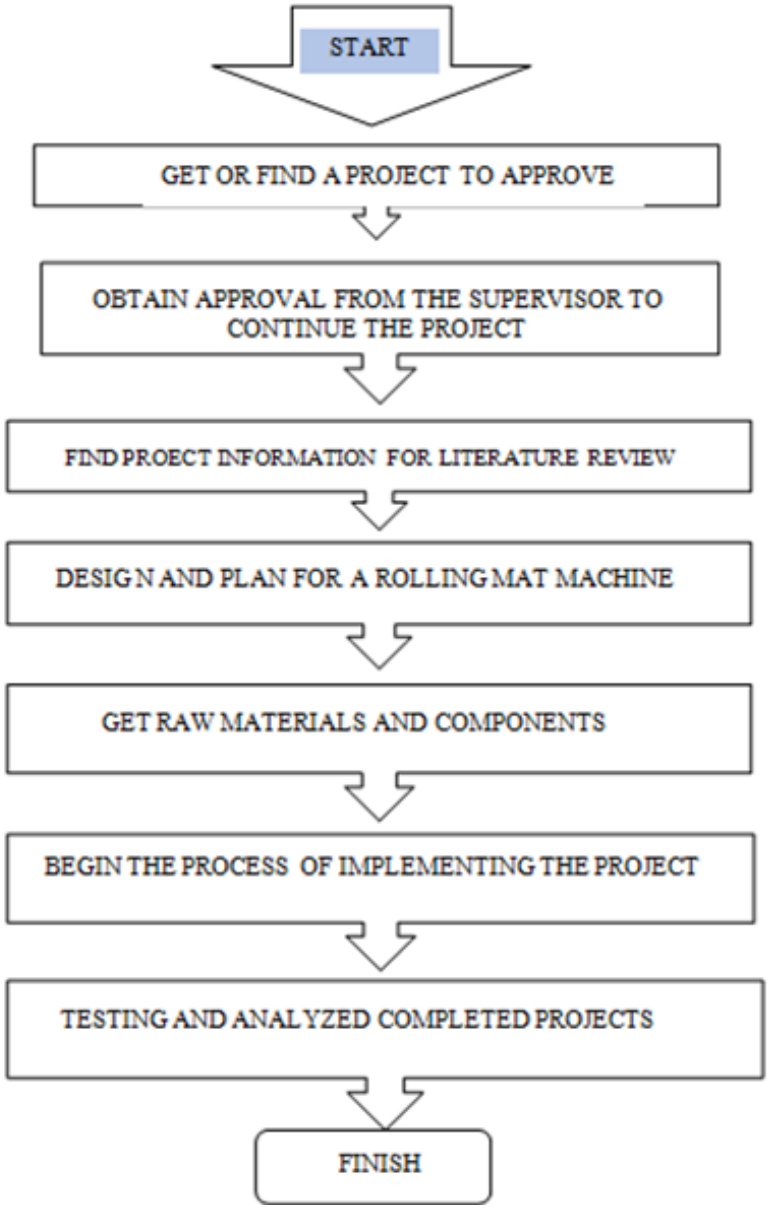

Figure 3.1

3.0 Result & Analysis

The project rolling mat machine was designed to save time and energy and speed up the work process. This project's objective is to reduce the risk of back pain and have a good and organized mattress roll. In the beginning, we planned to use a hand-adjusted roller mat, but it took a very long time to wind up the mat. We changed our plans using my1016z motor. This motor can make our product become automatic and can save energy, workforce and time. Time is significant to all of us. If we use the machine with manual, maybe we need to take 5 minutes to collect all the mates, but if we innovate it to the automatic, the work could be done in 1 minute. This motor gives a very high speed. This method allows the winding of mats to be done very fast. Project Design was successfully proposed and fabricated according to the designed material and fabrication method, as shown in Figure 4 (a) and Figure (b).

