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V-MIEX

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VIRTUAL-MELAKA INTERNATIONAL INTELLECTUAL EXPOSITION

ROAD TO COMMERCIALISATION

V-MIEX BOOK



V - MIIEX BOOK

'ROAD TO COMMERCIALISATION'

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FOREWORD

ASSOC. PROF TS. DR MOHD RASDI ZAINI
Rector
Universiti Teknologi MARA (UiTM) Cawangan Melaka



Welcome to Virtual-Melaka International Intellectual Exposition 2022 (V-MIIEEX 2022). It is an honour for me on behalf of UiTM Melaka Branch to thank all of you for joining the programme and we are proud to inform you that this is the 12th year consecutively, UiTM Melaka Branch is organizing this exposition.

V-MIIEEX 2022 is a platform to improve the commercialization collaboration among industries and communities and at the same time, we also give the opportunity to academicians and students to share ideas and increase their potential innovation products with the industries and communities through their projects. This exposition also serves as a platform to cultivate and upload the nation's innovation culture by presenting new ideas and research by young people, especially from academia, universities, college, high schools, and primary school students.

The economy and development of the country faced a challenging phase in 2021 due to the Covid-19 pandemic. We faced changes in business, education, society, and lifestyle. However, the pandemic proved to be a blessing in disguise as it somehow gave people ideas which would be beneficial to improve their lifestyle and solve problems that might occur in the future. Besides, the new digital landscape also inspires more innovation and new ideas that contribute to various activities such as business and industries. As a university that encourages the "Research, Innovation and Commercialization", this exhibition is organized to encourage more commercialization of products that are beneficial to scholars, industries, and communities to tackle such issues to improve our present and future life.

Since 2009, UiTM Melaka Branch has successfully become the organizer for this innovation exposition. We are not only successful in organizing the exposition, but I would proudly say that we have also successfully embarked on commercialized products. With the number of participants for this year's exhibition, we believe that more commercialized products will be produced in line with the theme for this year, "Road to Commercialisation".

This exposition would never happen without dedication, teamwork, and commitment. A round of applause should be given to the committee teams as the backbone of this exposition. Their hard work, effort, and time made this exposition possible.

Finally, I would like to conclude this brief remark by thanking all the participants and stakeholders for joining the exposition, we hope that this collaboration never ends here.

Thank you.



DR. NUR HAYATI BINTI ABD RAHMAN
Deputy Rector Research & Industrial Linkages
Universiti Teknologi MARA (UiTM) Cawangan Melaka

It is a great pleasure to welcome all the participants and presenters to the Virtual Melaka International Intellectual Exposition (VMIIEX 22). I am delighted that through this periodic event, we managed to bring together scholars and professionals from various fields to engage through this virtual platform where ideas and breakthrough are discovered and leveraged for commercialization potential.

Since 2009 UiTM Cawangan Melaka has held twelve Invention and Innovation Design competitions and this year we are very honoured to have the second year of VMIIEX organized in digital platform. This has proven that despite the global challenges due to the recent pandemic, it is never an issue for UiTM Melaka to continuously organize this yearly prestigious event and to support the ministry's aspiration in leveraging creativity and innovation in the new norm.

VMIIEX 22 is organized with no sole objectives of accomplishing the University's KPI but instead we are determined to make this programme as the place to help heighten commercialization collaboration in research and innovation with the industry and community through joint exhibitions from various external organizations.

Our aspiration is to also provide exposure and opportunities to academic staff as well as students from public and private universities to engage in direct excellent scholarly activities with the industry and community through activities that can be measured and assessed. As for the Research and Industrial Linkages Office of UiTM Melaka, this exhibition is seen as the platform that can encourage active collaboration and knowledge transfer with industries; objectively to support various activities that will benefit all stakeholders from the various government agencies, local and international universities, industries and communities.

Through the theme of "Road to Commercialization" this year, V-MIIEX 22 is committed to have this event as a boulevard to inspire and cultivate creativity and innovation to the numerous levels of inventors through exposure on latest technologies, astonishing ideas and creative designs with great potential to be commercialized. For this year, we proudly introduce a special category which is the "Endemic Challenge" as the provision to the government of Malaysia's goal of moving towards the endemic.

To ensure that the competing products in this exhibition is not exclusively for the purpose of competition, V-MIIEX 22 is dedicated for the commercialization of highly potential innovation products, which is attained through its active collaboration with tailored needs industries. The commercialization effort was not for income generation purpose only but it aimed to spearhead the development of quality products in line with industrial needs and community benefit.

Therefore, it is a great honour for me on behalf of the Research and Industrial Linkages Office as well as the organizing committee to have all participants in this competition and I would like to express my highest gratitude especially to the Rector of UiTM Melaka and all strategic partners and sponsors for supporting the event.

To finish, I sincerely wish VMIIEX 22 a remarkable success. I believe that this will not be the only collaboration between UiTM Melaka and the respective partners and linkages, but a beginning of a long and fruitful cooperation in future.

Thank you very much.

road to commercialisation...

WAN HASMAT WAN HASAN
Project Director V-MIIEEX 2022
Universiti Teknologi MARA (UiTM) Cawangan Melaka



Assalamualaikum and Warmest Greetings.

