2019 AASE INTERNATIONAL CONFERENCE

BESM-25
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- *25th International Conference on Business, Education, Social Science, and Management*
- *24th International Conference on Engineering, Technology and Applied Science*

MAY • 28-29 • 2019 @ OSAKA/JAPAN

PROCEEDINGS OF
24th ETAS & 25th BESM Conference

Applied and Advanced Science Exchange (AASE)

Published by

ETAS/BESM
Academic Press

International Conference on Engineering, Technology and Applied Science (ETAS)

- 24th ETAS @ Osaka/Japan, May. 28th-29th, 2019

International Conference on Business, Education, Social Science, and Management (BESM)

- 25th BESM @ Osaka/Japan, May. 28th-29th, 2019

Conference organizer: Applied and Advanced Science Exchange (AASE)
Publisher: ETAS/BESM Academic Press
ISBN Code: Pilot Edition
Website: https://www.aaseconference.org
Mail: Secretary@aaseconference.org; Contact.us@aaseconference.org

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The *Applied and Advanced Science Exchange* (AASE) is an active professional community and registered as a non-profit organization (NPO) in Japan. AASE has devoted itself to disseminate a variety of knowledge and worked with a vision to share the innovations in fields of academia by building up an international platform. Nowadays, interdisciplinary research is increasing and playing a key role. In our interdisciplinary joint conferences, participants are able to share their viewpoints from different perspectives and seek new collaborative opportunities across fields.

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AASE conferences footprints of the world

EDITORIAL

It is my proud privilege to welcome you all to the AASE International Conference at Osaka/Japan on May 28th-29th, 2019. AASE International Conference serves as platform that aims to provide opportunity to the academicians and scholars from across various disciplines to discuss interdisciplinary innovations. We are happy to see the papers from all part of the world published in this proceedings. This proceeding brings out the various Research papers from diverse areas of science, engineering, technology, management, business and education. These articles that we received for these conferences are very promising and impactful. We believe these studies have the potential to address key challenges in various sub-domains of social sciences and applied sciences. I am really thankful to all the participants for being here with us to create an environment of knowledge sharing and learning. I am also thankful to our scientific and review committee for spending much of their time in reviewing the papers for these events. I am sure the contributions by the authors shall add value to the research community.

Editor-In-Chief
Dr. H. Miyamoto

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Topic on Business, Education, Social Science, and Management

Editor by Dr. Eddie K.W. Li
Hong Kong University

A Development of STEAM Activity Based on Traditional Thai Culture for Science Teachers

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Abstract

The purpose of this research was to develop a STEAM activity base on Thai culture for science teachers in the context of teaching and learning creating STEAM activities by themselves and implement it in academic training for science teachers to determine the STEAM activity's complacency. The situation in STEAM activity developed from the problem of the low price of Thai traditional fabrics. In order to solve this problem, the creative design process and biomimic innovation must be used to increase product value. This activity was implemented for 10 hour in the training of science teachers at the primary and secondary levels, which consisted of 36 science teachers, rang of aged 25-60 years old in Sa Kaeo Province, Thailand. The tools used in this study are Likert attitudinal survey was used to assess the satisfaction of science teachers to STEAM activity and semi-structured interviews to determine how the science teachers became aware of the STEAM activity. The results are as follows: science teachers were positive satisfaction with indicating that they either "like a lot" 75% (N = 27) and "like" 25% (N = 9). Science teachers recognized the necessity of STEAM education as a problem-solving procedure through sharing opinions with each and another group. Therefore, STEAM activity in class would be applies to promote sciences lesson through the integration of science, technology, and art as well as develop creative problem-solving abilities

Keywords: STEAM activity, Traditional Thai culture, Science teachers, Biomimic

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Development of the Chemical Conception on Solutions Using STEM Activity for Tenth Grade students

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Abstract

The purpose of this research was to compare of the before and after conceptual score for students who were integrated learning management by STEM activity. The situation in the STEM activity used Thai herb as a precious food in order to valued-added. The activity took 15 periods (50 minutes/period) to design and produce high energy gel by applying the knowledge about chemistry subject on solution. The experiment group of the research were 35 tenth grade students from an extra-large secondary school in Bangkok, who were selected by purposive sampling. The research instrument used in this study consisted of STEM activity guidebook and pre-post conceptual test ,with 25 questions in the topic of solution. The statistics for data analysis included mean ($\bar{x}$), standard deviation (S.D.) and t-test for dependent sample. The results showed that the students were studied by using STEM activity got post-conceptual test score higher than pre-conceptual test score at .01 level of different statistical significant. This verified that using STEM activity for learning management was effectively to develop students conceptual understanding on the topics of solution. Moreover, STEM activity applied to the chemical class can incorporate the use of skills and knowledge from many disciplines and make them relevant to student learning.

Keywords: STEM activity, Solution, Conceptual understanding

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3D Photogrammetric Technique for Recording Shipwreck Sites in Sri Lanka

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Abstract

Photography is a most important recording method for archaeological activates such as exploration, excavation and conservation. Specially, the technique is playing key role for the recording of excavation. The main goal of the research is to record shipwreck sites in 3D format for the underwater cultural tourism and invite to researchers who is unable to dive in to the site. Any archaeological excavation can't be construction again even with high technology. Therefore, photographs are the only visual evidence for the excavated site for the future research. In recently 3D photogrammetric technology is using for recording of archaeological activities (in land) in Sri Lanka.

All the shipwreck sites which was used to photography for the 3D images were located around the island between 15-30meters depth. Those all site was examined and captured by participation observation. Well trained three divers were engaged with field works for collecting data. Also literature was examined though previous research done by pioneers of the field. The research team has spent one year for the field work and hundreds of hours spent for upload the pictures for the software. Among the hundreds of shipwreck sites in the coastal of Sri Lanka, there were selected 10 sites for the research, then more than 1300 photographs were taken that at least 100 photographs form one site. The photographs were taken to represent whole site line by line then uploaded to software for the 3D model. Finally, more than hundred pictures linked each other and produced on picture which can turn 360 degrees.

The underwater photography was started at least from 1899 then gradually developed in the global context. However, underwater photography has been used over the last few decades in Sri Lanka. Then thousand of photographs were taken from numbers of shipwreck sites. This is the first attempt to use 3D photogrammetric technology (PT) for the recording of shipwreck sites in Sri Lanka According to several experiment, successful 3D photographs were recorded from numbers of shipwreck sites. The completed 3D pictures are very useful for researchers who is unable to dive and get primary data. Not only research but also those

3D pictures can be used for film industry, preparing map, promoting tourism and other many proposes. Specially, Sri Lanka as a tourism country, there is high advantage to promote underwater cultural tourism which is not still focused and popular. There are hundreds of shipwreck sites around the coastal line in Sri Lanka. Most of sites are located shallow deep which able to reach divers even who has open water diving license. At the moment the demand of underwater cultural heritage is growing up as a world trend.

Keywords: Photogrammetric, Photograph, Shipwreck, Underwater.

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Culture in Organization: Balinese Young Organization as Building of National Character to Counter Asymmetric Warfare

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Abstract

Bali is an Island that has a diversity of cultures and traditions which is the reason for the rapid development of tourism on the Island. However, one of the negative impacts was the penetration of foreign culture into Bali. There are two ways to penetrate culture, namely *penetration pasipique* and *penetration violante*. Foreign penetration as a threat from abroad towards the ideology of the State can lead to disruption of various aspects of community, national and state life which have implications for the existence of sovereignty, territorial integrity, and national safety as a form of asymmetrical warfare that occurs. In an effort to ward off foreign penetration in Bali, the community uses a youth organization called "Sekaa Teruna". This study aims to analysis how youth organizations build the character of young people through regional culture to counter asymmetric warfare through foreign penetration that can change the ideology of the nation. This research is descriptive analysis using primary and secondary data. In conducting research, primary data collection tools are obtained by conducting interviews and field studies, while to obtain secondary data is done by studying documents or literature. The data analysis technique used in this study is descriptive qualitative. This study was examined using the theory of organizational culture and the concept of national character. The results of the study explain that youth organizations in Bali are able to create a national character to counter asymmetric warfare in Indonesia through conducting art training; training in Balinese and Indonesian languages; Ngayah and community service; Sangkep; and carry out socialization to Primary Schools regarding the importance of tolerance and Tri Hita Karana in community life. For the government of Bali and the Government of Indonesia, the existence of youth organizations in Bali has a positive impact to stem the foreign penetration that has occurred. This causes Balinese youth to have national character in accordance with the prevailing Pancasila norms and ideology. Finally, with national character and defending the country, asymmetrical warfare based on ideology can be reduced by its influence.

Keywords: Sekaa Truna, Balinese Young Organization, Asymmetric Warfare, organizational culture theory

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Threat Perception of Thai Government towards Migrant Workers from Myanmar and Rohingya

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Abstract

The main purpose of this article is to study a perception of Thai government towards migrants' workers from Myanmar and Rohingya. The perception towards these two group of people as observed, is quite similar. This happens because of the fact that the government perceives these peoples with fear and suspicion which doesn't only rooted from its large amount of numbers in a country but also from other factors that shape the perception toward these people into what we call "threat perception". To study why government fears and distrusts these people, the researcher uses the concept of David Singer' perception of threat and threat indicator of Myron Weiner as a research framework. The study finds that those significant factors contributing Thai government to perceive migrant workers from Myanmar as well as Rohingya as "threat" include with 1) Present situation 2) Historical experience 3) Cultural difference 4) Behavior of migrant workers and 5) Leaders' anxiety. Although, government's perceiving these two group of people as threat, both of them pose different level of being threat to the Thai state's security.

Keywords: Rohingya, migrant workers, fear, threat perception

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The Development of Activity in chemistry to Enhance high school student's critical thinking skills

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Abstract

Critical Thinking Skills are the important and helpful that can lead to successes in 21st Century. To facilitate student skills, Problem-based learning (PBL) is a major key and teacher need to create a suitable environment. In present study aimed to develop an activity in chemistry based on PBL to enhance critical thinking skills. The theme of activity is to find the best condition to generate hydrogen gas with lower cost. There were 33 high school students, who participated in this study. One group pretest-posttest design was used to trace critical thinking skills. The test was presented in real life situations with questions that related to the situation. Results of this research indicated that most student can improve their critical thinking skills from fairy bad to good. And furthermore, 12.12 percent of students can rise their skills to great after partake the activity. All of students enjoyed to solve the problems while doing activity. This had made the classroom more fun. In conclusion, critical thinking skills can be enhanced by using the activity in chemistry which based on problem-based learning.

Keywords: Critical Thinking, Chemistry Activity, Reaction Rate, Problem-based learning

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Five-Factor Model of Personality and Affective Commitment of Non-Academic Employees of State Universities in Colombo District, Sri Lanka

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Abstract

Five factor model of personality and employee commitment have been increasing significantly over the past two decades because of its popularity. Five factor model of personality consists of extraversion, neuroticism, openness to experience, agreeableness and conscientiousness while affective, normative and continuance are the main components of the employee commitment. It is rare to find the empirical research findings about the relationship between five factor models of personality and affective commitment in the available literature, especially among the non-academic employees in state universities. Therefore, this study is aimed to discuss the relationship between the five- factor model of personality and the affective commitment among the non-academic employees of the Sri Lankan state universities in Colombo district.

Quantitative methodology was adopted to measure the relationship between five factor model of personality and affective commitment among the non-academic employees. 200 non-academic employees were selected using simple random sampling method and standard questionnaire which was originally developed by Goldberg in 1992 used to measure the big five personality traits in this study. And standard questionnaire developed by Meyer and Allen in 1990 used to measure affective commitment. The external reliability of the instruments was examined using test – retest method and test - retest coefficients of all instruments were more than 0.762. Correlation coefficient was used to analyze the data using SPSS (Version 16).