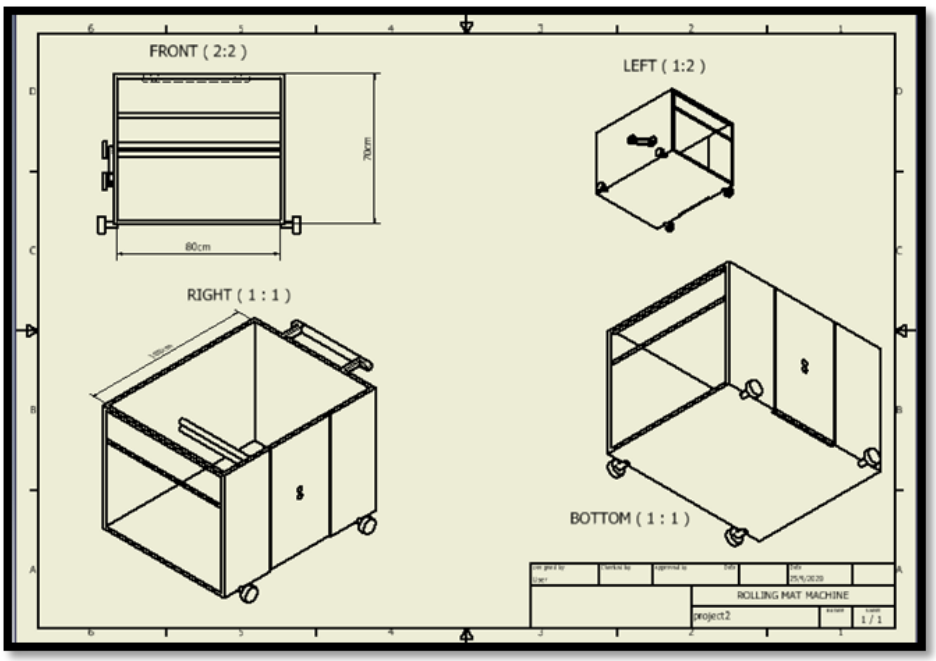

Figure 4 (a) Product Design

Figure 3.1

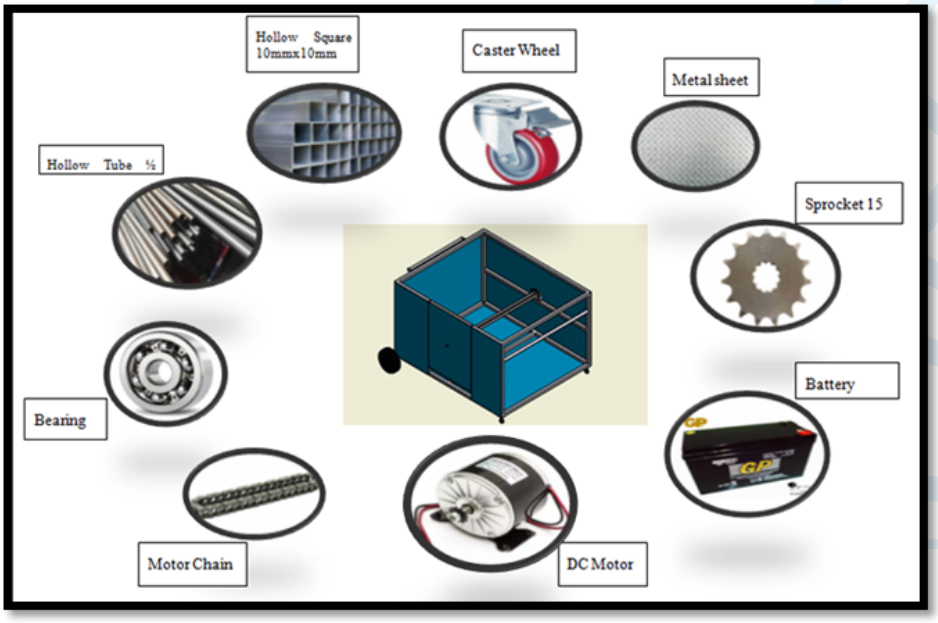

Figure 4(b) Product Fabrication

Product testing,

On the other hand, on the first attempt, while using an 80w powered motor, the spin movement was prolonged. The motor takes 3 minutes to complete a mat roll. On the second attempt, we tried to use a 240w powerful motor. The spin movement of the motor takes 1minute 28 seconds. But the time result still does not satisfy our needs. For the last experiment, we used a powerful 750w motor. The last results are very satisfying for our will. It only takes 1 minute to complete one roll of mats.

Moreover, this product is very durable and antirust. It can move smoothly. Nevertheless, this product can carry at least 3kg of roll mat. Finally, it can be concluded that the stated objectives were achieved and implemented effectively. Figure 5 exhibits the finished product achieved design objectives

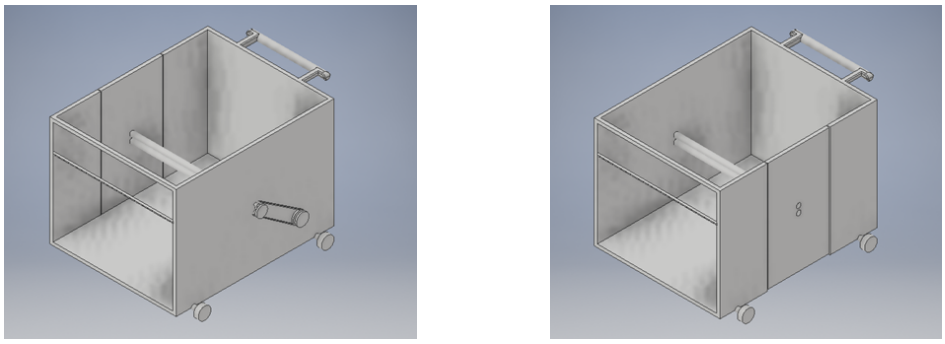

Figure 5: Finish product development

4.0 Conclusion

Through this project, it helps to speed up time as well as work to roll mats. The issue for us to create this project is to help mosque workers or students from school because sometimes the mosque or school will have an event that takes about a week, so it takes a lot of energy and time to make the program a success. We decided to create a rolling mat machine to cut from using a lot of time and energy. Our product also makes sure the consumer's health is guaranteed. Other than that, to create a safer environment, choosing a battery instead of oil is an eco-friendly environment.

