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ABSTRACTS BOOK
iJPCMR 2023

2ND INTERNATIONAL JOINT-POSTGRADUATE COLLOQUIUM FOR MULTIDISCIPLINARY RESEARCH

"Breaking Boundaries Through Multidisciplinary Research"

14TH DECEMBER 2023

UNIVERSITI SAINS MALAYSIA

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Summary of Abstract Book

The abstract book consists of 71 abstracts from the participation of postgraduate students mainly from Universiti Sains Malaysia (USM), Universiti Malaysia Sarawak (UNIMAS), Universiti Pendidikan Sultan Idris (UPSI) and Universiti Teknologi Mara (UiTM). 2nd International Joint-Postgraduate Colloquium on Multidisciplinary Research (JPCMR) 2023 also honored to have participant from international universities. For instance, Prince of Songkla University (PSU), TanTrao University, (Vietnam), Universitas Syiah Kuala (Indonesia), Universitas Terbuka (Indonesia), Dhaka University (Bangladesh). The theme of the colloquium is ***"Breaking Boundaries Through Multidisciplinary Research"*** provides an opportunity for all postgraduate students from the mentioned universities to share their expertise, research efforts and discoveries on multidisciplinary research with one another.

The main objectives of the colloquium are to:

- To apprise postgraduate students with cutting-edge multidisciplinary-based research and to facilitate the sharing of research ideas.
- To commence a friendly and non-confrontational environment for postgraduate students to present their current stage of research progress.
- To nourish networking and collaborative research

The colloquium covers the following topics:

- ✓ Education
- ✓ Sciences
- ✓ Arts
- ✓ Social Sciences
- ✓ Management

Dean Message

School of Distance Education, Universiti Sains Malaysia (USM)

In the name of Allah, Most Gracious and Most Merciful,
Assalamualaikum warahmatullahi wabarakatuh,

It is with great honor and pleasure that I accept the gracious invitation to the International Joint Postgraduate Colloquium for Multidisciplinary Research (iJPCMR) 2023. This collaborative endeavour is orchestrated by the School of Distance Education, Universiti Sains Malaysia, and Prince of Songkla University, in conjunction with the esteemed collaboration of Universitas Terbuka, Indonesia, Walailak University, Thailand, and Institut Teknologi Sepuluh Nopember, Indonesia. To all participants, both locally and internationally, I extend a warm welcome on behalf of our distinguished co-organizers and collaborators. The revised theme for this colloquium, now eloquently titled "Breaking Boundaries Through Multidisciplinary Research," encapsulates the spirit of our shared pursuit. In a world marked by diverse challenges, this event serves as a distinguished platform for intellectual collaboration and the exploration of innovative solutions.

The journey of postgraduate research is one that demands resilience, both financially and emotionally.
As we convene, our primary objective is to provide a forum for postgraduate students to share their research experiences and engage in meaningful collaborations with their peers and mentors. The quality of the abstracts presented mirrors the dedication and focus of individuals committed to becoming experts in their respective fields. Beyond academic evaluations, the success of your research should be measured by the positive impact it has on the lives of others. As participants in iJPCMR 2023, I encourage you to seize this opportunity to magnify the influence of your research on both academia and society.

My sincere appreciation extends to the dedicated committee that has meticulously organized this colloquium. I express gratitude to each postgraduate student who has contributed to this event, investing time and effort in research that holds the promise of long-term benefits for all involved. I wish you all a productive and enjoyable colloquium, filled with meaningful interactions and intellectual discoveries.

Thank you.

Assoc. Prof. Dr. Zulnaidi Yaacob
Dean
School of Distance Education
Universiti Sains Malaysia (USM)

Foreword

Acting Dean of Graduate School, Prince of Songkla University (PSU)

Greetings from the organizers of the first USM-PSU International Joint-Postgraduate Colloquium for Multidisciplinary Research 2023! It is with great pleasure that we extend our warm welcome to all the distinguished presenters and participants who will be joining us for this momentous event. Hosted by the School of Distance Education, Universiti Sains Malaysia (USM), and the Graduate School, Prince of Songkla University (PSU), the Colloquium aims to foster academic discussion and exchange among graduate students from both institutions. In the spirit of collaboration that has flourished over the years between our universities, we are thrilled to co-organize this Colloquium as a platform for students to showcase their research endeavors. The theme, "Breaking Boundaries Through Multidisciplinary Research," reflects our commitment to exploring the intersections of various disciplines, including Arts, Education, Management, Science, and Social Science. This event comes on the heels of the vibrant celebrations of the 55th anniversary of PSU in 2023. The collaboration with esteemed partner universities and the series of exclusive lectures by Nobel Laureates organized in conjunction with the International Peace Foundation (IPF) stand testament to our dedication to academic excellence. As we embark on these two days of academic discourse on December 13-14, 2023, through the online platform Webex, we celebrate the achievements of all the researchers who have dedicated their time and efforts to contribute valuable insights to their respective fields. We anticipate that the findings presented during this Colloquium will not only enrich the academic landscape but will also find practical applications in various domains. Our heartfelt congratulations go out to each researcher who has achieved their desired results. We are confident that your contributions will pave the way for advancements in knowledge and innovation. A special note of gratitude goes to the organizing committee for their tireless efforts in bringing this Colloquium to fruition. Your dedication has been instrumental in creating a platform for meaningful academic exchange. To all our presenters and participants, we extend our best wishes for a successful and enriching event. May this Colloquium be a stepping stone towards higher goals and continued collaboration between our institutions.