The personality traits of extroversion ($r = 0.897$, $p < 0.01$), agreeableness ($r = 0.261$, $p < 0.05$), openness to experience ($r = 0.439$, $p < 0.05$) and conscientiousness ($r = 0.738$, $p<0.05$) are positively and significantly associated with affective commitment while neuroticism has negative and significant association ($r = -0.380$, $p < 0.05$) with the affective commitment among the non-academic employees. The findings reveal that there are four personality traits of five factor model have significant relationship with affective commitment and neuroticism

has negative relationship with affective commitment. The overall conclusion of the study reveals that the management of the state universities must incorporate appropriate strategies to manage the affective commitment for the non-academic employees because there is only one kind of personality trait (neuroticism) is negatively related with the affective commitment. Then, majority of the non-academic employees can be committed to the works and institutes through strategies relating to the affective commitment.

Keywords: Big Five Personality Trait, Affective Commitment, non-academic employees, State Universities

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Factors affecting the User Satisfaction of e-Learning Systems

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Abstract

In this era of globalization, knowledge has become the most critical mean for gaining competitive advantage. As a method of acquiring knowledge, e-learning has become a crucial element. The use of e-learning system is considered as an important and integral part of educational process. Developed countries use e-learning systems successfully whereas in Sri Lankan context there is a lack of usage of e-learning system. In this background, user satisfaction plays an important role and may affect the use of e-learning system. Therefore, the aim of this study is to find factors affecting the user satisfaction of the e-learning systems and to find out the relationship between those factors. The conceptual model was developed to find the satisfaction of e-learning systems. Four factors have been identified according to the empirical studies. Identified factors for this model were Information Quality, Computer Self-efficacy, Perceived Ease of Use and Perceived Usefulness. Survey instruments were developed to conduct an online survey to collect data from students from the University of Sri Jayewardenepura. 92 completed questionnaires were used for data analysis. Partial latest square (PLS), a variance-based latent variable structural equation molding technique, was used for data analysis. The results suggest that information quality and perceived usefulness are the most significant factors that impact user satisfaction of e-learning system.

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Keywords: E-learning, User satisfaction, Computer self-efficacy

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A study on the impact of entrepreneurial orientation on business performance among graduate entrepreneurs of University of Sri Jayewardenepura of Sri Lanka

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Abstract

Entrepreneurial Orientation has developed into a key concept in the field of entrepreneurship and in recent times has attracted increasing amounts of interest from academia and practitioners. Upon recognizing the significance of Entrepreneurial Orientation research focused on this construct has increased exponentially, especially with regard to its impact on Business Performance. Consequently, entrepreneurship curricula are being introduced into the university system as a new trend in academic arenas attempting to provide solutions for a variety of conflicts in the society. This thesis investigates the impact of Entrepreneurial Orientation on Business Performance and the moderating effect of entrepreneurial learning on the above relationship among graduate entrepreneurs of university of Sri Jayewardenepura of Sri Lanka. This study primarily examines the above effect using multidimensional approach, competency theory, contingency theory, Lumpkin and Dess model and Taatila model. The primary data was gathered from a sample of 109 graduate entrepreneurs from university of Sri Jayewardenepura using a self-administered structured survey questionnaire. The three main research hypotheses including five sub hypotheses derived from the conceptual framework of this study were tested using Partial least square structural equation modeling. During data analysis of this study, the descriptive statistics were developed initially, and subsequently the inferential data was analyzed using the partial least square structural equation modeling with Smart-PLS to finalize the outcome. The validity of the instrument was tested by applying factor analysis and the internal consistency reliability was tested through Cronbach's alpha values. The outcomes of this research exhibited a positive and statistically significant impact of Entrepreneurial Orientation on Business Performance among graduate entrepreneurs of University of Sri Iayewardenepura of Sri Lanka. Upon further testing, Business Performance exhibited statistically significant impacts with four dimensions of Entrepreneurial Orientation while the dimension of risk taking exhibited a neutral impact and insignificant output. Further, Entrepreneurial Learning does not exhibit any moderating effect

on the relationship between Entrepreneurial Orientation and Business Performance. Furthermore, 18 graduate entrepreneurs selected in random were interviewed using semi structured interviews, which further confirmed the received outcomes of the research

Keywords: Business Performance, Entrepreneurial Orientation, Graduate Entrepreneur, Entrepreneurial Learning

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Tourism Sri Lanka: Posit for Tourist Satisfaction

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Abstract

Sri Lanka is an island in the Indian Ocean and it is a major destination for tourism activities. Natural beauty, wildlife, better climate are some major reasons for this popularity. Tourism of the country is one of the growing industries and identified as top tourist designation for 2019 by Longley Planet. After conclusion of the terrorist war in 2009, it is noted a gradual increase of tourist during the period of 2009-2018 and successfully achieve 2 million tourist arrival in 2018. Tourist satisfaction is identified as one of the important factors to manage the sustainability of the industry. A satisfied tourist might return back to after some time and become a brand ambassador of Sri Lanka to promote tourism which positively supports the sustainability of the industry. Therefore, it is important to understand the gap between a tourist's experience at the destination visited and the expectations about the destination to minimize the possible negative experience of the visit. In this context, identification of factors affecting the tourism satisfaction is highly important to improving tourism industry of Sri Lanka. In this regards the aim of the study is to review the satisfaction level of the tourists who visit Sri Lanka and identify what areas should be improved.

The study identified five key factors namely, Hospitality, Attraction & Accessibility, Cost of Staying, Environmental factors and Infrastructure facilities as a factor affecting to the tourism satisfaction based on comprehensive literature review which leads to design five non-directional hypothesis. Primary data was collected through a qualitative questionnaire survey designed as Partial-Least Square Questionnaire and a total of 191 valid respondents were collected at the departure of the Bandaranaike International Airport, Katunayaka, Sri Lanka.

The study found that five factors explained in the model achieved a R2 value of 65.15% which confirmed that the model explains about 65 percent of the total satisfaction. Two tail test results of the hypothesis confirmed that tourists are satisfied with Attraction and Accessibility, Cost of Staying as well as Hospitality as a criterion for overall tourist

satisfaction with a significant level of 5%. However, Environmental Factors and Infrastructure Facilities are not facilitating satisfaction of tourist and become non-significant factors on tourist satisfaction. The resulting Q2 values larger than 0 indicate that the exogenous constructs have predictive relevance for the endogenous construct under consideration. Therefore, policy makes of tourist development of Sri Lanka should be focused on Attraction and Accessibility, Cost of Staying as key areas of tourist satisfaction.

Keywords: Tourist Industry, Tourist Satisfaction, Factors on Satisfaction

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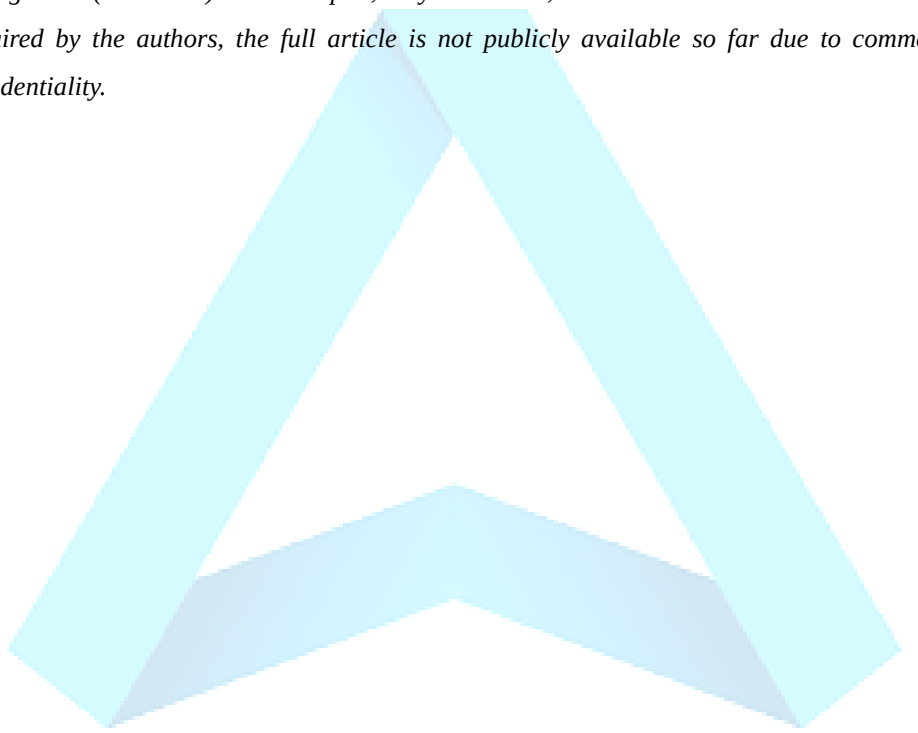

Promoting Green Building Concept in Sri Lanka: Perception of Professionals

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Abstract

The concept of green building has become a key concern in the construction industry in the context of sustainable development. Green buildings provide many benefits including the efficient use of resources while ensuring the sustained benefits for the future generations as well. Along with the growing interest in the world Sri Lanka too paid a special attention to introduce this concept into the construction sector in the country. The general objective of this research is to measure the awareness and perception of professionals engaged in the building sector in Sri Lanka.

As this a new concept in the modern context the awareness on the positive and negative aspects and the correct understanding on the concept is of prime concern. It should be in the wider context of the society covering policy makers, professionals, developers, construction specialists and users or customers. Green Building concept is not new to Sri Lanka. Our traditional building technology practiced in the ancient rural areas is totally adhering to the GB concept. (E.g. Thatched roofs with coconut leaves, paddy husks, grasses and flooring with cow dung). However, the concept in the modern context takes a different form. Several initiatives were taken to promote the concept in Sri Lanka. Green Building Council (GBSL) of Sri Lanka was established in 2009. In 2010 a new construction rating system called GREENSL® rating system which is very much similar to the LEED has been introduced by the GBCSL to issue the green certification. Other than the GBCSL, many organizations in Sri Lanka committed to promote the concept. Besides Sri Lanka has 16 LEED certified buildings and 20 projects registered for certification with United States Green Building Council (USGBC). In 2000 Kandalama Hotel was recognized by the USGBC as a LEED Certified Green Building and later awarded the LEED Bronze rating. First LEED Green Hotel in the world. Kandalama won many awards (about 70 awards).

This study therefore focused to find out the awareness and perception of professionals engaged in the construction industry on this concept and promotion of this concept in Sri Lanka. The study takes a descriptive form elaborating the different views of professionals like Architects, Planners, Valuers, Surveyors, and Academics

It is important for a country like Sri Lanka to recognize positive as well as negative aspects when adopting green concept in construction of buildings. The escalating cost of construction is a serious challenge that facing the developers in the country. On the other hand the sustainable construction and the sustainable use of resources are the most demanded aspects that need to be ensured in the building industry. Thus, it is not only the developers the professionals engaged in the building sector need to find ways and means to address this dilemma by compromising these two situations that is to ensure the sustainability while minimizing the cost of construction in the building sector. The green building concept is one of the solutions to address this situation. It is a well-known fact that green buildings ensure the environmental sustainability. However further research and investigations are required to find out the cost of construction and adoption of such technology to a country like Sri Lanka. On the other hand, the perception of professionals on this concept is more important as they are the prime agents that bring this concept to the wider society. Therefore, the findings of this research would be beneficial to identify the potentials and constraints to promote the green building concept in Sri Lanka and areas for further research.

Keywords: Green Buildings, Professionals, Perception

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Asian Infrastructure Investment Bank (AIIB): path-dependent evolution or paradigm shift in multilateral development banking?

