



UNIVERSITI
TEKNOLOGI
MARA

Compassion Melaka

V-MIEX

28 JUNE
06 JULY
2022

VIRTUAL-MELAKA INTERNATIONAL INTELLECTUAL EXPOSITION

ROAD TO COMMERCIALISATION

V-MIEX BOOK



V - MIIEX BOOK

'ROAD TO COMMERCIALISATION'

EDITORS AND COMPILERS:

Dr. Nur Hayati Abd Rahman
Dr Syukri Abdullah
Wan Hasmat Wan Hasan
Aini Qamariah Mohd Yusof
Norazlan Anual
Dr. Khairunnisa Abd Samad
Nordianah Jusoh @ Hussain
Rozana Othman
Norlela Abas
Azira Rahim

COVER DESIGN:

Adi Hakim Talib

PUBLISHED BY:

Division of Research and Industrial Linkages
UiTM Cawangan Melaka
KM26 Jalan Lendu,
78000 Alor Gajah, Melaka
Tel: +606-5582094 / +0606-5582190 / +606-5582113
Email: miixuitm@gmail.com
Website: <https://www.miiex.my/>
ISBN: 978-967-2846-04-8

All right reserved. No parts of this publication may be produces, stored in retrieval system or transmitted in any form by any means, electronic, mechanical, photocopying, recording, or otherwise without permission of the copyright holder.

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.

Graphene From Industrial Waste

Noor Asnida Asli^{1,2,a}, Nurfazianawatie Mohd Zin^{1,2}, Hafsa Omar^{1,2}, Nur Syazwani Abdul Malek^{1,2}, Nurfarhana Rosman^{1,2}

¹Centre of Functional Materials and Nanotechnology, Institute of Science, Universiti Teknologi MARA, 40450, Shah Alam, Selangor, Malaysia

²School of Physics and Material Studies, Faculty of Applied Sciences, Universiti Teknologi MARA, 40450, Shah Alam, Selangor, Malaysia

^aasnida1462@uitm.edu.my

Abstract

Food waste is a global concern, with Malaysia producing approximately 605,120 tonnes of coconut shell waste and waste cooking oil per year. Food and Agriculture Organization (FOA) estimates that approximately 800,000 tonnes of soybean waste are discarded annually as a byproduct of tofu production. Food waste from production industries has caused severe environmental damage to landfills. This study focuses on biomass synthesis for carbon-based nanomaterials (CNMs), emphasising graphene and reduced graphene oxide (rGO) utilising chemical vapor deposition (CVD) and Hummer's method. For the first time, graphene was successfully synthesised using industrial waste from coconut shell charcoal, waste cooking oil and soybean waste as a carbon source. The excellent electrical, optical, and mechanical capabilities of graphene-based materials have sparked significant scientific interest and perspective for various applications. The carbon source is cost-effective in terms of waste reduction and environmental benefits. In terms of cost-efficiency, the carbon source is cost-effective, and it also reduces environmental waste. Most carbon sources derived from fossil fuels are non-renewable and produce less than 50% yield carbon source. Graphene oxide from coconut shell charcoal powder can produce a higher yield of 83% carbon sources, while waste cooking oil yields 80% carbon sources. The produced graphene would benefit applications such as humidity sensor users as graphene's properties can improve sensitivity performance and cost-effective production.

Keywords: Graphene, Graphene Oxide, Industrial Waste, Humidity Sensor

1. INTRODUCTION

Graphene has attracted the researcher's attention in various applications due to its excellent mechanical stiffness, electrical, high charge mobility, and chemical properties. It is a 2D (2 dimensional) material with a hexagonal structure, while graphene oxide differs from graphene by having additional functional groups. Although high-quality carbon nanomaterials (CNMs) may be generated using conventional methods, obtaining environmentally friendly synthesis on a wide scale at a reasonable cost is a challenge. Recycling waste materials into high-value goods such as waste oil, waste soybean, and coconut shell charcoal is viable, which has encouraged researchers to create CNMs from waste resources for various potential uses. Recycling waste precursors to synthesising graphene-based materials into value-added goods has sparked industrial researchers' interest (Ikram et al., 2020).

Coconuts have been cultivated in our country and have shown to be highly valuable in the food industry. Coconut parts such as shell, husk, and coir have been used in various food industry applications, and some of them have become waste. This waste produces a large amount of carbon dioxide pollution during the incinerated process. The coconut shell contains 30% oxygen and more than 50% carbon percentage. The amount of carbon increases as it turns into coconut shell charcoal, which contains more than 80% carbon. This high percentage of carbon amount led to graphene-based materials such as graphene and graphene oxide. Waste cooking oil has a high contained free fatty acid (41%) than fresh cooking oil (35%). In order to benefit the waste, waste of industrial cooking oil (WICO) from the AYAMAS Food Cooperation Sdn. Bhd. is used as a precursor in the synthesis of graphene film. Every year, the United States, Brazil, and China grow a few billion bushels of soybeans resulting in nearly a billion tonnes of soybean waste. According to the FAO, imported soybeans totalled 3.5 million tonnes in Japan in 2009, with around 800,000 tonnes of soybean waste lost annually as a consequence of tofu manufacturing (Li et al., 2013). It costs around 16 billion yen per year (Li et al., 2013).