Asst. Prof. Dr. Kawinbhat Sirikantisophon
Acting Dean of Graduate School Graduate School,
Prince of Songkla University (PSU), Thailand.

Biography of Keynote Speaker

Dr. Janya Chanchaichujit is an Associate Professor in Logistics and Supply Chain Management, Director, Center for Sustainable Logistics and Supply Chain Management in the faculty of Environmental Management and Assistant President for Promoting of Foreign Affairs at Prince of Songkla University in Thailand. Dr. Chanchaichujit has over 20 years of experience in logistics and supply chain management in industry and academic. Her research interest focuses on incorporating various aspects of operational research applications, mathematical modelling techniques, and technologies into the design and operation of green and sustainable logistics and supply chain management. She is also actively providing consulting services on green and sustainable operations, technology transformation, feasibility study and business model to public and private organization varies from freight and transportation, to manufacturing in Thailand.

Associate Professor Dr. Janya Chanchaichujit
Assistant President for Promoting of Foreign Affairs
and Director Center for Sustainable Logistics and Supply Chain Management
Faculty of Environmental Management, Prince of Songkla University (PSU), Thailand

Biography of Invited Speaker

Dr. Shine Pintor Siolemba Patiro., ST., MM is an Associate Professor of Post Graduate School at Universitas Terbuka, Indonesia since then until present. Along his career journey, his writings have been widely published in accredited national journals, reputable international journals, and international proceedings. No doubt, he won quiet best number of the best paper presented at national level. For instance, the best paper presented at the national seminar community service IBI -Kosgoro 1957 in 2022. The best paper presented at the national seminar proceeding and call for paper: Business in Society: Towards Asian Era of Business and Economic Faculty Sebelas Maret Surakarta University in 2014. Also, the best paper presented at the national seminar proceeding and call for paper: Business Ethics and Competition of Management Master Program Padjadjaran University in 2006.

Associate Professor Dr. Shine Pintor Siolemba Patiro., ST., MM
Post Gradute School of Universitas Terbuka, Indonesia

Biography of Invited Speaker

Dr. Kok Fong See is an Associate Professor in the Economics Program at the School of Distance Education, Universiti Sains Malaysia. In 2017-2018, he was awarded an Australia Awards–Endeavour Research Fellowship from the Department of Education and Training, Australia, and a Taiwan Fellowship from the Ministry of Foreign Affairs, Republic of China (Taiwan). His exceptional achievements include being honored with the prestigious 2019–2020 Fulbright Award, recognized as one of the most esteemed international accolades, which allowed him to pursue advanced research in the United States. His research focuses on efficiency and productivity analysis. His works have been accepted and published in the top 25 % of the journal category, which is indexed by the Journal Citations Reports (JCR), including Energy Economics, Energy Policy, European Journal of Operations Research, Socio-Economic Planning Sciences, Journal of Cleaner Production, Technological Forecasting & Social Change and others.

Associate Professor Dr. See Kok Fong
School of Distance Education
Universiti Sains Malaysia (USM)

Biography of Invited Speaker

Dr. Eva Oktavia Ningrum first getting her tertiary education in the field of Chemical Engineering from Institut Teknologi Sepuluh Nopember in 2007. After that, she further studied in the same research background at Chemical Engineering Department, National Cheng Kung University, Tainan City, Taiwan in Year 2009. In 2015, Dr Eva obtained her Doctoral Degree in Chemical Engineering from Chemical Engineering Department, Hiroshima University-Japan. Dr Eva Oktavia Ningrum having expertise related to UN Sustainable Development Goals. In 2015, UN member states agreed to 17 global Sustainable Development Goals (SDGs) to end poverty, protect the planet and ensure prosperity for all. Dr Eva work contributes towards the following SDG(s) zero hunger, affordable and clean energy, responsible consumption, and production and also life below water. Recently. Dr Eva awarded research grant to conduct a study of Synthesis of biocompatible hydrogel for artificial soft tissue from hydroxyapatite (Hap) of blue crab shells (Portunus pelagicus) and its characterization. Latest paper publications by Dr Eva is Correlating properties between sulfobetaine hydrogels and polymers with different carbon spacer length was published in Polymer, Volume 186, pp.122013, 2020.