Acknowledgment

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References

[1] Industrial Matting – Notrax® Ergonomic Anti-Fatigue & Safety Matting – Notrax® Mats for Professional Use

[2] https://en.wikipedia.org/wiki/Hollow_structural_section

[3] Central Steel & Wire Company Catalog". Central Steel & Wire Company Catalog (2006– 2008 ed.): 151.

[4] https://en.wikipedia.org/wiki/Sheet_metal

[5] "wheel". Online Etymology Dictionary. Archived from the original on 3 July 2017. Retrieved 28 March 2007.

[6] "Definition of GEAR". www.merriam-webster.com. Retrieved 20 September 2018.

[7] https://en.wikipedia.org/wiki/Gear

[8] https://en.wikipedia.org/wiki/Bearing_(mechanical)

[9] Merriam-Webster, "headwords "bearing" and "bear"", Merriam-Webster's Collegiate Dictionary, online subscription version

[10] https://en.wikipedia.org/wiki/Chain_drive

[11] Herman, Stephen. Industrial Motor Control. 6th ed. Delmar, Cengage Learning, 2010. Page 251.

[12]^ Ohio Electric Motors. DC Series Motors: High Starting Torque but No Load Operation Ill-Advised. Ohio Electric Motors, 2011. Archived October 31, 2011, at the Wayback Machine

[13] battery hazards". YouTube. Retrieved 20 September 2018.

[14] https://en.wikipedia.org/wiki/Webster%27s_Dictionary

[15] https://www.healthline.com/health/back-pain

KAJIAN DAN ANALISIS PASARAN PROGRAM SIJIL REKABENTUK DALAMAN 2013-2020

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ABSTRAK

Sebagai salah satu pemain utama dalam penawaran program Sijil Rekabentuk Dalaman (SRD) sejak tahun 2010, Kolej Komuniti Shah Alam (KKSA) telah melahirkan 169 graduan bidang ini. Kolej Komuniti Shah Alam perlu menganalisis pasaran kerja oleh alumni yang telah tamat untuk melihat keberhasilan program yang ditawarkan. Kajian ini secara khusus memfokuskan hasil pembelajaran program Sijil Rekabentuk Dalaman di KKSA. Responden terdiri daripada majikan alumni KKSA yang sedang bekerja di syarikat mereka. Analisis data adalah berbentuk deskriptif dengan menganalisis menggunakan peratus. Hasil menunjukkan 83 % menyatakan kandungan dan kesesuaian program dengan keperluan organisasi, separuh daripada responden berpendapat alumni ini sesuai diberikan gaji sebanyak RM1000 hingga RM1500 sebulan selaras dengan tahap kemahiran mereka, semua responden berpendapat program pengajian SRD di KKSA sesuai untuk dinaiktaraf ke peringkat lebih tinggi, kakitangan majikan tersebut wajar mendapat skim galakan bagi mengikuti program pengajian SRD dan berpendapat program SRD ini dapat menghasilkan graduan yang diinginkan oleh majikan di dalam bidang.

Katakunci: sijil reka bentuk dalaman, analisis pasaran, kerjaya

1.0 Pengenalan

Kolej Komuniti Kementerian Pengajian Tinggi Malaysia (KPT) merupakan sebuah institusi pendidikan tinggi yang memainkan peranan bagi menghasilkan graduan berilmu dan berkemahiran tinggi. Sebagai penyedia Pendidikan dan Latihan Teknikal dan Vokasional (TVET) yang utama di Malaysia, Kolej Komuniti turut disasarkan menjadi sebuah institusi TVETtersohor di rantau ASEAN dengan melaksanakan pendidikan dan latihan berpandukan keperluan pihak industri dan komuniti. Program Sijil Reka Bentuk Dalaman yang mula ditawarkan pada tahun 2010. Tujuan kajian pasaran ini dilakukan bagi memastikan program yang sedang ditawarkan kekal relevan dengan kehendak guna tenaga negara, kajian dan analisis pasaran program pengajian telah dilaksanakan pada tahun ini selaras dengan Rancangan Malaysia Kedua Belas (RMK-12) (2021–2025). Kajian ini dilaksanakan secara dalam talian bagi memaksimumkan jumlah responden di samping memudahkan proses analisis dapatan kajian.

Program Sijil Rekabentuk Dalaman ini memfokuskan kepada rekabentuk dan persekitaran dalaman bagi semua aspek struktur, ruang dan susun atur bahan. Pelajar akan mempelajari konsep rekabentuk dalaman berdasarkan konteks fizikal, budaya, alam sekitar dan sejarah rekabentuk senibina dalaman di samping membangunkan rekabentuk dalaman yang kreatif dan berdaya cipta samada bagi ruang awam atau peribadi.