Graphene oxide (GO), graphene with functional groups, uses chemical synthesis as a technique such as Hummer's method. This approach produces graphene oxide on a big scale at a minimal cost. Synthesis of graphene oxide using a natural carbon source produces high-quality graphene oxide. A natural carbon source is critical as it contains the highest oxygen to carbon ratio compared to synthetic graphite, which affects the properties of GO (Mahmoudi et al., 2019). At the same time, chemical synthesis such as Hummer's method gives an advantage of producing partially reduced graphene oxide. For the chemical vapour deposition (CVD) method, graphene is generated in an inert environment from biomass such as waste soybean and WICO, which initially vaporise on the catalytic surface and decompose into carbon atoms.

A previous study has shown that using 10% graphene has a better humidity sensor than 12-90% graphene. As low-cost technologies are in high demand, it is possible to commercialise WICO graphene in humidity sensors as it requires low production costs. Graphene oxide is the first material chosen for relative humidity (RH) sensors owing to its hydrophilicity mainly attributed to the presence of abundant organic functional groups containing oxygen moieties. GO-based humidity sensors have ten times higher sensitivity than conventional humidity sensors, with fast response and less recovery time (Bi et al., 2013).

2. OBJECTIVE

The focus of this research is to study synthesis pathways for CNMs, focusing on graphene-based products by utilising industrial waste. This analysis begins with identifying wastes that can be processed and recycled using materials processing and recycling technologies. Waste is the most promising starting material since it provides a high carbon content in the formation of graphene. The aimed outcome of this research is to achieve high yield/mass production comparable to commercial graphene.

3. NOVELTY & INVENTIVENESS

Our graphene-based product is the first in Malaysia to synthesise graphene and graphene oxide from industrial waste in collaboration with Perusahaan Arang Tempurung Enterprise, AYAMAS Food Cooperation Sdn. Bhd., and the Syarikat Salmi Hj. Tamin Sdn. Bhd. (Tamin). Graphene-based derived from coconut shell charcoal powder, waste cooking oil, and waste soybean achieved high yields of carbon content at 84%, 80% and 77%, respectively. Graphene was successfully synthesised using biomass as a carbon source by the CVD and Hummer's method. From previous studies, fossil fuels were utilized to obtain carbon sources. On the other

hand, our carbon source is a natural source that is both economical and environmentally friendly. Our novel carbon source for graphene synthesis from biomass will provide an alternate, lower-cost, and more versatile approach for producing large scale graphene. In terms of facts, our product reduces the cost of coconut shells and waste oil by 72% and 60%, respectively. The humidity sensor application only needs 10% graphene to enhance the performance.

4. PRACTICALITY & USEFULNESS

Recycling waste into graphene-based material helps waste management, particularly in industry, thus giving society an advantage as it helps reduce pollution to the environment. As the expression "Waste to Health" suggests, the conversion of waste materials to graphene has helped generate wealth. Due to the sheer shortfall of carbon sources for graphene production, most commercial graphene is costly. As a result, employing waste as a zero-cost input carbon source (waste) to lower-cost output can eliminate the commercialization obstacle (application). The speciality of using waste using CVD methods and Hummer's method is that the synthesis process is a single step as the waste produces graphene. The graphene synthesised from biomass waste carbon source is ideal for various applications due to its superior mechanical stiffness, electrical, high charge mobility, and chemical properties. It results in good and transformable graphene properties, equivalent to graphene made by conventional methods. The produced graphene would benefit applications such as humidity sensor users as the properties of graphene enhance humidity sensor performance. Graphene produced from waste can also be used in various possible applications, including electronic devices, supercapacitors, batteries, composites, flexible transparent displays, solar cells, and sensors.

5. CONCLUSION

In conclusion, natural carbon sources from waste can reduce the cost of synthesising graphene-based materials, save the environment for air and the river system, and give ways for Malaysia to overcome waste management issues.

REFERENCES

- Ikram, R., Jan, B. M., & Ahmad, W. (2020). Advances in synthesis of graphene derivatives using industrial wastes precursors; prospects and challenges. *Journal of Materials Research and Technology*, 9(6), 15924–15951. <https://doi.org/10.1016/J.JMRT.2020.11.043>
- S. Li, D. Zhu, K. Li, Y. Yang, Z. Lei, and Z. Zhang, "Soybean Curd Residue: Composition, Utilisation, and Related Limiting Factors," *ISRN Ind. Eng.*, vol. 2013, pp. 1–8, 2013, doi: 10.1155/2013/423590. [24]
- Bi, H., Yin, K., Xie, X., Ji, J., Wan, S., Sun, L., . . . Dresselhaus, M. S. (2013). Ultrahigh humidity sensitivity of graphene oxide. *Scientific reports*, 3(1), 1-7.