It gives me an enormous pleasure, on behalf of the organizing committee to welcome all participants and presenters to the Virtual -Melaka International Intellectual Exposition 2022 (VMIIEX '22) with the theme "Road to Commercialisation". We are honoured and glad to welcome all participants to this biennial event.

This is the second time that we have organized this biennial event virtually. V-MIIEEX 22 is an innovation competition, in which, innovation products, ideas and systems related to various science and technological fields are exhibited as a solution for the presented problems.

V-MIIEEX22 expectantly will be a platform that gathers experts from academies, scientists, and researchers, locally and internationally, to contribute towards the growth of scientific and technological knowledge in each participant's specialisation and expertise.

The competition also serves as a platform to give fresh exposure to the various level of inventors, as well as to encourage the culture of innovation design focused on latest technologies and related to new norms technologies and inventions due to COVID-19.

V-MIIEEX 22 is also hoped to be an avenue for gathering and disseminating the latest knowledge on ideas and acquisition of innovation among the participants. It is hoped that the competition will be able to open the mind of the participants towards latest technologies and design. It is also in line with the government's aspiration to encourage innovation activities in Malaysia.

As a final note, I would like to congratulate my fellow committee members for their tremendous effort, which have been critical to the event's success. In addition, I would like to thank our co-organizer, event sponsors and supporters. Optimistically, we wish that all new knowledge that is discovered, invented, or innovated will drive towards our future sustainability.

Thank you.

ABOUT V-MIIEEX

The world after COVID-19 is unlikely to return to the world that was. Despite the challenging pace during the pandemic, the strong rebound is expecting in this exciting year 2022. Malaysia is welcoming the great prospects ahead with positive impact on the country's economy and development. Hence, the hope for greater opportunities motivates for more creative thinkers to come up with innovative ideas that can be put forward to be harnessed to overcome similar problems in the future. V-MIIEEx 2022 is one of these platforms which contribute relevant ideas that could help communities of all walks of life cope with this pandemic.

UiTM has identified research, innovation, and commercialization to be among the core components and strategic effort towards becoming a well-known and prominent university. Aside from realizing this goal, with these components and efforts, fostering the development of knowledge, generating financial stability of the university, and producing knowledgeable academicians are also potentially achievable.

By having invention and innovation competition yearly, UiTM Cawangan Melaka is confident that it could further enhance creative and innovative abilities among staff and students. In support of the government notion which upholds the importance of innovation, UiTM Cawangan Melaka has taken the initiative of organising the Virtual Melaka International Intellectual Exposition (V-MIIEEx).

In instigating and nurturing the continuous culture of inventing and innovating, this event is an ideal platform for lecturers, administrative staff, students, and the public to showcase and commercialize their products or prototypes as well as novel ideas. The first IID which was held nationally in UiTM Cawangan Melaka in 2009, has successfully gathered and displayed more than 37 inventions and innovations. Accordingly, to continue this strong passion towards inventing and innovating, the IID competition should be continued and celebrated.

With that, the Division of Research and Industrial Linkages will be organising its 12th IID competition, the Virtual - Melaka International Intellectual Exposition (V-MIIEEx 2022) with the theme, 'Road To Commercialisation'. V-MIIEEx 2022 hopes to welcome 200 competing products to be showcased and commercialized, at the same time, attract attention of related and matching industry.

Objectives

1. Encourage and instill passion towards inventing and innovating among UiTM Cawangan Melaka staff, students and academicians of local and international higher education institutions;
2. Highlight distinguished talents of skillful inventors and exhibit intellectual products, inventions and innovations among local and private tertiary institutions, government and private agencies, including international participants;
3. Become an effective Business Matching platform for participating research products, matching industries and partnering government agencies;
4. Recognise, inspire and promote invention and innovation products to be patented and commercialized;
5. Increase passion towards inventing and innovating through research and boost interests of government and non-government agencies to obtain consultancy services from a line up experts of higher education institutions and UiTM Cawangan Melaka.

GeoPOBA as Green Technology in Landfill Liner

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Abstract

In the palm oil industry, the waste products of the palm oil boiler ash have become one of the major issues because as a by-product, it is less utilized and dumped in landfills. Geopolymer is a new green technology that has been intensively studied in concrete applications, but few studies on geopolymer have been conducted in soil applications. This aims of this study to investigate the effect of geopolymer in landfill soil liner. The main objective of this study is to develop the Modelling and Nomograph in predicting hydraulic conductivity of landfill soil liner. Different percentages of geopolymer (0%, 5%, 10%, 15%, and 20%) were added to laterite soil. Based on data from the compaction test, 15% of geopolymer in laterite soil indicated the best-mixed design with a maximum dry density of 2.23 Mg/m³ and moisture content of 13.58%. According to compaction measurement, a high value of maximum dry density reduces the air voids, thereby reducing hydraulic conductivity. The SEM images proved the development of geopolymer gel stabilized the soil structure from a loose structure to a denser soil structure. The goal of this study is to analyze the geopolymer of boiler-ash applied to laterite soil as an alternative method in geotechnical applications to increase soil strength and potentially decrease the rate of hydraulic conductivity. As a conclusion, this can be concluded that by geopolymer technology as additives will develop new liner design, reduce hydraulic conductivity, and sustain the environment.