2.0 Objektif Kajian

Kajian ini adalah untuk menganalisis pasaran majikan terhadap graduan KKSA merangkumi tiga (3) aspek utama iaitu:
a)program pengajian yang sedang ditawarkan,
b)peluang kerjaya selepas menamatkan pengajian dan
peluang kerjaya dan profesional alumni selepas tamat pengajian

3.0 Sorotan Kajian

Pada era globalisasi ini, keperluan tenaga kerja yang berkemahiran tinggi amat diperlukan bagi memenuhi permintaan di sektor awam dan swasta. Kemampuan graduan untuk memenuhi kehendak pekerjaan bergantung kepada pelbagai faktor meliputi kemahiran, pengetahuan dan kemahiran insaniah. Sumber data daripada agensi-agensi berikut telah diperolehi dalam memastikan program yang ditawarkan memenuhi kehendak pasaran tenaga kerja negara.

Walaupun ada pekerjaan yang ditawarkan, namun graduan ini masih tidak mencapai apa yang seharusnya mereka dapat dalam pekerjaan mereka. Justeru adalah diharapkan agar institusi pendidikan dapat membekal dan menyediakan pelajar apa yang diperlukan dalam dunia pekerjaan sebenar (McCoy, 1991 dalam Gurvinder & Sharan, 2008).

Hakikatnya, isu kebolehpasaran dalam kalangan graduan telah sekian lama dibincangkan secara global di persada dunia. Dan sehingga kini, isu ini masih menjadi tumpuan tajuk perbincangan masyarakat dunia dari pelbagai sudut. Susima (2009), dalam kajiannya, mengakui bahawa isu kebolehpasaran siswazah ini bukanlah suatu isu yang baharu. Kajian tersebut menyatakan bahawa pihak pemerintah atau kerajaan sentiasa berusaha melaksanakan pelbagai perancangan untuk meningkatkan tahap kebolehpasaran graduan agar menepati kehendak pasaran masa kini. Secara globalnya, kehendak pasaran kerja dan permintaan majikan terhadap kemahiran siswazah dilihat berbeza antara satu negara dengan negara yang lain.

Perubahan demi perubahan dalam bidang perdagangan pula menekankan kepentingan penawaran pendidikan untuk memenuhi keperluan kebolehpasaran, bukan hanya setakat memfokuskan kepada kemahiran semata-mata tetapi juga keperluan pengalaman praktikal dalam kalangan graduan. Keperluan atau kehendak majikan dan keupayaan mahasiswa untuk meningkatkan kemahiran mereka perlu diambil perhatian. Justeru, demi meningkatkan kebolehpasaran dalam kalangan graduan serta kemampuan mereka untuk bersaing dalam pasaran kerja yang mencabar, pelajar universiti harus terus berusaha untuk mempertingkatkan kemahiran serta pengalaman yang diperlukan di samping mendalami ilmu pengetahuan dalam bidang pekerjaan yang bakal diceburi (Susima, 2009). Menurut Perera, E.R.K & Perera, A.N.F (2009) kesesuaian dan kualiti program pengajian perlu ditambah baik melalui penilaian kurikulum yang menjurus kepada meningkatkan kemahiran generik serta kemahiran profesional mahasiswa dan samping memperkukuh hubungan antara institusi pengajian dengan pihak industri.

Kajian terkini yang dilakukan oleh Kesatuan Sekerja Sedunia (ILO-International Labour Organization) memperlihatkan peningkatan kadar pengangguran yang amat ketara dalam kalangan pemuda yang sebahagian besarnya merupakan lepasan siswazah. Kajian yang dilakukan sehingga hujung tahun 2016 menyebut bahawa hampir 71 juta golongan muda di seluruh dunia menjadi penganggur dan kadar tersebut memberikan corak konsisten dalam peningkatan kadar pengangguran saban tahun. Nisbah peratusan pengangguran yang dicatatkan pada tahun 2015 adalah pada kadar 12.9% dan meningkat kepada 13.1% pada tahun 2016. Situasi

ini dijangka meningkat pada tahun 2017 dan tahun-tahun seterusnya menurut laporan bertajuk "Pekerjaan dan Isu-isu Masyarakat di Dunia : Masa depan Golongan Muda" yang diterbitkan oleh Kesatuan tersebut (Eva, 2016).

Kajian yang dilakukan oleh Odey & Gimba (2015) turut menunjukkan bahawa isu kebolehpasaran ini menjadi tajuk utama perbincangan di negara-negara Afrika khususnya Nigeria yang saban tahun didapati menghadapi masalah pengangguran, sekaligus menjadi satu cabaran getir kepada pemimpin dan masyarakat di negara tersebut. Kadar pengangguran didapati meningkat daripada 21% pada 2010 kepada 23.9% pada 2011 walaupun pertumbuhan ekonomi berada pada tahap yang memberangsangkan. Hal ini disebabkan oleh kurangnya tenaga kerja yang berkemahiran tinggi dalam memenuhi kekosongan jawatan yang ada di negara tersebut (Abdul Farouk, 2009). Pemilihan bidang akademik yang sesuai dilihat lebih memainkan peranan dalam menentukan tahap kebolehpasaran berbanding dengan pencapaian akademik seseorang graduan. Bagi tujuan menangani masalah ini, Odey & nGimba (2015) mencadangkan agar kurikulum di institusi pengajian tinggi diperbaharui supaya lebih bersifat universal khususnya dalam mempersiapkan graduan dengan kriteria yang memenuhi keperluan semasa pasaran kerja.