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Abstract

In a period that the world faces daunting development challenges, the Asian Infrastructure Investment Bank (AIIB) was established in 2015, as a South-South regional development bank (RDB), upon China's initiative. AIIB's aim is to promote economic and social development in Asia, mainly through infrastructure financing. Despite being the most recent addition to the existing constellation of multilateral development banks (MDBs), 70 years after the creation of the World Bank (WB) in 1944 at the Bretton Woods conference, the AIIB has already achieved the second largest global membership behind the WB. It has therefore triggered immediate academic discussions, focusing mainly on aspects of international relations and governance and exceptionally on legal and business strategy decisions. This paper complements existing works by examining AIIB's business fundamentals and how it can fulfill its mission: creating and delivering value—in other words, how the AIIB formulates its remit and subsequently puts it into practice. The proposed paper addresses the research question in a novel way through AIIB's business model (BM). The paper facilitates the understanding of AIIB based on a BM-focused analysis, adjusted to the AIIB through the information contained in publicly available legal documents, developed by the author to specifically study the operation and evolution of RDBs and MDBs. AIIB's BM is analyzed against the backdrop of the pressing infrastructure needs that the bank is meant to address, the prevailing economic and social environment in its region, and the existing multilateral banking paradigm. This approach enabled an understanding of how the AIIB formulated its remit and how it puts it into practice while unlocking insights into its role and activities. The paper posits that AIIB's set-up and operations to date are in line with its peers. Its BM, however, leaves the opportunity for additional and alternative routes of activity, with its lending in its first three years of operation being only a very small fraction of the vast infrastructure needs of AIIB's target region. A significant increase in its lending volume will

constrain the AIIB. AIIB's management will be limited by how much it can drive the bank to deviate from its path-dependent evolution through the investor community attitudes—that is, determining how the AIIB will be able to fund itself from the capital markets. Investors will thus distinguish the feasible from the wishful determine whether the AIIB will follow a path-dependent evolution or follow a paradigm shift to multilateral banking.

Keywords: business model (BM), Asian Infrastructure Investment Bank (AIIB), multilateral development banks (MDBs), regional development banks (RDBs)

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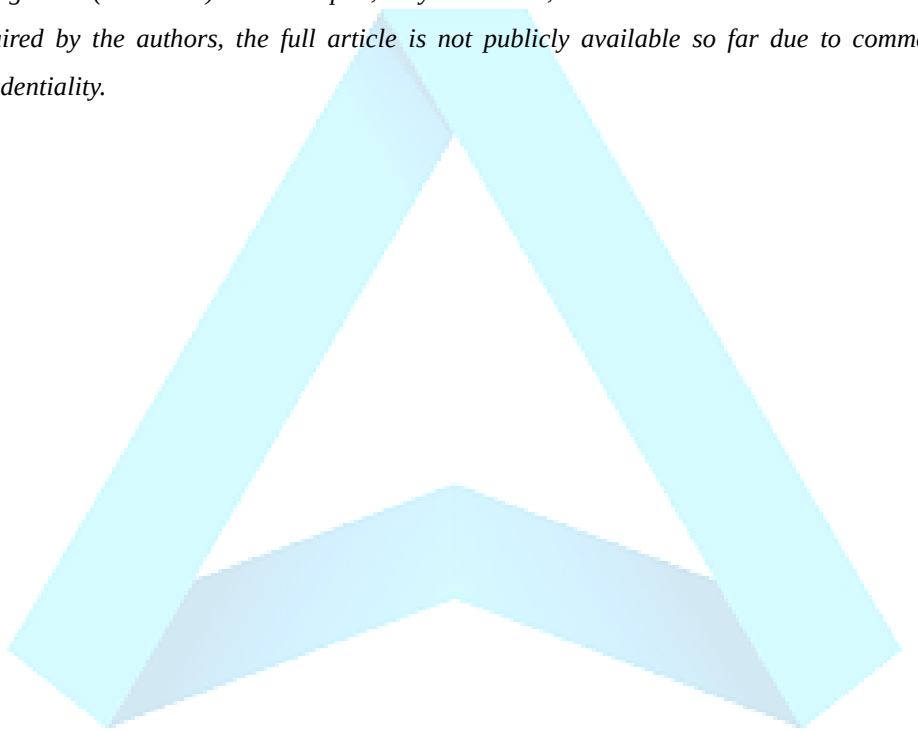


1. Background/Objectives and Goals

The Asian Infrastructure Investment Bank (AIIB) is the most recent regional development bank (RDB). It was established as a multilateral institution in October 2015 on the initiative of China two years earlier. This initiative is the main element of interest within the academic community. This interest, however, is still rather anemic compared to the bank's potential economic and political role, as evidenced by its worldwide impact and strong shareholder base. Studies have focused on the positioning of the new institution—particularly the background and reasons for the creation of the AIIB, mainly China's rationale for taking the lead to establish the AIIB, as well as the AIIB's eventual role as a competitor or partner in the American-led multilateral status quo order (Wan 2016, Hakans & Hynes 2016, Larionova 2016, Larionova & Shelepov 2016, Xu et al. 2015, Xu 2017, Bustillo et al. 2018, Shelepov 2018). Scholarly works have also explored the international relations aspect (Xu et al. 2015), AIIB's institutional and governance issues (Bin 2018, Xu 2017, Ransdell 2019), and AIIB's business strategy (Lim & Mako 2015). This paper complements existing works by examining the AIIB's business fundamentals and how it can fulfill its mission, namely how it creates and delivers value—in other words, how the AIIB formulates its remit and subsequently puts it into practice.

2. Methods

This paper addresses the research question in a new way through AIIB's business model (BM). It develops AIIB's BM, based on a BM archetype designed by the author to suit RDBs and multilateral development banks (MDBs), but not limited to them. This approach allows the incorporation of the logic embedded in the legal norms that drafters have skillfully developed over millennia into a powerful business strategy tool—which constitutes, in institutional analysis, a means of describing, understanding, and analyzing organizations and their evolution. There are two reasons for this approach: a) BMs are conceptual maps of institutions reflecting a system of interdependent activities that transcend institutional boundaries, enabling the institution to create value and appropriate a share of that value. This conceptual map of actors, actions, interactions, and outcomes can be the basis for decisions and/or policies made about the establishment, development, and eventual termination of a public or private institution and b) BMs are representational, rather than purely rhetorical, enabling a comprehensive visualization of business fundamentals and thus facilitating the understanding and tracking of evolution. BMs follow a Parmenidean ontological line of thought, in that they deal with organizations and their functions, namely how functios are grouped according to similarities and differences and how these categories relate to each other within a hierarchy. BMs, therefore, go beyond a merely taxonomic classification,

allowing insights into how an organization formulates its remit and subsequently puts it into practice in an interplay with its environment.

The archetype BM developed by the author and used in this paper is a "hybrid" model elaborated from an existing academic work (Johnson et al. 2008) and complemented by elements of the affinity diagram of a BM presented by Shafer et al. (2005). The proposed BM archetype accounts for the value and benefits that not-for-profit public institutions offer the public in pursuing their mission. The archetype consists of four primary interlocking elements that, together, create and deliver value: strategic choices, value capture, value creation, and value network. These elements are disambiguated as follows: a) Strategic choices: This is the most important element, as it describes organizations' core logic and rationale. The remaining elements serve the strategic choices, which include the identity parameters, mission, offering, scope, target market, and core differentiation from competitors. b) Value capture: This refers to organizations' capabilities and competencies that ensure viability through the necessary resources. Value capture mainly encompasses resourcefulness through funding, efficiency through reduced cost margins, resilience in maintaining asset quality over time, effectiveness through serving the organization's mission and objectives, and avoidance of the waste of organizational resources by doing the wrong thing; c) Value creation: This consists of the elements that enable organizations deliver value propositions to their beneficiaries. Such elements include the entry to the market, satisfaction of market needs, sourcing, pricing, and positional advantages, autonomy in responsible decision-making, and maintenance of credibility. d) Value network: This pertains to the support network that allows organizations formulate strategic decisions and create, as well as capture, value. Value network hems stakeholders, alliances, branding, and product flow.

BMs can be refined under the magnifying glass approach at various levels of detail. For the purposes of institutional analysis though, the first level of detail was deemed appropriate, corresponding to the strategic level of the organization. This implies the "transcription" of the elements provided in AIIB's basic legal documentation (Articles of Agreement [AA], Report on the Articles of Agreement, and By-Laws) and, where necessary, from other official documentation into the BM's constituting elements, resulting in AIIB's BM (Figure 3.1). For verification, the resulting BM was benchmarked against AIIB results contained in the bank's annual reports mainly. Furthermore, from a constructivist approach, and assuming that economic and political identities were significant determinants of economic action, the AIIB's BM was analyzed in the context of the pressing infrastructure needs that the bank had been set up to satisfy, the economic and social environment in the region of its concern, as well as the existing multilateral banking paradigm, which has followed Bretton Woods institutions. This approach enabled an understanding of how the AIIB formulated its remit

and how it puts it into practice while unlocking insights into its role and activities.

3. Results

The AIIB is the most recent addition to the existing constellation of RDBs and MDBs, 70 years after the creation of the World Bank (WB) in 1944 at the Bretton Woods conference. Its set-up reflects the prevailing political and economic conditions at its establishment. Consequently, the AIIB was conceived as a broader and more sophisticated organization, than most of the MDBs belonging to the first generation of multilateral banks, created after the model of the WB in the period 1944–1970 and the second wave, mainly consisting of the European Bank of Reconstruction and Development (EBRD), after the geopolitical changes of the early 1990s. It follows the existing RDB and MDB paradigm for aligning members' interests by following the traditional three-tier political governance structure, superposed on its organizational structure, resulting in a high and multi-layered organizational structure of an old-style bureaucracy in terms of organizational theory. Similar to its peers—for example, the European Investment Bank (EIB)—the AIIB has a nonresident board (Larionova 2016). It follows the existing paradigm also in stating a regional developmental public, as well as private, sector focus. Ancillary features such as the complementarity of its financing, hinting even to subsidiarity, in the sense that finance should be provided in case of unavailability of the appropriate funds; the conformity with the states' policies in whose territory projects are financed; and the full juridical personality and legal capacity, including relevant immunities, are in general lines, also following a path-dependency evolution as an RDB in the existing constellation of MDBs.

Nevertheless, the AIIB does not follow its peers on several other issues. To name a few, i) its pricing is not clearly stated as nonprofit-based, unlike most other RDBs and MDBs. Even for concessional finance, its AA require such funds to be "on terms and conditions consistent with the purpose and functions" of the bank (AA Art. 17.1). "This open-ended language, coupled with repeated Chinese statements emphasizing the AIIB's profit-minded nature, may presage an aversion to concessional lending" (Ransdell 2019: 7); ii) its vague bidding requirements, characterized occasionally as "universal" (Xu 2017) are not in line with peers, aligning with the establishing claim for lack of conditionality and policy application prerogatives of member states. Furthermore, its impact on the efficiency/inefficiency of the projects financed has not yet been shaped nor reflected on its BM; iii) the absence of a specific jurisdiction for issues other than AIIB's borrowings, including lending and staff, differentiates the bank from its peers, without the possibility of evaluating the possible repercussions at the present stage.

What clearly distinguishes the AIIB from its peers, at first sight, is its purpose: "The

purpose of the Bank shall be to (i) foster sustainable economic development, create wealth, and improve infrastructure connectivity in Asia by investing in infrastructure and other productive sectors and (ii) promote regional cooperation and partnership in addressing development challenges by working in close collaboration with other multilateral and bilateral development institutions" (AA, Art. 1). More specifically, the points that attract interest are the statements in prominent positions reflecting i) wealth creation, alongside development—especially since in the area of its concern are a number of low-income countries, where the AIIB is the only RDB/MDB having special provisions in its AA to assure such countries' shareholding and the balanced share of its funding in their favor; ii) focus on a particular sector (i.e., infrastructure), but the forthcoming analysis will show this is not AIIB's sole interest; and iii) cooperation with other MDBs and bilateral development institutions, which is not stated prominently in the establishing charters of AIIB's peers. Concerning the first point, there is no obvious reason for this statement. The last two, however, could be possibly explained by AIIB's intention to appear synergetic with other MDBs to exploit their know-how, especially at its start-up phase, and facilitate its entry to the market through their project pipelines. The AIIB has already formalized its cooperation with five MDBs (the WB, International Finance Corporation, Asian Development Bank [ADB], EBRD and EIB), by signing framework agreements or memoranda of understanding. Formalized MDB cooperation, similar to the Japanese Keiretsu, have existed since the early 1990s to curb the criticism of overlapping activities and multiple costs for doing the same work since the concerned MDBs are often in competition. Moreover, it allows MDBs to strike deals for bigger projects by sharing resources and the risk for large infrastructure projects on their balance sheets, relaxing their countries' and sectors' risk thresholds, as well as benefit from the know-how of peers, while reducing costs for due diligence.