Head of Department
Department of Industrial Chemical Engineering,
Faculty of Vocational Studies, Institut Teknologi Sepuluh Nopember (ITS), Indonesia.

Biography of Invited Speaker

Assoc. Prof. Dr. Krisanadej Jaroensutasinee is a lecturer of School of Science, Walailak University (Thailand). He is also a senior fellow of the higher education academy (SFHEA) and a member of GLOBE Technology Working Group. He obtained first tertiary education from Chulalongkorn University, Thailand in 1990 and further doctorate study at University of Warwick, England in 1994. Assoc. Prof. Dr. Krisanadej Jaroensutasinee having strong research interest in Microplastic and Marine Debris, Green Hotel, Zero Waste Project, Science Education, Coral reef research, Artificial Intelligent, Machine Learning, Internet of Things, Smart Agriculture, Spatial Database, Social Marketing, Web database system, Information Technology, Digital Storage, Processing & Visualization. Until today, he awarded with 43 publications in National Journals, 310 conference proceedings and actively collaborate and affiliate to other universities and students to share his expertise.

Assoc. Prof. Dr. Krisanadej Jaroensutasinee
Director of CoE for Ecoinformatics
Assisting Dean on Research of School of Science
School of Science, Walailak University, Thailand
Present Council Board at Nakhon Si Thammarat Rajabhat University, Thailand.

ANTIFUNGAL ACTIVITIES OF MODIFIED CHITOSAN WITH VANILLIC ACID AGAINST PLANT PATHOGENIC FUNGI, *Fusarium solani* AND *Fusarium proliferatum*.

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ABSTRACT

Modification of chitosan with phenolic acids has garnered increasing interest to obtain the new modified chitosan with greater potential and physicochemical as well as biological properties. In this study, modification of chitosan was achieved via free radical grafting between low molecular weight chitosan (LMwCS) and vanillic acid (VA). The ratio of VA in grafting was optimised while the amount of LMwCS and redox initiators were kept constant. Characterisations of the modified chitosan were conducted based on the grafting efficiency, vanillic acid content, chemical composition, and solubility at all pH range. The inhibitory effect of modified chitosan on the mycelia growth of *Fusarium solani* and *Fusarium proliferatum* was evaluated. The characterizations of the modified chitosan demonstrated that the modification between LMwCS with VA at ratio 0.5 had the highest content of VA. Similarly, LMwCS with VA at ratio 0.5 showed the greatest inhibitory effect towards the growth of *F. solani* and *F. proliferatum*. Overall, this study provides the preliminary findings of the new modified chitosan with vanillic acid for their application in the control of plant pathogenic fungi.

Keywords: Biomaterials; Chitosan; Fungicide: *Fusarium* sp.; Modification

1. INTRODUCTION

Chitosan (CS) grafted with phenolic acids are widely exploited for their application in food technology as film or coating to reduce the usage of the non-degradable and pollution of waste plastic as food packaging (Li et al., 2022; Zhu et al., 2022). The grafted CS were reported to have significant effects in terms of free radical scavenging activities which could reduce the growth of food pathogens and improve the duration of food preservation (Xie et al., 2014). However, the applications of CS grafted with phenolic acids in agriculture as an agent to combat the plant pathogens as a fungicide are still limited and need further exploration. In addition, CS has remarkable characteristics of low toxicity and biodegradable. Phenolic acids belong to the class of naturally occurring bioactive compounds that possesses aromatic ring structure. Grafting phenolic acids on chitosan is approachable via free radical grafting method. This reaction can be operated at room temperature and only use hydrogen peroxide and ascorbic acid under inert condition, which are common in chemistry laboratory. Imparting phenolic acids either hydrocinnamic acids (Nagy et al., 2022) or hydrobenzoic

acids (Chatterjee et al., 2015) onto chitosan have promoted the characteristics of the native chitosan in terms of its antioxidant and antibacterial efficacy. Nonetheless, only a few reports of antifungal activity of chitosan-phenolic acids have been revealed. Therefore, this project is aimed to modify the low molecular weight of chitosan (LMwCS) with vanillic acid (VA). The different amount of VA was grafted on chitosan backbone via free radical grafting and the modified chitosan (LMwCSVA) were tested for their antifungal efficacy against *Fusarium solani* and *Fusarium proliferatum.*

2. MATERIALS AND METHODS

All chemicals were of reagent grade and used without further purification. Plant fungi pathogens (*F. solani* and *F. proliferatum*) were provided by the Molecular Genetic Lab of University Malaysia Sarawak (UNIMAS).