Dalam era globalisasi masa kini, pelbagai penanda aras diletakkan bagi mengukur kualiti institusi pengajian tinggi. Salah satu penanda aras yang penting untuk mengukur kualiti sesebuah institusi pengajian tinggi di peringkat global ialah kebolehpasaran graduannya serta kemampuannya dalam memenuhi kehendak pasaran kerja (Shumilova & Cai, 2011). Justeru, didapati bahawa tajuk utama perbincangan dalam kajian secara globalnya lebih tertumpu kepada perbahasan berkaitan faktor yang menjadi penyumbang kepada isu kebolehpasaran ini serta faktor yang menjadi pemangkin kepada kebolehpasaran graduan dalam usaha untuk mendepani isu ini (Shumilova & Cai, 2011; Adeyemo et al, 2010; Nauta et al, 2009; Perera, E.R.K & Perera, A.N.F, 2009). Di Malaysia, kajian seumpama ini turut mendapat perhatian dan ia dijalankan sebagai langkah untuk mencari jalan penyelesaian bagi meningkatkan tahap kebolehpasaran graduan atau siswazah.

4.0 Metodologi Kajian

Bahagian yang utama dalam menentukan metodologi kajian adalah mengenal pasti reka bentuk kajian. Reka bentuk kajian merupakan panduan tentang pendekatan kaedah yang sesuai digunakan bagi sesuatu kajian (Othman, 2001). Reka bentuk kajian dapat ditetapkan sekiranya pernyataan

masalah, tujuan kajian serta persoalan kajian telah dikenal pasti.Kajian yang dilakukan adalah berbentuk deskriptif yang menggunakan sepenuhnya borang soal selidik. Menurut Mohd. Majid (1990), soal selidik lebih praktikal dan berkesan digunakan kerana penggunaannya dapat meningkatkan ketepatan dan kebenaran gerak balas yang diberikan oleh responden. Selain itu, instrumen soal selidik juga merupakan satu mekanisme bagi memperoleh data untuk tujuan menghurai sikap, pandangan, kepercayaan, perasaan dan tingkah laku (Chua, 2013).
Instrumen yang digunakan di dalam kajian ini adalah soal selidik yang diadaptasi dari Franchak dan Smiley (1981), Jones (1981) dan NAIT Employer Satisfaction Survey (2000). Bahasa dan susunan item walau bagaimanapun telah diubahsuai berasaskan kesesuaian persekitaran tempatan. Item baharu telah dimurnikan kerana instrumen kajian terdahulu didapati tidak menyeluruh dalam aspek pengukuran item.

4.1 Populasi dan Persampelan kajian

Persampelan merupakan satu strategi penyelidikan iaitu pengkaji boleh mendapatkan maklumat tentang sesuatu populasi daripada sebahagian individu yang menganggotai populasi tersebut. Prinsip utama persampelan adalah untuk mendapatkan sampel yang benar-benar mewakili populasi. Persampelan bagi kajian ini menggunakan persampelan jenis rawak mudah. Rawak jenis ini memberikan peluang yang sama kepada kepada setiap individu untuk mewakili populasi (Mohd. Najib, 2003). Berdasarkan jadual Krejcie, R.V dan Morgan, D.W dalam Azizi et al. (2006), nilai minimum bagi populasi 100 orang adalah 82 orang.

Di dalam kajian ini, seramai 30 majikan yang sedang menggajikan alumni KKSA diambil sebagai responden untuk menjawab semua instrumen yang dikemukakan. Sampel ini diperolehi melalui senarai nama majikan yang terdapat di dalam rekod Unit Perhubungan Industri dan Alumni KKSA. Kesemua majikan ini kemudian dihubungi secara emel bagi menyatakan niat kajian dan seterusnya dimohon menjawab instrumen yang dibekalkan bersama. Tempoh diberikan kepada semua responden adalah selama 30 hari dan maklumbalas juga dihantar semula oleh responden melalui emel.

4.2 Skop Kajian

Majikan yang terlibat dalam kajian ini merupakan syarikat yang telah menggaji graduan KKSA bekerja dengan mereka meliputi graduan KKSA yang bergraduat pada tahun 2013 hingga 2020.

4.3 Instrumen Kajian

Borang soal selidik yang digunakan untuk kajian ini mengandungi tiga (3) bahagian utama iaitu Bahagian I: Kandungan program dan kesesuaian, Bahagian II: Peluang kerjaya dan Bahagian III : Lain-lain.