In addition, through its cooperation with the ADB, the AIIB avoids giving the impression of duplicating ADB's mission. This is strengthened further, by its current mono-focus activity relating to infrastructure—which also constitutes a "niche" market reflecting real needs (ADB 2017, Arcus Foundation 2018), making AIIB's market entry easier.

The AIIB was established within two years, further to the Chinese initiative of October 2013, in response to real needs in infrastructure, as well as in international relations and economic development, especially in Asia (Xu 2017). This represents record time for the establishment of a multilateral institution. In one year after the initial proposal, 21 founding members of the world spread managed to agree on a memorandum of understanding. Member countries increased subsequently, bringing the number of those present during the signing of the AA on 12 October 2010 (out of which 53 effectively signed the document despite US

opposition) to 57. As expected for a multilateral institution, AIIB's basic legal documentation is comprehensive and detailed in determining governance issues. Therefore, the detected broadness of the operating principles can only be considered purposeful, being a major differentiating factor from those of similar institutions. This broadness makes the study of the AIIB BM even more compelling to investigate the actual operations profile of the AIIB in the future. Evidenced mainly in AIIB's strategic choice elements of the BM, this broadness, concerning majorly its ownership, geographical, and sectoral target market and its offering, is also reflected in the rest of its BM elements. Despite a claimed Asian regional interest, the AIIB draws its ownership from around the globe, with all member countries of the WB (International Bank for Reconstruction and Development) qualifying as potential shareholders, therefore keeping membership possibilities still open to interested countries, whishing eventually to join in the future. Although the AIIB had already reached 93 shareholders by 1 January 2019, compared to 189 shareholders of the International Bank for Reconstruction and Development, its capital share reshuffling provisions and a counterbalancing threshold of 75% of regional membership to safeguard a regional interest in its AA allowed newcomers to still participate. AIIB has therefore already achieved the second largest global membership behind the WB.

In line with its claimed Asian regional character, AIIB is targeting Asia and Oceania. By derogation, however, its intervention also remains open in other areas through the AA provision "except as otherwise decided." This is evidenced by its forthcoming operations in areas such as Africa (Egypt underway) and Latin America. Albeit the infrastructure financing contained in AIIB's name, mission, and scope, its sectoral target market is much broader, encompassing all productive sectors. AIIB's offering is also very broad, ranging from nonconcessional "plain vanilla" loans and guarantees for specific projects or programs to equity participation and concessional finance—including grants and advisory services (inclusive of, but not limited to, technical assistance), as well as other services. This offering is so broad that it encompasses five different forms of banking: i) wholesale banking (large and often repeat lending and guarantee operations), ii) a policy bank in support of international development and poverty elimination iii) for-profit banking at premium over market rates (equity participation and other forms of risk-sharing with regards to projects), iv) service banking on a fee basis for technical assistance related advisory, and even v) investment banking (for assisting the creation of capital for third parties through underwriting new debts and securities). No other RDB/MDB had such a broad offering at its establishment, and none has the investment banking element. Of course, AIIB's name refers to the bank as an "investment bank"—not as a development bank, although its rationale is "to promote economic and social development." The only other bank that its name entails the term

"investment bank" is the EIB, although without having investment banking in its statutes, strategic choices, and activities. The EIB is also the only peer of the AIIB with many different forms of banking under one roof. This was, however, not the case when it was established, but these options gradually came into effect in two BM revisions after 50 years of operation. These different banking type activities can remain within the AIIB—assuring its future development through well-diversified market, income, resource, cost, and risk possibilities, thereby giving to the bank a head start compared to its peers. Alternatively, this currently middle-range RDB (Bundesfinanzministerium 2019) could develop into a group of the WB type through spin-offs and the creation of subsidiaries or other institutional forms of a more independent nature, as this can already be foreseen in its AA. This is also similar to the EIB, which evolved and thrived through this offering flexibility but has, since 2007, created the statutory possibility to create specialized subsidiaries.

During the first three years of its operation, the AIIB's aggregate approved investment operations in 13 countries reached USD 6.4 billion by September 2018. By 19 April 2019, the total projects approved reached a total of USD 7.94 billion in 15 countries. Half of the projects were cofinanced with other RDBs/MDBs. For this purpose, the AIIB signed memoranda of understanding with the WB, ADB, EBRD, and EIB. A sectoral distribution shows a salient focus on energy (34%), followed by transport (23%), and then water and waste (16%). In 2018, the AIIB approved up to USD 150 million, and in no case above 20% of the total committed capital as foreseen in its AA, in the North Haven India Infrastructure Fund, which seeks to raise USD 750 million of committed capital and will accept fund subscriptions for up to USD 1 billion. The aim of this fund is to benefit midcap infrastructure projects in India by creating a mechanism to mobilize private capital from global long-term investors for energy, transport, and other infrastructure projects in India. A further regional private equity fund with a target size of USD 3 billion is in the pipeline to mobilize private capital by investing in noncontrolling equity stakes. The Asia Investment Fund will be established to provide institutional investors with the opportunity to invest in companies in infrastructure and other productive sectors—including telecommunications, transportation, and energy. The fund will invest primarily in mature companies in Asia with proven track records. In certain situations, the fund may invest in portfolio companies domiciled outside Asia, in AIIB member countries, but with significant operations within Asia. For serving its mission and its modus operandi principles of "lean, clean, and green," the AIIB promotes the creation of a growth-enabling environment by selecting projects based on the following three thematic priorities, as stated on its site: sustainable infrastructure, cross-border connectivity, and private capital mobilization. By 2022 the energy and transport sectors are expected to represent 60–70% of AIIB's activities, which is expected to extend to 24 countries. By 2027

the bank expects its loan book to reach USD 45 billion and its equity investments, USD 2.5 billion.

To achieve these results, the AIIB has tried to develop its value network by increasing its shareholder basis—establishing customer relations through its channels, mainly the other MDBs, raising investor awareness by approaching the rating agencies for receiving the best possible rating, and testing its product flow processes and expertise assured by international staff through universal recruitment (Xu 2017). Furthermore, the AIIB, during its first years, raised its value creation element by increasing its credibility through public statements of being "lean, green, and clean" (AIIB 2017, Qingyang 2018), the introduction of best-practice relevant accountability, and transparency and environmental policies to achieve good environmental, social, and governance ratings and by stressing its independence from China despite vocal concerns (Bin 2018). In addition, to pick momentum regarding market entrance supply, the bank used its positional advantages in Asia to address market infrastructure needs and tap project resources existing in the pipeline of other MDBs. AIIB, acting as a wholesale and a policy bank, has therefore concentrated on infrastructure financing—as evidenced by the size, nature, and location of its projects—building on the due-diligence know-how of peer MDBs (65% of its projects have been cofinanced with another MDBs). Its proclaimed catalyst role in crowding-in capital resources for the realization of projects has not yet been established. Its market entrance demand aspect has also not been developed yet, as there were no bond issues floated in the capital markets.

During AIIB's start-up phase, the value creation element was developed cautiously; hence, its counter-balance BM element (i.e., value capture) has been exceptionally solid in all four of its constituents—namely the resourcefulness, efficiency, resilience, and effectiveness. Its USD 100 billion capitalization held by 93 countries—with a rather low, compared to its peers, median rating of AA- or better—at 28% is compensated by a large 20% paid-in capital portion (expected to reach its full amount of USD 18.9 billion by the end of 2019). The paid-in portion of capital is very high compared to other RDBs/MDBs (most of which, however, already have built-up reserves to counter their lower paid-in capital ratios). Its banking solidity, with a gearing ratio of 1:1, is also very strong compared to its peers, which can be explained by the aforementioned paid-in capital share. AIIB's strong value capture element has been decisive for the excellent AAA credit rating attributed to the bank on 29 June 2017 by Moody's (Bundesfinanzministerium 2017), followed by other rating agencies. Nevertheless, as the bank will enter its development phase, expected by its management to be after 2020, its offering will extend beyond sovereign "straight vanilla" lending to more risk-carrying products, as contained in its offering. In this case, AIIB's value capture will have to carry the main burden. Of course, the AIIB has room to maneuver through some

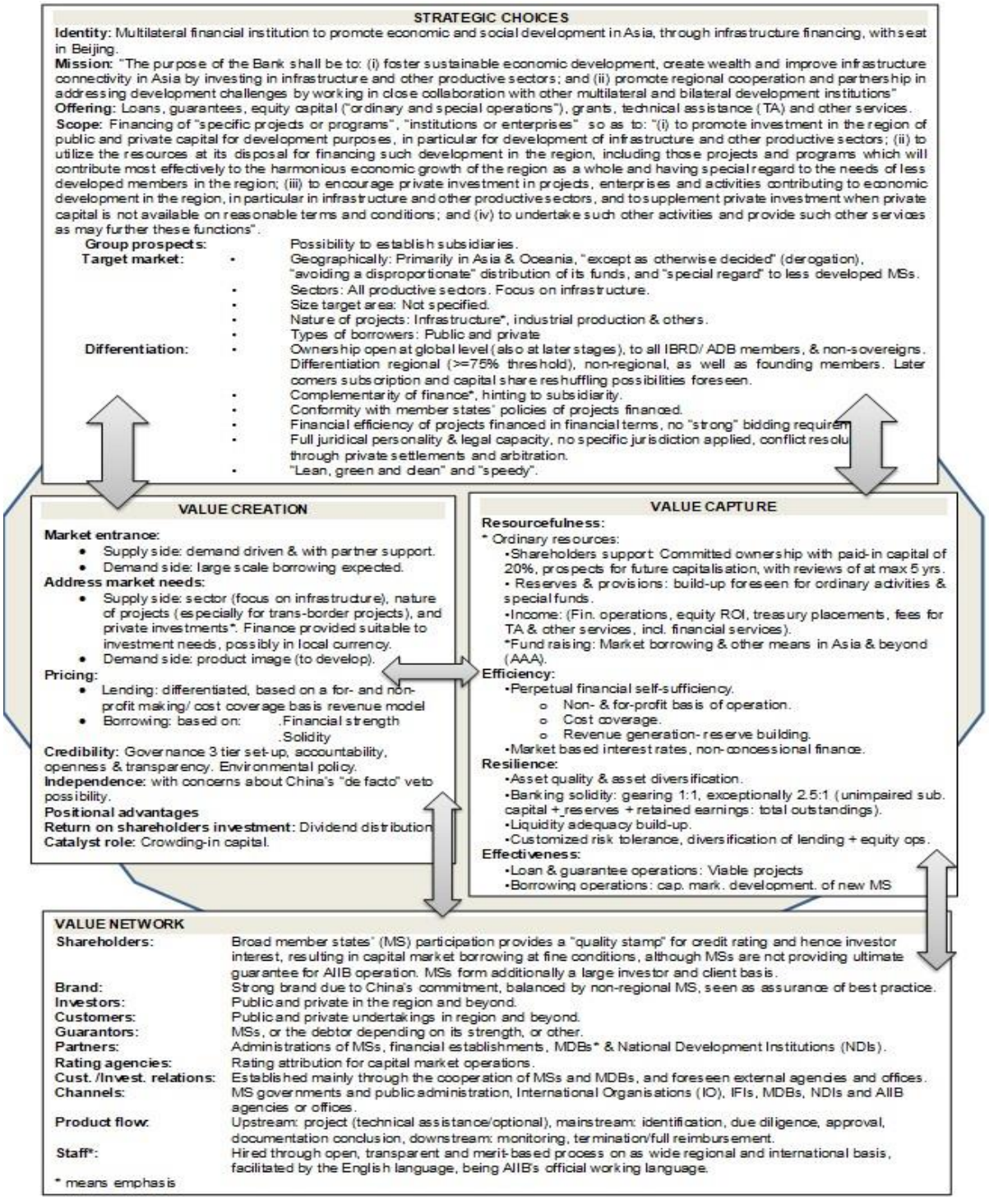
variable components of its BM value capture element. AIIB has, in this respect, established a comprehensive and proactive risk management approach, and as operations pick up, so would reserves and income.