1. INTRODUCTION

The study investigates a green technology geopolymer as additives in enhancing the properties of landfill soil liner. Soil liners are used to contain waste in modern landfills. Essentially, the liner system isolates the landfill contents from the surrounding environment and protects the soil and groundwater from pollutants originating from the landfill. Liner requires low hydraulic conductivity (1×10^{-9} m/s) and adequate shear strength. Laterites are of great interest because of their abundance, availability, and easy workability. Despite the source of laterite in construction, the soil type is hard, impenetrable, and high permeability. Geopolymer can be considered the key factor that could enhance laterite's properties in the performance of hydraulic conductivity. Geopolymer paste consists of palm oil boiler ash mixed with an alkaline solution of sodium hydroxide and sodium silicate. Boiler ash is another industrial waste product from the combustion of coal. In this study, laterite mixed was mixed with different percentages of boiler ash based geopolymer (GeoPOBA) to improve the properties on soil liner application. This research aims to determine the optimum percentage of geopolymer mixed with laterite as an additive and reduce the value of hydraulic conductivity. Laterite was mixed with 5, 10, 15, and 20% of GeoPOBA by weight. The test carried out were divided into

physical properties (particle distribution test, Atterberg test, specific analysis, and shrinkage test), chemical (structural morphology, chemical oxides, and pH test), and engineering properties (compaction and compressive strength) of original laterite and the mixture with geopolymer. Mixture samples for hydraulic conductivity were tested using falling head compact at dry, wet, and optimum moisture content ranging from -2 and +2 of the optimum moisture contents with standard proctor test. Result shows the addition of GeoPOBA as additives in laterite has significantly given positive results on soil strength and chemical alteration in geopolymerization. As GeoPOBA is mixed with the laterite, the hydraulic conductivity of laterite soil decreases from 3.08×10^{-8} to a range 3.00×10^{-8} m/s to 5.05×10^{-9} m/s. Sample above 15% of Laterite-GeoPOBA meet the requirement in designing a soil liner that gives low hydraulic conductivity, at less than 1×10^{-9} m/s. The increases in GeoPOBA content are associated with a decrease in hydraulic conductivity, leading to a significant reduction in hydraulic conductivity. An empirical model with nomograph was successfully develop from this study. The empirical model and nomograph in predicting hydraulic conductivity, k , were developed as alternative guidelines for engineers to design landfill soil liners without conducting laboratory testing that takes a long time and can reduce the cost and time. As an added benefit, GeoPOBA as an additive in laterite could help reduce the environmental impact of boiler ash produced by palm.

2. OBJECTIVE

This study investigates the effects of Palm Oil Boiler Ash-based Geopolymer (GeoPOBA) and develops an empirical model with nomograph of hydraulic conductivity, k , for the compacted soil liner application. The specific objectives of this study are:

- i) To determine the properties (basic & chemical) of laterite soil without and with different percentages of GeoPOBA.
- ii) To investigate the engineering properties (compaction, compressive strength and hydraulic conductivity) of laterite without and with different percentages of GeoPOBA.
- iii) To analyze the correlation of optimum percentage of GeoPOBA and Laterite GeoPOBA mix in relation to physical properties, engineering properties using Minitab software.
- iv) To establish the model with nomograph, k in laterites soil with and without GeoPOBA to be practically used in landfill soil liner

3. NOVELTY & INVENTIVENESS

This study will add valuable knowledge and landfill design to engineers by developing empirical formulas and nomograph in predicting hydraulic conductivity. These formulas will be based on the correlation and optimum content of laterite soil with the percentage of GeoPOBA. The empirical formula and develop nomograph, it is possible to predict the k value quickly.

4. PRACTICALITY & USEFULNESS

This study has successfully developed a model and nomograph in predicting hydraulic conductivity, k value, giving two (2) empirical formulas without and with GeoPOBA content.

The best R^2 with 0.76 without content of GeoPOBA and R^2 with 0.74 with GeoPOBA content chosen in this research in develop the prediction k value. The data of succeed empirical model

with nomograph on predicted k value content will simplify the landfill construction process can be used as a guideline in designing a soil liner system at landfill area. It can be calculated promptly, reducing the cost and time compared with conducting a laboratory test that takes a long time. In the end, GeoPOBA modeling is expected to help engineers accelerate the design process of landfill systems.

5. CONCLUSION

GeoPOBA at different percentages has different effects on the compaction parameter and permeability of the sample, resulting in good knowledge and understanding about the properties of the product. Preliminary and main laboratory tests of the Laterite-GeoPOBA mix provided a good prediction of hydraulic conductivity, k for soil liner application from statistical validation of physical and engineering properties. Empirical formulas and nomograph in predicting hydraulic conductivity, k , based on available variables (LL, Clay and GeoPOBA content) were developed as alternative guidelines for engineers to design landfill soil liners without conducting laboratory testing that takes a long time and thus can reduce the cost and time.

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