Soal selidik ini telah diterjemahkan secara atas talian menggunakan platform google forms. Makluman kepada pihak majikan berkaitan soal selidik juga telah dibuat menggunakan email beserta surat iringan yang mengandungi kenyataan menyatakan kepentingan kajian dan jaminan kerahsiaan ke atas maklumat yang diberi supaya wujudnya kepercayaan antara responden dan penyelidik.

Skala Likert 5 poin digunakan dalam soal selidik ini. Poin yang tertinggi adalah 5 sementara yang paling rendah adalah 1. Poin ini dikelaskan seperti berikut:

Jadual 1: Skala Likert

1	2	3	4	5
Amat Lemah	Lemah	Memuaskan	Baik	Amat Baik

Untuk kajian ini, instrumen kajian dibangunkan sebagai menjawab persoalan kajian untuk mengetahui kandungan dan kesesuaian program, peluang kerjaya selepas menamatkan pengajian dan peluang alumni selepas tamat pengajian.

4.4 Kaedah Analisis Data

Data daripada soal selidik yang diperoleh dianalisis menggunakan perisian Microsoft Excel. Data yang diperolehi ditunjukkan dalam bentuk frekuensi (peratus). Bagi menerangkan data dengan lebih jelas penyelidik memaparkan data melalui kaedah jadual dan graf. Tafsiran skor min dapatan kajian bagi mengukur tahap kepuasan majikan adalah seperti Jadual 3.

5.0 Analisis data dan Keputusan

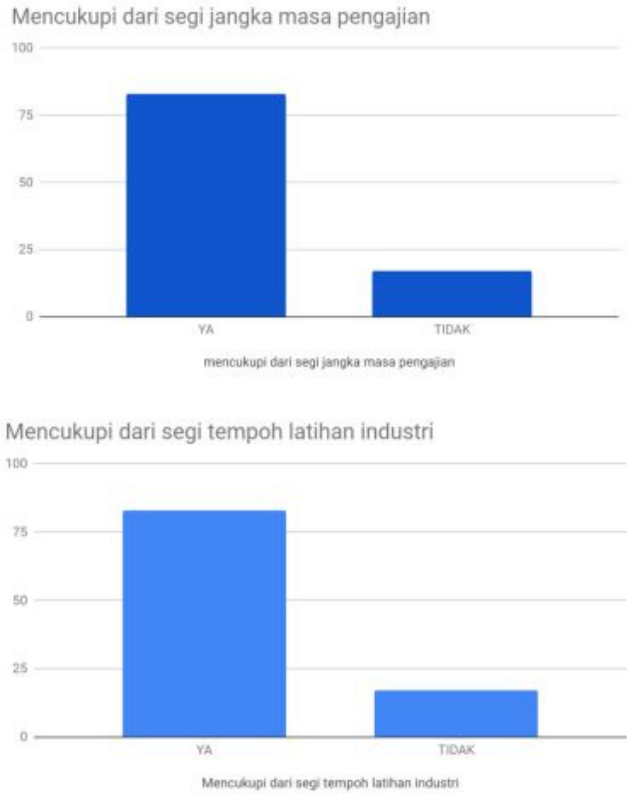
Hasil dapatan kajian yang telah dinyatakan di bahagian ini melalui tiga bahagian iatu Kandungan Program dan Kesesuaian dengan Keperluan Organisasi; Peluang Kerjaya; dan Lain-lain. Hasil dapatan ini diperolehi selepas menganalisis semua instrumen yang dikemukakan kepada para responden.

5.1 Bahagian I: Kandungan dan Kesesuaian Program dengan Keperluan Organisasi

Adakah anda berpendapat program yang dicadangkan ini mencukupi dari segi:

Aspek	**Mencukupi dari segi jangka masa pengajian** **%**	**Mencukupi dari segi tempoh latihan industri** **%**
Ya	**83%**	**83%**
Tidak	**17%**	**17%**

Jadual 2: Kesesuaian tempoh pengajian dan latihan industri program pengajian SRD



Graf 1: Kesesuaian tempoh pengajian dan latihan industri program pengajian SRD

Hampir kesemua responden iaitu 83 % berpendapat tempoh pengajian adalah mencukupi bagi Sijil Rekabentuk Dalaman. begitu juga dengan tempoh latihan industri di mana 83% responden juga berpendapat ianya adalah mencukupi. Ini bermakna tempoh dua tahun bagi tempoh keseluruhan pengajian sijil ini adalah memadai bagi pelajar SRD untuk mempelajari ilmu-ilmu perlu dan penting sebelum memasuki alam pekerjaan.