AIIB's lending and equity portfolios are expected to reach USD 45 billion and USD 2.5 billion, respectively, by 2027, while the infrastructure needs, as mentioned above, are forecasted at USD 26 trillion by 2030 (ADB 2017, Bhattacharyay 2010). If, on average, an AIIB loan represents a third of the total investment cost and its equity participation a tenth of the total investment cost, the total investment that can be achieved through its "straight vanilla" lending action will represent only about 0.01% of the total investment needs. To increase its impact, the AIIB would have to use higher leverage products for infrastructure finance. In this case, however—with a multiplier of 15, as used in EIB's Juncker plan—AIIB's funding would only contribute 0.08% of the Asian infrastructure investment needs mentioned earlier.

It is questionable to what extent the AIIB would wish to stretch its leverage to improve its impact and to what extent its value capture element would be able to support such a stretch. Its efficiency, resilience, and effectiveness components can only carry a certain amount of risk, albeit sophisticated risk management policies with "comprehensive risk limits in all areas-investment, treasury, liquidity risk, market risk-the whole bank at one shot. (Given the type of loans) infrastructure-heavy, you want to have a capital concept that is very sensitive to concentration, credit quality, and tenor" (Chuang 2019: 2). Its resourcefulness will depend on investors' trust, attitudes, capacity, and wish to invest in AIIB papers floated in capital markets. They will be at the end of the day, the ones to ultimately decide whether to divert from path-dependent evolution in its RDB/MDB development and, if yes, to what extent the AIIB will be able to divert from the strategy, despite the bank's very wide offering and broad charter. With funding needs "in excess of USD 10 billion per year in the mid-2020s" (Chuang 2019: 2), investors will thus distinguish the feasible from the wishful and determine whether the AIIB will make a paradigm shift to multilateral banking.

3.1 Figures and Tables

Fig. 1: Asian Infrastructure Investment Bank's Business Model



3.2 Acknowledgments and Legal Responsibility

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Preference of Second Language as a Medium of Instruction for Undergraduates of Public Universities in Sri Lanka

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Abstract

English medium instruction has been introduced in public universities in Sri Lanka with the intention of making graduates readily employable in the private sector as the business language in the country is English. Students who enter universities find it difficult to manage their studies in the medium of English as majority of them have had their secondary education in their mother tongue. Though medium of instruction was in English language long time ago, later it has being changed to Sinhala and Tamil language as a national policy. It made recent generations to study their secondary education in their mother tongue. Since market demands for English, there was a huge necessity to conduct in English medium in universities. It resulted in reverting back to English medium as a medium of instruction in public universities. Although there are some studies around the world within this field, there are lack of studies in tertiary education in Sri Lankan context. The objective of the study was to analyze the preference of second language (English) as a medium of instruction among undergraduates of public universities in Sri Lanka.

Mixed method was used to collect data from undergraduates. Quantitative analysis was based on surveyed data. The study surveyed the undergraduates of Management stream in public universities in Sri Lanka. Primary data were collected using a semi structured questionnaire. Qualitative analysis were used to triangulate the quantitative findings.

Majority of the students were supportive of English medium instruction and a considerable percentage of them suggested bilingual teaching during the first and second years enabling them improve their language abilities. A small minority suggested reverting back to mother tongue in instruction. On the other hand, the study found that a small percentage of students were against bilingual teaching as they emphasized listening to English would contribute towards improvement of their language skills. These findings can be utilized in improving the teaching and learning process resulting in producing an employable graduate in Sri Lanka.

Keywords: Bilingual teaching, Employability of graduates, English Language, Medium of Instruction, Teaching – learning process

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- *This research presented on 25th International Conference on Business, Education, Social Science, Management (BESM-25): Osaka/Japan, May. 28th-29th, 2019*
- *Required by the authors, the full article is not publicly available so far due to commercial/academic confidentiality.*

Big Five Personality Traits and Communication Styles of the University Students: Reviewing Three Large Universities in Sri Lanka

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1. Background/ Objective and Goals

Personality and communication styles of individuals play significant role for interpersonal relations and successful management in any context. Lack of adequate empirical research findings in the available literature lead to empirical and theoretical knowledge gap about the relationship between big five personality traits and communication styles. Therefore, this paper is aimed to discuss the relationship between big five personality traits and the communication styles among the university students in Sri Lanka.

2. Methods

343 students were selected randomly as the sample from three largest universities located at Colombo district and used two standard questionnaires to gather the primary data. The instrument of measuring big five factors personality was Neuroticism-Extraversion-Openness Five-Factor Inventory (NEO-FFI) developed by Costa & McCrae (1992). It consisted of 60 questions measuring the five factors with 12 items per domain. Communication styles of the undergraduates were measured using Communication Style Inventory (CSI) developed by de Vries et al. (2009). It consisted of 96 questions measuring the six communication styles with 16 items per domain. The inter item consistency reliability was examined using Cronbach's Alpha test and the Cronbach Alpha results were more than 0.72 of both instruments. The data were analyzed using correlation analysis.

3. Results/ Conclusion and Contribution

Both expressiveness style of communication and preciseness style of communication are positively and significantly related with extraversion ($p<.05$), openness to experience ($p<.05$), agreeableness ($p<.05$) and conscientiousness ($p<.05$) of the big five personality traits. Verbal aggressiveness style of communication is positively and significantly related with

neuroticism trait (p<.05) of big five personality traits. Questioningness style of communication is not significantly related with all traits of big five personality in this sample (p>.05). Communication style of emotionality is positively and significantly related with neuroticism trait of big five personality (p<.05). Impression manipulativeness style of communication is positively and significantly related with neuroticism trait of big five personality (p<.05). When reviewing the literature relating to the big five personality traits and communication styles with the research findings, there is resemblance between personality traits and the communication styles among the university students. Therefore, the instructors or the lecturers can use appropriate strategies to delivery their lessons understanding the personality types and communication styles of the students in the classroom.

Keywords: Big Five Personality, Communication Styles, University, Students

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Part Two:

Topic on Engineering, Technology and Applied Science

Editor by Dr. Hanmin Jung
South Korea University

Zinc deposited on carbon felt electrode for secondary zinc-air batteries

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Abstract

Zinc-air batteries received increasing research attention due to their high specific energy, non-toxic, high safety, and low cost. Nonetheless, secondary zinc-air batteries suffer from dendritic zinc formation as well as shape change of zinc electrode during recharge. These issues lead to cell short-circuit deteriorating cell performance. In this study, carbon felt was used as the current collector of zinc electrode. Zinc is deposited by electrochemical technique from 7.0 M KOH containing 1 M ZnO. Electrochemical performances of the electrode are investigated using cyclic voltammetry and chronoamperometry. The mechanism of zinc stripping and plating follows the diffusion-controlled scheme. The morphology of zinc deposits into carbon felt is observed by a scanning electron microscope (SEM). Zinc deposited exhibited sponge-like network morphology on the carbon fiber leading to a high surface area of zinc. The coulombic efficiency of the zinc electrode is examined using a full cell test.

Keywords: zinc-air batteries, zinc electrode, dendrite, carbon felt

- *This research presented on 24th International Conference on Engineering, Technology and Applied Science (ETAS-24): Osaka/Japan, May. 28th-29th, 2019*
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1. Introduction

Recently, the energy demand is increasing while the fossil-fuels resource is decreasing and has a limit. In the same way, climate change and pollution resulted from the usage of fossil fuels, are an urgent problem [1, 2]. It is important to find clean, renewable, and sustainable energy to solve the problem [3]. However, renewable and sustainable energy, such as solar and wind power, also need proper electric energy storage for effective use. A battery is a promising alternative of electric energy storage.

The battery is used as an energy source for different devices. However, high energy density battery has a high cost. Other issues of battery include safety, environmental impact, and life cycle. For this reason, the battery that has a high energy density, high safety, and low cost is attractive for many studies [4]. Various batteries, such as lead-acid batteries, nickel-cadmium batteries, and lithium-ion batteries, are used widely. Although lithium-ion batteries have a high energy density, lithium-ion batteries also have safety problem and expensive. While zinc metal is safer than lithium and can be recycled. Besides, the amount of zinc reserves is much high. Therefore, zinc-based batteries exhibit high potential for future application.

Zinc-air batteries are attractive due to their high specific energy density, non-pollution, high safety, and low cost [1, 2]. However, in secondary zinc-air batteries, the structure and shape change of the anode during charge-discharge repeated cyling is a primary concern. The shape change problems occur during charging are dendrite formation. These issues lead to cell short-circuit deteriorating cell performance and loss of active material [3].

Zinc electrode and current collector are essential for the improvement of the performance, such as increasing area and minimize dendrite formation upon charging. The morphology and porosity of the zinc anode significantly affect the behavior of the battery. The three-dimension design is one effective approach to minimize the potential for zinc passivation [4]. Carbon felt is commonly used as an electrode due to its high stability at adequate conductivity. Besides, it offers a high surface area and porosity. Excellent electrolytic efficiency and mechanical stability at relatively low cost [5]

In this study, carbon felt was used as the current collector of zinc electrode to fabricate three-dimension zinc electrode. The electrodeposition process was examined in the deposition of zinc. Moreover, the morphology of zinc deposits also was studied.

2. Methods

2.1 Chemical and materials

Carbon felt (Shenzhen 3KS Electronic Material co., Ltd, thinness 3mm) was used as current collectors to fabricate three-dimension zinc electrode. Copper sheet was used to

improving conductivity of anode current collectors. Poly(vinylidene fluoride) (Sigma-Aldrich PTE Ltd., Mw 180000), Carbon black (Vulalcan® BP2000, Carbot Corporation), Graphite powder (<20µm particle size, Sigma-Aldrich PTE Ltd.), N,N-Dimethyltryptamine (LOBA CHEMIE PVT. LTD, 99.8%) were used to prepare binder for anode electrode. ZnO (QReC, 99%), KOH (Merck, 85%) and deionized water were used to prepare the electrolyte. All chemicals were used without any purification.

2.2 Zine electrode preparation

Copper sheet was cut (10x25 mm) and rinsed by acetone and deionized water. Copper was immerged in 15% HCl 3 minutes for treatment. And then was washed by deionized water and dried up. After that coated the binder ink on copper. The binder ink was prepared by mixing 87 wt.% Graphite powder, 3 wt.% Carbon black, 10 wt.% Poly(vinylidene fluoride) and N-Dimethyltryptamine solvent. Carbon felt was cut (10x10 mm) and placed on copper coated binder ink and annealed in vacuum oven overnight at 60 oC. To treatment and improve wettability, carbon felts were immerged in 1 M HNO3 as reported previously [1].

2.3 Haft-cell test

The haft-cell test, three electrode cell was used to study electrochemical measurement using unit software (AMETEK, PAR VersaSTAT3A). Three electrode cell consisted of carbon felt (10x10 mm) was used as working electrode. Platinum (10x10 mm) was used as counter electrode. The reference electrode was an Hg/HgO electrode, which contained 1M NaOH. The electrolyte was 7.0 mol dm-3 KOH containing 1.0 mol dm-3 ZnO. All experiments were tested at the room temperature. First, the cyclic voltammetry was examined at scan rate 5, 10, 20 and 50 mV/s. The chronoamperometry was tested to study electrodeposition of Zn. In this study was used potential range experiments -1.55V, -1.60 V and -1.65 V. for 2 hours. After finished chronoamperometry, the anode was washed by deionized water and isopropyl alcohol respectively. And then electrode annealed in vacuum oven overnight at 60 oC. A scanning electron microscope (SEM; JEOL, JSM-5800LV) was used to analyze morphologies of zinc deposits into carbon felt.

3. Results and discussion

3.1 Electrochemical performance

Electrochemical measurement was used to investigated zinc deposition and dissolution for zinc electrode from dissolution 7 M KOH containing 1 M ZnO. Fig. 1(a) Shows cyclic voltammograms of carbon felt electrode measured at scan rate of 5, 10, 20 and 50 mV/s corrected for respective base currents. Cathode peak of carbon felt, no peak is observed.

Zn2+ reduction onset potential is during -1.45 to -1.47 V. The peak current of anodic indicates that the wave increases with the increasing scan rate. Anode peak is observed at -1.21 to -1.23 V although the scan rate is changed. Fig. 1(b) shows the relationship between dissolution rate of zinc determinate the reaction control step. Normally the reaction controlled by surface reaction (linear dependence, i α ν) or diffusion limited mechanism (square-root dependence, i α ν1/2) can be indicate by the responding current peak for various scan rates, where i is the current peak and ν is the scan rate as report in literature [2]. For carbon felt, a square-root dependence is observed, which indicates that dissolution of zincates ions from carbon felt is controlled by diffusion limited.

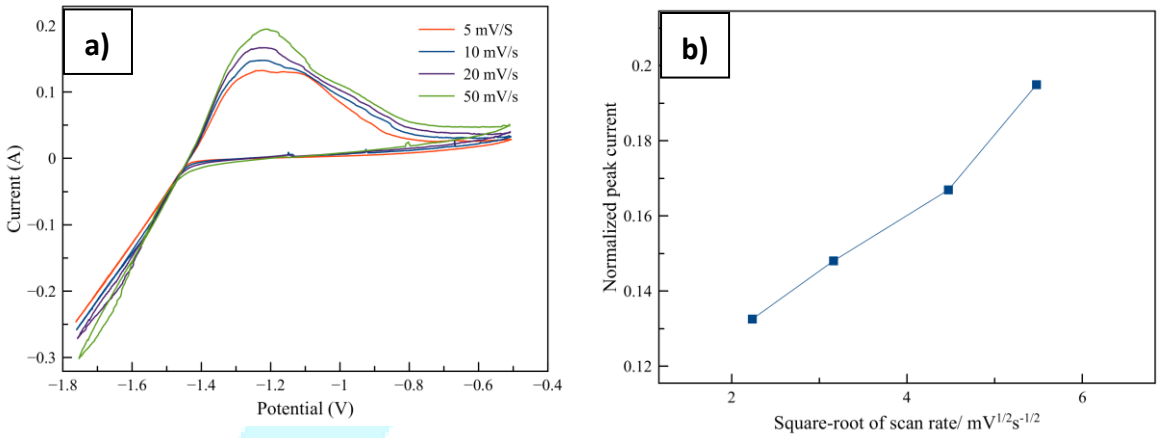

Fig. 1. a) Cyclic voltammogram of carbon felt thickness 3mm. for zinc deposition and dissolution at various scan rate 5, 10, 20 and 50 mV/s. vs. Hg/HgO., b) dependenc of normalized anodic peak current to the scan for carbon felt

Zinc deposition and dissolution behavior at carbon felt electrode for 10 cycles is studied by cyclic voltammetry measured at scan rate 50 mV/s. it can see that cyclic voltammetry curves are similar, which indicates a curve of oxidation and reduction peak, represented by Fig. 2(a). Fig. 2(b) shows zinc deposition and dissolved behavior on different electrode (carbon felt thickness 1 mm., carbon felt thickness 3mm., copper sheet and zinc sheet) studied by cyclic voltammetry measured at scan rate 50 mV/s. For zinc sheet, sharp peak current can be observed during reduction scan due to breakage of the ZnO passivation layer And the peak position cause by the passivation layer breakage is close to oxidation peak potential [3]. While the other electrode is not observed passivation layer breakage. Cathode peak of carbon felt thickness 1mm., carbon felt thickness 3mm. and zinc sheet are not observed. Cathode peak of copper sheet is -1.57 V. Anode peak of carbon felt thickness 1 mm and copper sheet are similarly (-1.21 V). Anode peak of carbon felt thickness 3 mm is -1.14 V

and zinc sheet is -0.73 V. Additionally, it is observed that the zinc stripping peak current of zinc sheet is greater than the others working electrode.

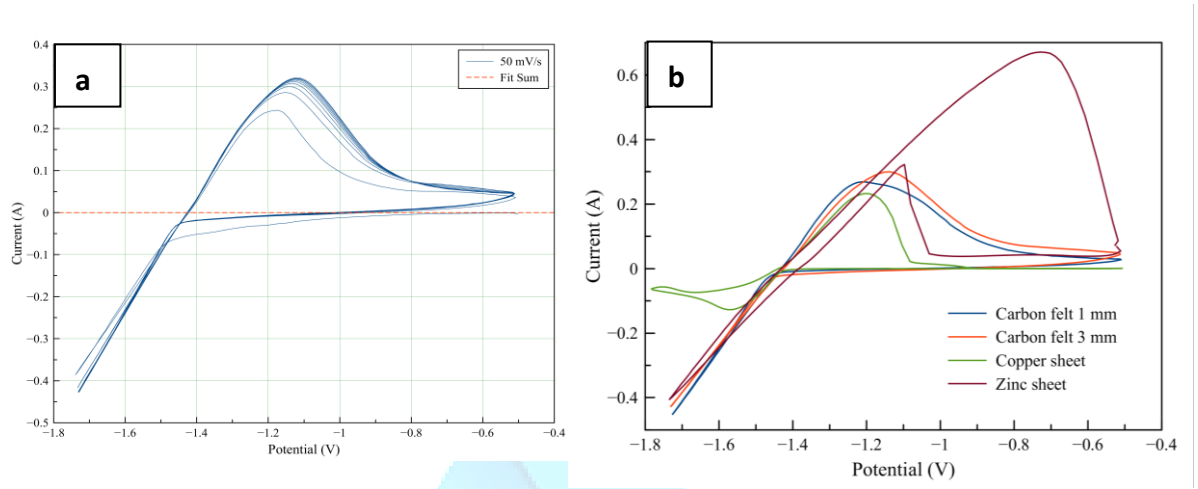

Fig. 2. Cyclic voltammogram of (a) zinc deposition and dissolution on carbon felt thickness 3 mm. at scan rate 50 mV/s. vs. Hg/HgO for 10 cycles, (b) zinc deposition and dissolution of various working electrode at scan rate 50 mV/s. vs. Hg/HgO

Chronoamperograms measure during potentiostatic deposition at -1.55, -1.60 and -1.65V using carbon felt as working electrode represented in Fig. 3, shows, at those potentials, at time approximately 0 s, the Zn deposition current decayed, attributed to the development of the concentration profile in the Nernst diffusion boundary layer near the electrode surface [4]. After that zinc deposited is fast that lead to fast increase zinc surface. Effect to fast increase in current density. Due to fast zincate ions consumption, the concentration is reducing close to the surface. For this reason indicates that the reaction proceed under diffusion-controlled [5].

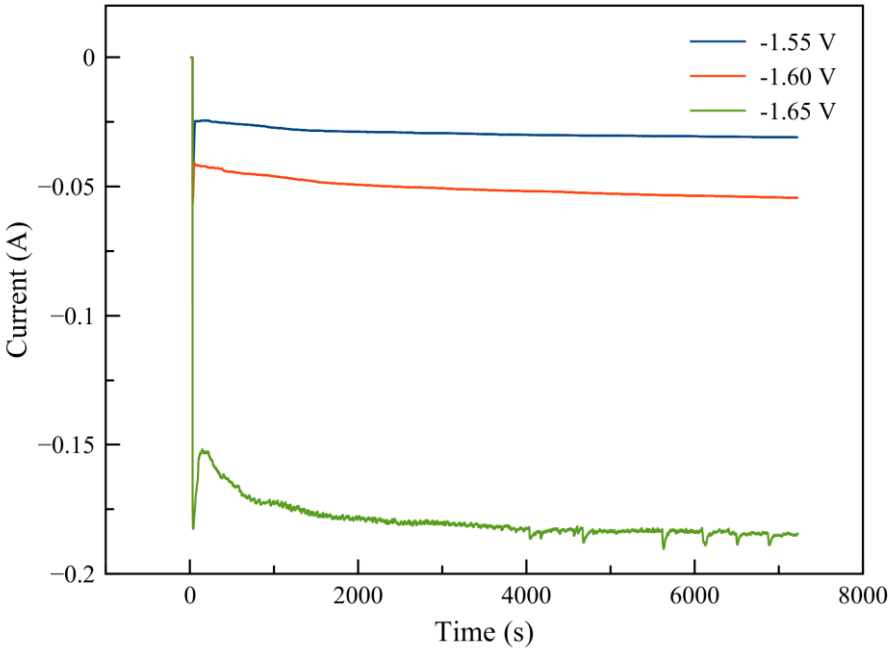

Fig. 3. Chronoamperometric current transient of electrodeposition of Zn on carbon felt at different applied potentials vs. Hg/HgO in 7 M KOH containing 1 M ZnO.

3.2 Morphology study of zinc deposits

Zinc electroplating has been used to prepare an excellent zinc electrode, which obtain large electrochemically active surface area and high loading of active material [6]. In this study, zinc deposited at potential -1.55, -1.60 and -1.65 V for 2 hours. Zn deposition on carbon felt represented by SEM image in Fig 4 (a) – (f). It can see from Fig. 4 (a) and (c) that zinc deposited on carbon felt between porous carbon felt. And it also can be observed that carbon felt surface covered with zinc, various widths formed and randomly distributed. For Fig. 4 (b), (d) and (f) show that the morphology of zinc is similarly which applied potential range in this study. Amount of zinc that deposited on carbon felt is dependent on current density. Zinc deposited exhibited sponge-like network morphology leading to a high surface area. Compared to zinc planer electrode, porous electrode largely improves discharge capacity due to the high effective surface area and electrolyte reservoir [7].

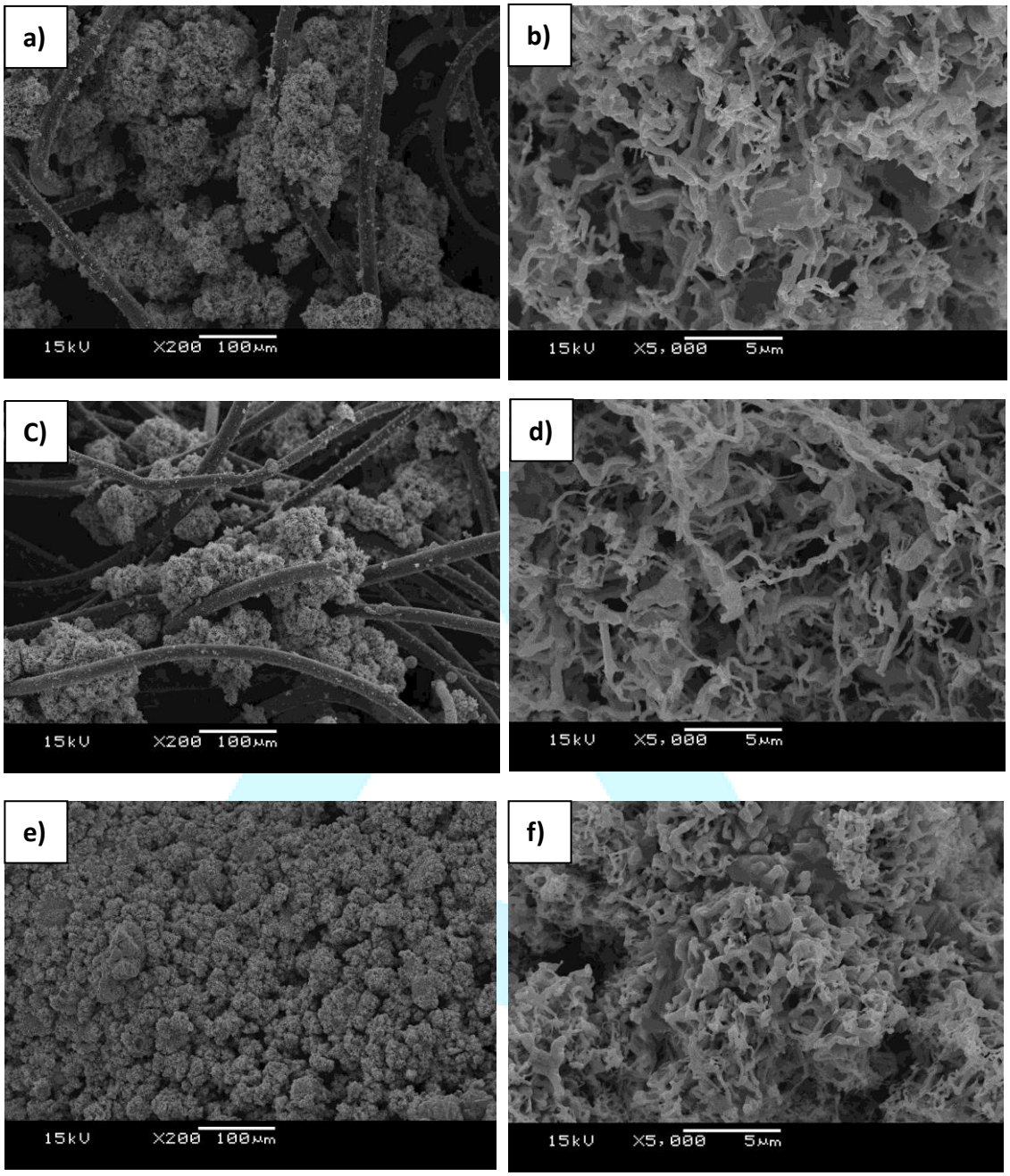

Fig. 4. SEM image of zinc deposition on carbon felt (a) and (b) at potential -1.55 V for 2 hours., (c) and (d) at potential -1.60 V for 2 hours, (c) and (d) at potential -1.65 V for 2 hours.