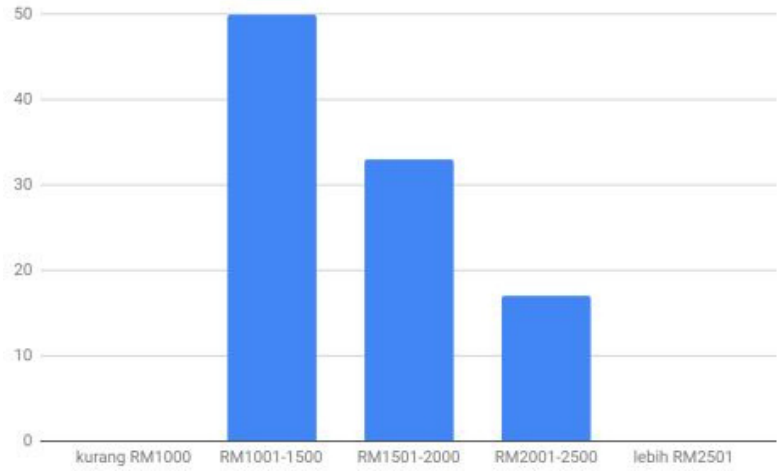
Mengikut pandangan responden, tempoh 2 tahun yang diperuntukkan untuk pengajian peringkat sijil ini adalah berpatutan dan tidak terlalu lama atau terlalu singkat. Begitu juga dengan tempoh latihan industri yang wajib diikuti oleh pelajar di firma, ianya sesuai dengan matlamat latihan industri iaitu sebagai pengenalan suasana bekerja sebenar kepada bakal graduan SRD.

5.2 Bahagian I: Kandungan dan Kesesuaian Program dengan Keperluan Organisasi

Apakah pendapatan yang sesuai ditawarkan kepada graduan ini?

Pendapatan	Peratus
kurang RM1000	0
RM1001-1500	50
RM1501-2000	33
RM2001-2500	17
lebih RM2501	0
Jumlah	100

Jadual 3: Julat pendapatan yang sesuai bagi alumni SRD



Graf 2: Julat pendapatan yang sesuai bagi alumni SRD

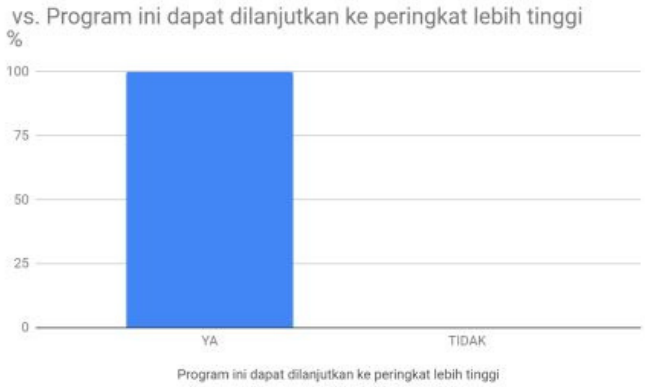
Dari segi pendapatan yang sesuai diberikan kepada alumni SRD, lebih separuh daripada responden berpendapat alumni ini sesuai diberikan gaji sebanyak RM1000 hingga RM1500 sebulan selaras dengan tahap kemahiran mereka.Tiada responden berpendapat alumni SRD ini layak diberikan pendapatan bulanan kurang daripada RM1000. Ini menunjukkan alumni SRD khususnya, alumni Kolej Komuniti amnya mempunyai nilai kebolehpasaran yang tinggi di mata majikan.

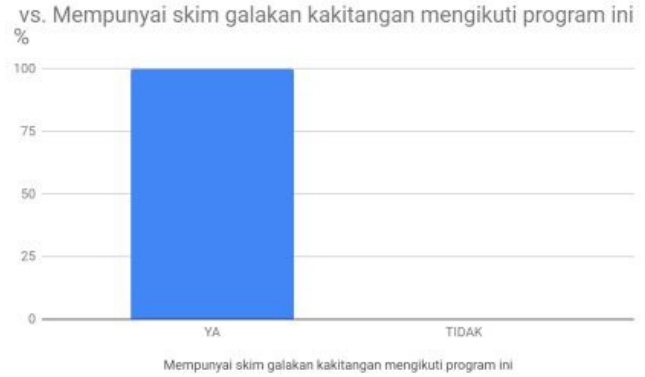
Ini merupakan satu titik kejayaan bagi KKSA dalam menghasilkan alumni yang berpendapatan tinggi berbekalkan sijil kemahiran dan setaraf dengan lulusan pemegang kelayakan akademik lain yang lebih tinggi.