4. Conclusion

In this study, carbon felt has been examined as the current collector of zinc electrode. The electrochemical performance on zinc deposition and dissolution of zinc electrode was investigated. The results revealed that the dissolution of zincate ions from

carbon felt is controlled by the diffusion process. Besides, the ZnO passivation layer was not observed. Zinc deposited on carbon felt between porous carbon felt, various widths formed and randomly distributed. Zinc deposited exhibited sponge-like network morphology leading to the high surface area. Therefore, carbon felt showed a high potential to be used in rechargeable zinc-air batteries.

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Application of co-solvent for improving biodiesel production in an ultrasound-assisted reactor

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Abstract

The work focuses on improving the efficiency of biodiesel production by addition of co-solvent in transesterification of palm oil and methanol in an ultrasound assisted reactor. CaO was used as heterogeneous base catalyst. The fresh catalyst was characterized using X-ray diffractometer (XRD) and Hammett indicators method for determining basicity and basic strength. The basicity of CaO catalyst was 0.067 mmol/g and the basic strength (H_) was $7.2 \leq H_ \leq 9.3$. Acetone, THF and methyl ester (biodiesel product) were chosen as co-solvent. Methyl myristate was selected to represent the biodiesel product to be a co-solvent. Screening tests for the suitable co-solvent for transesterification of palm oil with methanol was investigated. The selected operating condition was as follows: the methanol to oil molar ratio of 9:1, reaction temperature of 60oC, and CaO loading of 10wt% based on oil. The addition of co-solvent can increase reaction rate and reduce reaction time. The FAME yield increases from 37.1 to 84.4% within 120 min by addition of methyl myristate to methanol ratio of 0.1. This is because methyl myristate can increase the miscibility between oil and methanol, resulting in higher FAME yield (95.31%). Moreover, the mixture of methyl myristate and acetone can remove the induction period and provide the higher transesterification rate.

Keywords: Biodiesel, Heterogeneous catalyst, Transesterification, Co-solvent, Ultrasound probe reactor.

- *This research presented on 24th International Conference on Engineering, Technology and Applied Science (ETAS-24): Osaka/Japan, May. 28th-29th, 2019*
- *Required by the authors, the full article is not publicly available so far due to commercial/academic confidentiality*

1. Background/Objectives and Goals

Nowadays, energy issue related to the carbon emission from burning fossil fuels was found to be an environmental problem in term of global warming. This problem has also been increased due to the continuously increasing use of fossil fuels. At the same time, the rapid increase in the number of industries and vehicles also gives rise in the petroleum price. Therefore, many researchers have been encouraged to investigate the possibility of using alternative sources of energy instead of energy from fossil sources [1-3].

Biodiesel has attracted significant attention as it is renewable energy, alternative fuel, biodegradability, non-toxicity, non-flammable property and less emissions of harmful gases such as sulfur dioxide, carbon monoxide and unburnt hydrocarbons in comparison to petroleum diesel fuel. Mostly, biodiesel production via transesterification requires catalyst to produce the faster reaction rate and completion reaction. The conventional catalyst used for biodiesel production is based on homogeneous catalyst such as sodium hydroxide (NaOH) and potassium hydroxide (KOH). This catalyst requires the washing step to separate catalyst from biodiesel causing environmental problem. Using heterogeneous catalyst gains more advantages including easy separation of catalyst from reactant and product, reducing the washing procedure, decreasing amount of waste water, long life catalyst and reusability[4, 5]. The major disadvantage of biodiesel production via transesterification using heterogeneous catalyst and excess alcohol are only two problems including (i) mass transfer limitation between reactant and active site of catalyst and (ii) insolubility of oil and alcohol phases.

Nevertheless, the disadvantage is mass transfer limitation, ultrasound-assisted reactor can be used to overcome this disadvantage. Ultrasonic or ultrasound wave is mechanical wave in the range of 20–1000 kHz. Ultrasonic wave can be applied for measuring depth of sea and finding object under water, etc. Using ultrasound assisted reactor provides the greater mixing by increasing the interfacial area of mixture via cavitation and micro bubble formation. Thus, mass transfer limitation was decreased and reaction rate was increased[6]. Our previous work studied biodiesel production via transesterification of palm oil using a circulated continuous flow ultrasound assisted reactor (US) and compared with mechanical stirred reactor (MS). The reaction was carried out at 60oC, 1 atm and methanol to oil molar ratio of 9:1 with 2% of CaO catalyst loading. The results showed that biodiesel yield was increased in the shorter time in US. Moreover, ultrasonic frequency and power also have affected on degree of mixing of reactant[7]. The addition of co-solvent can increase reaction rate and reduce reaction time. Various co-solvents for transesterification likely acetone, hexane, diethyl ether (DEE), tetrahydrofuran (THF) and carbon dioxide (CO2) were used to increase the yield of biodiesel [8-10].

The aim of this investigation is to improve the efficiency of biodiesel production by

addition of co-solvent for transesterification from palm oil in an ultrasound assisted batch reactor. Acetone, THF and methyl ester (biodiesel product) were chosen as co-solvent, due to its boiling point near the alcohol being used. This approach can be applied to the continuous biodiesel production.

2. Materials and Methods

2.1 Materials

Commercial refined palm oil "Morakot" brand was purchased from a local store in Thailand. The methanol analytical reagent was purchased from QRëC®. Methyl heptadecanoate and heptane were used as internal standard and solvent, respectively for GC analysis and purchased from Sigma-Aldrich and Fisher Scientific, respectively. Purity calcium oxide, CaO (96%) fine powder catalyst was used heterogeneous catalyst in this experimental provided by Sigma-Aldrich. CaO catalyst was prepared by the calcination method in a muffle furnace with the heating rate 10℃/min to 900℃ and holding time for 5 h then kept in a desiccator cabinet before use. Acetone (99%), tetrahydrofuran (THF 99.5%) and methyl myristate as co-solvent were obtained from Fluka.

2.2 Methods

The experiments included transesterification activity test and analysis of biodiesel yield. The batch ultrasound assisted reactor (UP) was used to test the biodiesel production performance via transesterification of palm oil with methanol with addition of co-solvent as shown in Fig 1.

The palm oil was heated at 60oC. Then, methanol and CaO catalyst were mixed 30 min before being added into the reactor. CaO catalyst and methanol were added after co-solvent and palm oil mixed together. The mixture solution was maintained temperature at 60oC.

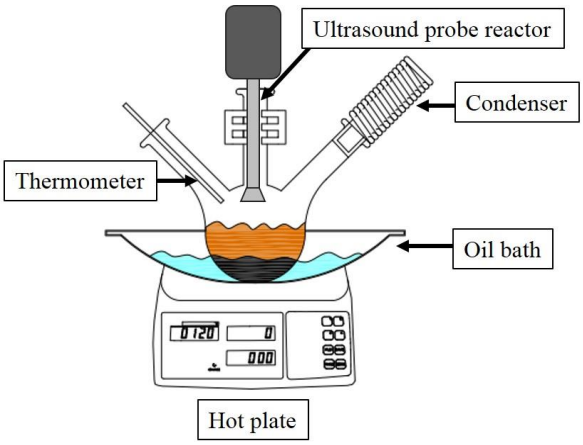

Fig. 1 Transesterification in an ultrasound probe reactor (UP)

The operating condition is shown Table 1. The effect of different co-solvent volume ratio was performed using the suitable co-solvent. Samples were collected on time schedule. Sample was separated methanol, biodiesel product and glycerol by centrifugal machine before analysis of FAME yield with a gas chromatography (GC) according to EN 14103 standard.

Table 1 Operating condition for batch ultrasound probe reactor

Parameter	Condition
Feedstocks	Palm oil
Reaction temperature	60oC
Reaction time	240 min
Methanol to oil molar ratio	9:1
Methanol to co-solvent volume ratio	1:1,1:0.5, 1:0.25 and 1:0.1
Catalyst loading	10%wt based on oil
Catalyst type	CaO
Co-solvent type	Acetone, Methyl myristate and THF
Ultrasound probe reactor (UP)	60 W and 20kHz.

3. Results and discussion

3.1 Characterization of the catalysts

XRD technique was used to confirm the formation of CaO phase and the XRD result is shown in Fig.2. The CaO catalyst was calcined at 900oC for 5 h. The XRD pattern of fresh catalyst indicated that CaO is the main composition of catalyst. CaO peaks was demonstrated

at 2θ of 32.3o, 37.4o, 53.8o, 64o and 67o. CaCO3 peaks was observed at 2θ of 34 o, 47.2o and 50.8o. CaO and CaCO3 peaks with corresponding to the previous work [10]. Hammett indicators method for determining basicity and basic strength of fresh CaO catalyst was investigated. It was found that the basicity of CaO catalyst was 0.067 mmol/g and the basic strength was $7.2 \leq H_{-} \leq 9.3$.

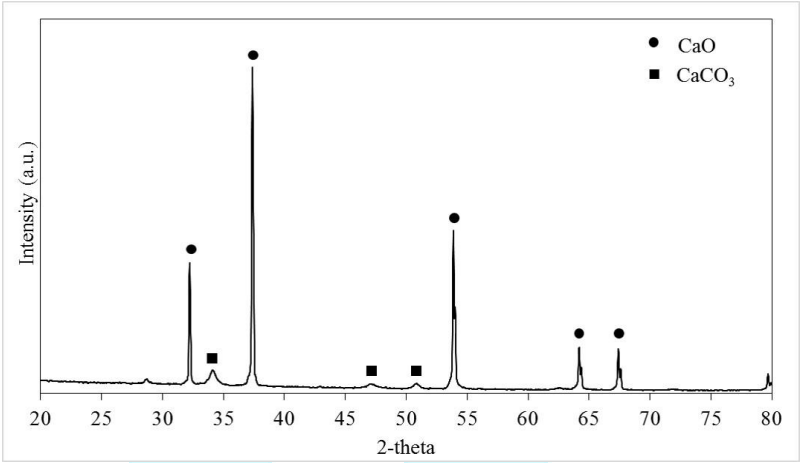

Fig. 2 The powder X-ray diffraction pattern of fresh CaO catalyst.

3.2 Effect of co-solvent on FAME yield.

Transesterification of palm oil was performed using the operation condition shown in Table 1. Fig. 3 shows FAME yield of transesterification of palm oil using the different co-solvent types.

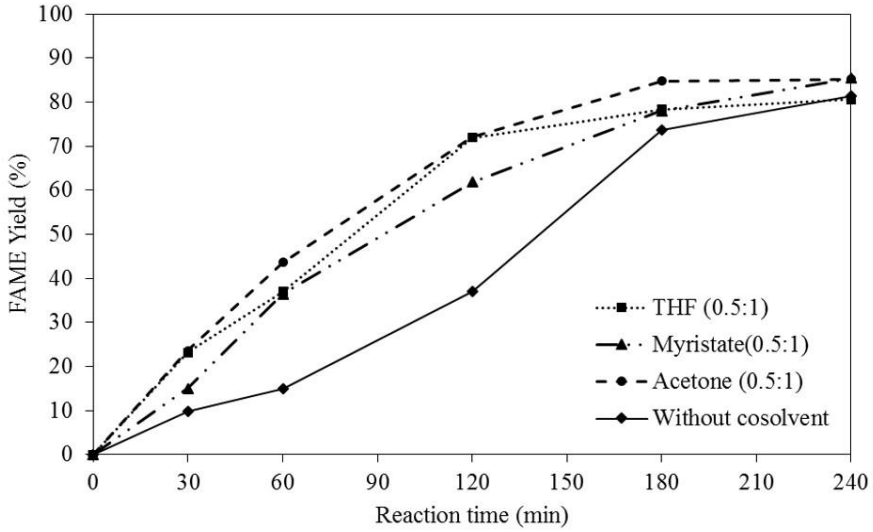

Fig. 3 FAME Yield (%) using the different co-solvent types

Using co-solvent did not only accelerate the initial transesterification rate but also increased the FAME yield as compared to the blank test (without co-solvent). The highest FAME yield at 240 min was obtained from myristate (85.35%) and acetone (85.19%) respectively. The induction period of the CaO catalyzed transesterification using co-solvent was reduced because the co-solvent can increase the solubility of immiscible fluids for overcome mass transfer limitation and/or the new phase of CaO catalyst was generated during the catalytic process. XRD characterization of used CaO catalyst after transesterification was also investigated as presented in Fig. 4.

Fig. 4 shows the XRD pattern of used CaO catalyst after transesterification of palm oil. All sample of used CaO catalyst showed calcium hydroxide (Ca(OH)2) peaks at 2θ of 28o,34.1o,47.1o,50.8o and 54o [6, 11]. Calcium diglyceroxide (Ca(C3H7O3)2) was indicated for the used CaO catalyst derived from the addition of THF and acetone. Intense peaks were found at 2θ of 21.2o, 24.3o and 26.6o. This indicated that CaDG was formed by the bonding of CaO catalyst and by-product (glycerol)[10, 12]. Nevertheless, no CaDG phase was observed when the used CaO catalyst was obtained from the addition of myristate and the used CaO catalyst without co-solvent. Lukić et al.[13] reported that the CaDG has affected mostly on the initial period of reaction because CaDG acts an emulsifier that enhances solubility in immiscible liquid including catalyzing the methanolysis of sunflower oil.

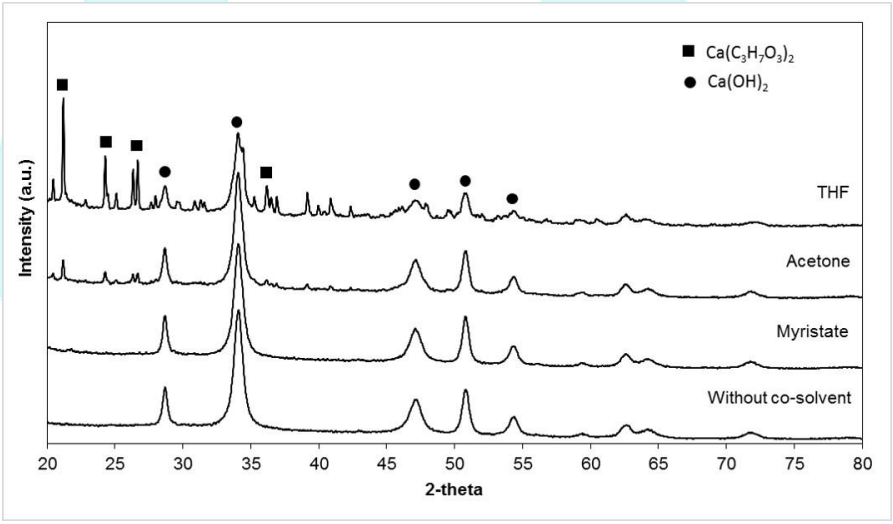

Fig. 4 The powder X-ray diffraction pattern of catalyst after reaction.

Kouzu et al. [12] also proposed that the formation of CaDG also likely acted as the solid base catalyst that can accelerate the transesterification rate as corresponding to FAME yield profile (Fig 3.). Using acetone and THF as co-solvent can increase the initial transesterification rate than that of methyl myristate. This is because of the synergistic effect

that the addition of acetone and THF not only increase the solubility of oil and methanol but also generate the new phase (CaDG) to provide the higher FAME yield in a short reaction time.

The selection constrain of appropriate co-solvent does not only provide high yield but also concern in the separation step. However, using product as a co-solvent can eliminate the separation step of co-solvent. As can be seen form Fig. 3, methyl myristate provided the highest yield at 240 min which is one of biodiesel composition without the requirement of co-solvent separation step. Therefore, methyl myristate was selected to investigate the effect of amount co-solvent on the FAME yield as illustrated Fig.5.

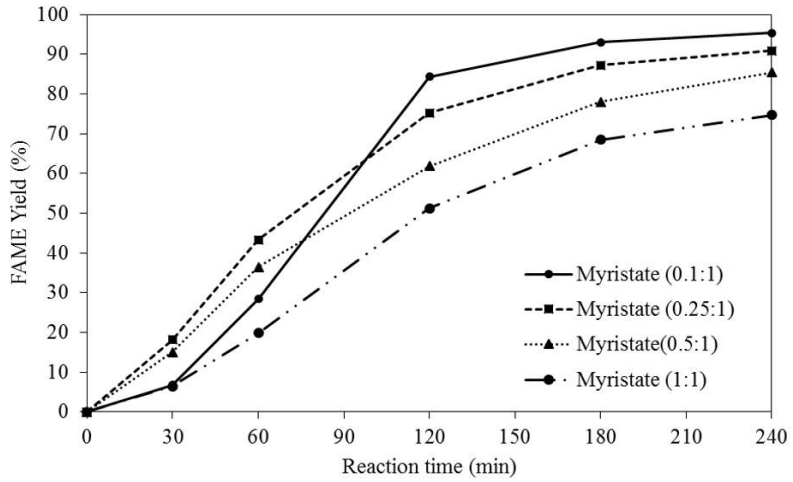

Fig. 3 The effect of co-solvent ratio for transesterification of palm oil.

The highest FAME yield reached 95% that obtained from methyl myristate to methanol ratio is 0.1:1. Nevertheless, the induction period was also observed for this condition. Therefore, to eliminate the induction period, the mixture of co-solvent between myristate and acetone was introduced because acetone can improve the solubility of mixture and increase FAME yield at initial period. Fig. 6 shows the comparison of FAME yield obtained from acetone, methyl myristate and the mixture of acetone and methyl myristate. Using acetone to methyl myristate to methanol ratio at 0.25:0.75:1 provided the highest FAME yield of 92.14% at 180 min. This is because the mixture of acetone and methyl myristate gave rise the synergistic effect for CaO catalyzed transesterification of palm oil in an ultrasound assisted reactor.

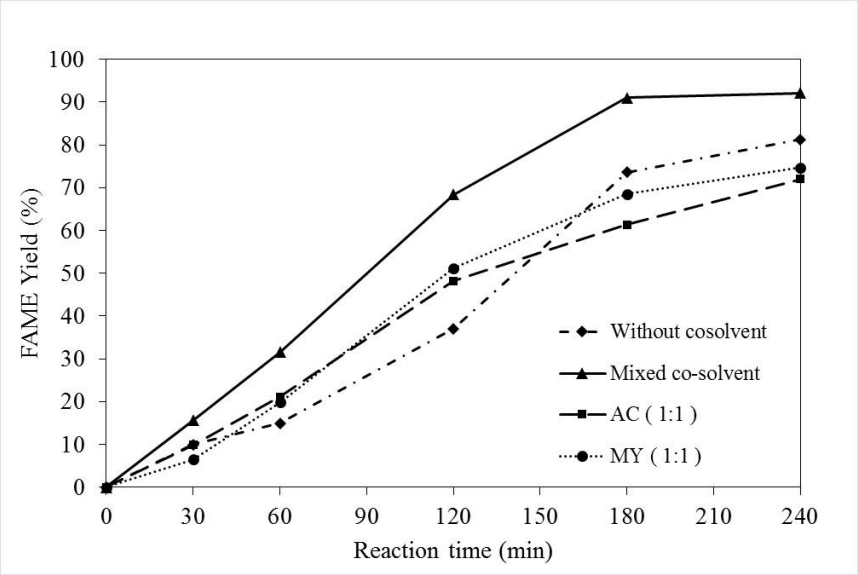

Fig. 4 FAME yield (%) of mixed co-solvent and without co-solvent.

3.3 Conclusion

Using co-solvent can enhance the FAME yield via CaO catalyzed transesterification of palm oil because the co-solvent can increase solubility of mixture for overcoming mass transfer limitation resulting in decrease of the induction period. The addition of acetone and THF can generate the new phase as emulsifier (CaDG) for enhancing solubility of mixture and thus provide the higher FAME yield in a short reaction time. The highest FAME yield was obtained from methyl myristate but the short induction period was also observed. Moreover, acetone was selected to mix with methyl myristate as a co-solvent to reduce the induction period and increase the FAME yield. Therefore, using the mixture of co-solvent approach can be applied to the continuous biodiesel production.

3.4 Acknowledgments and Legal Responsibility

The authors would like to acknowledge the ‘‘Research Chair Grant” National Science and Technology Development Agency (NSTDA) for funding the project.

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3D Photogrammetric Technique for Recording Shipwreck Sites in Sri Lanka

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Abstract

Photography is a most important recording method for archaeological activates such as exploration, excavation and conservation. Specially, the technique is playing key role for the recording of excavation. The main goal of the research is to record shipwreck sites in 3D format for the underwater cultural tourism and invite to researchers who is unable to dive in to the site. Any archaeological excavation can't be construction again even with high technology. Therefore, photographs are the only visual evidence for the excavated site for the future research. In recently 3D photogrammetric technology is using for recording of archaeological activities (in land) in Sri Lanka.

All the shipwreck sites which was used to photography for the 3D images were located around the island between 15-30meters depth. Those all site were examined and captured by participation observation. Well trained three divers were engaged with field works for collecting data. Also literature was examined though previous research done by pioneers of the field. The research team has spent one year for the field work and hundreds of hours spent for upload the pictures for the software. Among the hundreds of shipwreck sites in the coastal of Sri Lanka, there were selected 10 sites for the research, then more than 1300 photographs were taken that at least 100 photographs form one site. The photographs were taken to represent whole site line by line then uploaded to software for the 3D model. Finally, more than hundred pictures linked each other and produced on picture which can turn 360 degrees.

The underwater photography was started at least from 1899 then gradually developed in the global context. However, underwater photography has been used over the last few decades in Sri Lanka. Then thousands of photographs were taken from numbers of shipwreck sites. This is the first attempt to use 3D photogrammetric technology (PT) for the recording of shipwreck sites in Sri Lanka According to several experiment, successful 3D photographs were recorded from numbers of shipwreck sites. The completed 3D pictures are very useful

for researchers who is unable to dive and get primary data. Not only research but also those 3D pictures can be used for film industry, preparing map, promoting tourism and other many proposes. Specially, Sri Lanka as a tourism country, there is high advantage to promote underwater cultural tourism which is not still focused and popular. There are hundreds of shipwreck sites around the coastal line in Sri Lanka. Most of sites are located shallow deep which able to reach divers even who has open water diving license. At the moment the demand of underwater cultural heritage is growing up as a world trend.

Keywords: Photogrammetric, Photograph, Shipwreck, Underwater

- *This research presented on 24th International Conference on Engineering, Technology and Applied Science (ETAS-24): Osaka/Japan, May. 28th-29th, 2019*
- *Required by the authors, the full article is not publicly available so far due to commercial/academic confidentiality*

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