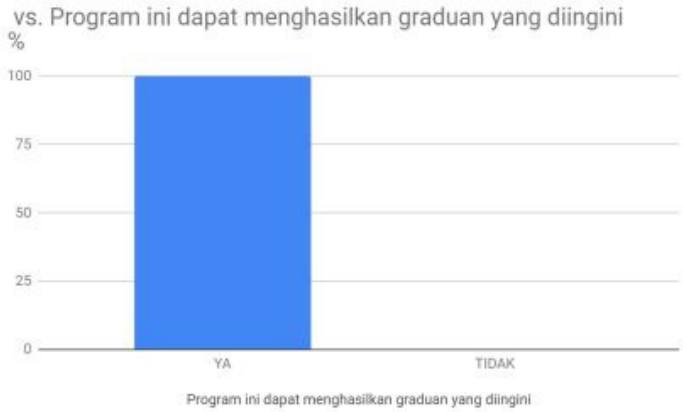
5.3 Bahagian 3: Lain-lain

	Program ini dapat dilanjutkan ke peringkat lebih tinggi %	Mempunyai skim galakan kakitangan mengikuti program ini %	Program ini dapat menghasilkan graduan yang diingini %
Ya	100	100	100
Tidak	0	0	0

Jadual 4: Peluang peningkatan kerjaya dan profesional bagi alumni SRD







Graf 3: Peluang peningkatan kerjaya dan profesional bagi alumni SRD

Di dalam mana-mana bidang pengajian, peningkatan kerjaya dan tahap profesional adalah impian kebanyakan alumni dan kakitangan. Hampir semua responden berpendapat program pengajian SRD di KKSA sesuai untuk dinaiktaraf ke peringkat lebih tinggi. Begitu juga dengan peningkatan kerjaya dan kemahiran di kalangan kakitangan responden, di mana responden berpendapat kakitangan tersebut wajar mendapat skim galakan bagi mengikuti program pengajian SRD. Ini dapat memantapkan lagi kemahiran kakitangan tersebut sekiranya mereka tiada sebarang ikhtisas akademik sekurang-kurangnya peringkat sijil kemahiran. Lebih dari itu kebanyakan responden juga berpendapat program SRD ini dapat menghasilkan graduan yang diinginkan oleh majikan di dalam bidang.

6.0 Kesimpulan

Secara amnya, kajian dan analisis pasaran bagi program Sijil Reka Bentuk Dalaman ini telah mencapai objektif yang diharapkan di mana analisis sumber data dan analisis kajian pasaran dari industri/majikan menunjukkan program ini mempunyai permintaan industri dan memenuhi keperluan pasaran guna tenaga kerja negara.

Hasil dapatan kajian adalah input berharga bagi penambahbaikan penyampaian perkhidmatan pendidikan dan latihan teknikal dan vokasional. Maklumbalas daripada pihak majikan amat penting dalam merangka polisi dan strategi bagi menghasilkan graduan TVET yang berkualiti sekaligus dapat membantu menambah baik keperluan PdP,tenaga pengajar, infrastruktur dan fasiliti,kurikulum dan lokasi seiring dengan kehendak industri.

PENGHARGAAN

Penyelidik mengucapkan ribuan terima kasih atas kerjasama pihak majikan memberi maklum balas dalam kajian ini. Pihak kami juga ingin mengucapkan jutaan terima kasih kepada pihak majikan kerana memberi peluang kepada graduan KKSA untuk bekerja di syarikat dan menimba pengalaman berguna sepanjang alam pekerjaan mereka.

RUJUKAN

Azizi Yahaya et al. (2006). Menguasai Penyelidikan Dalam Pendidikan. Selangor: PTS Professional Publishing Sdn. Bhd.

Chua, Y. P. (2013). Kaedah dan Statistik Penyelidikan Buku 2 Asas Statistik Penyelidikan. Kuala Lumpur: McGraw Hill

Edinyang, S. D, Odey, C. & Gimba, J. 2015. Academic Factors and Graduate Employability in Nigeria, dalam Global Journal of Human Resource Management Vol.3, No.5, pp.9- 17, September 2015.

Eva Choufi. 2016. Al-Istikhdam wa al-Afaq al-Ijtimac iyyah fi alc alam, dalam Majallah Mujtamac wa Iqtisad, Siri 297. Dicapai dari http://www.al-akhbar.com/node/263870

Franchak & Smiley. (1981). Evaluating employer satisfaction: measurement of satisfaction with training and job performance of former vocational education. Ohio.

Jones, W. (1981). Education and Employer: Expectation and Experiences of Students Graduates and Employers

Mohamad Najib Abdul Ghafar (1999). Penyelidikan Pendidikan. Skudai: Penerbitan Universiti Teknologi Malaysia

Mohd Majid Konting (1990). "Kaedah Penyelidikan Pendidikan." Kuala Lumpur: Dewan Bahasa Dan Pustaka

NAIT Institutional Research (2000). NAIT Employer Satisfaction Survey. Alberta

Othman Mohamed (2001). Penulisan Tesis dalam Bidang Sains Sosial Terapan. Serdang: Penerbit Universiti Putra Malaysia.

Perera, E.R.K & Perera, A.N.F. 2009. Factors Affecting Employability of Graduates holding NonProfessional Degrees in Sri Lanka, dalam Sub Theme C – Issues for Non-Professional Faculties – ASAIHL University of Kelaniya, Sri Lanka, p171-183.

Susima Samudrika Weligamage. 2009. Graduates" Employability Skills: Evidence from Literature Review, dalam Sub Theme A - Enhancing Employability through Quality Assurance – ASAIHL University of Kelaniya, Sri Lanka, p115-125.

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