2.1 Modification of chitosan with vanillic acid

The modification of chitosan was done with slight modifications (Teng et al., 2022). Briefly, 1.0 g of LMwCS was dissolved in 100 mL of 1% (v/v) of acetic acid. The mixture of ascorbic acid and hydrogen peroxide served as the redox initiators in the free radical grafting method. Different mass of VA was slowly added with the mass ratio of VA and LMwCS of 1:1, 0.75:1, 0.5:1 and 0.25:1 under inert environment. The mixture was left under stirring at 700 rpm for 1 day at room temperature. Later, the reaction mixture was dialysed and freeze dried to obtain the solid.

2.2 Characterization of water solubility, chemical composition, and grafting efficiency of modified chitosan.

The water solubility of the modified chitosan was determined based on observation (Tian et al., 2015). The chemical composition was recorded by using Attenuated total reflection-Fourier transform infrared (ATR-FTIR) at 4000–400 cm^{-1}.The nin-hydrin assay was conducted to determine the degree of amino substitution in the modified chitosan with vanillic acid according to the method of Chatterjee et al. (2015). Phenolic content in the modified chitosan was determined according to the previous reported method (Hu et al., 2016).

2.3 Antifungal assay against *F. solani* and *F. proliferatum*

The in-vitro assay of the radial mycelial growth inhibition followed the method described by (Kheiri et al., 2016). The percent inhibition growth rate was calculated by using this formula:

Percent of Inhibition Growth Rate, PIRG %=100- RTRC× 100

where R_c is the radial mycelial growth in control plate, R_T is the radial mycelial growth in

treated plates. Each treatment was replicated three times, and the data was reported in mean ± standard deviation, SD.

3. RESULTS AND DISCUSSION

3.1 Characterization of physical properties, chemical composition, water solubility and grafting efficiency of modified chitosan with vanillic acid

The grafted chitosan with VA had a stable pale-yellow colour and soluble in water as reported in Table 1. As observed in the FT-IR spectra, the intensity of absorption bands of the modified CS with VA at 1418 cm^{-1} was decreased, might be resulted from the loss of NH_3 from grafting reaction. In all modified LMwCSVA, the peak of amide I at 1651 cm^{-1} has shifted to around 1620-1625 cm^{-1} suggesting the conjugation has produced NH-CO group. LMwCSVA (0.5:1) had the highest content of vanillic acid among all LMwCSVA.

Table 1: The degree of deacetylation, grafting efficiency, and colour of modified CS

Sample	Colour of modified chitosan	Phenolic acid (mg VA/g)	Percent substitution of amino group (%)	Solubility in water
LMwCS	-	-	-	Insoluble
LMwCSVA (1:1)	Light yellow	50.40	35.4	Soluble
LMwCSVA (0.75:1)	Light yellow	52.12	46.6	Soluble
LMwCSVA (0.5:1)	Light yellow	74.61	24.4	Soluble
LMwCSVA (0.25:1)	Light yellow	23.58	28.4	Soluble

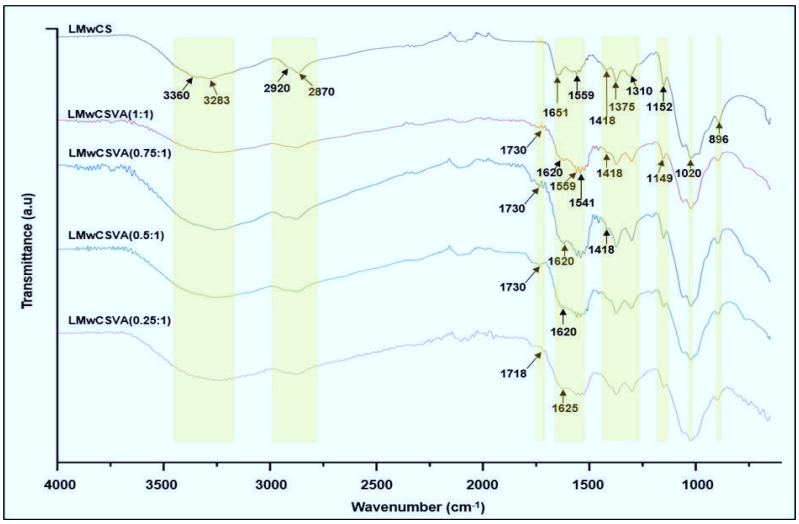

Figure 1: FTIR spectra of modified chitosan with VA at different ratio

3.2 Antifungal activity of the modified CS against *F. solani* and *F. proliferatum*

The antifungal activities of all modified chitosan, at 1.0 mg/mL against *F. solani* and *F. proliferatum* are revealed in Figure 2 and Figure 3, respectively. It is hypothesized that the greater antifungal activity of modified chitosan LMwCSVA (0.50:1) was attributed to the highest content of vanillic acid (74.6 mg VAE/g VA-g-chitosan), followed by LMwCSVA (0.75:1), which had 52.1 mg VAE/g VA-g-chitosan.

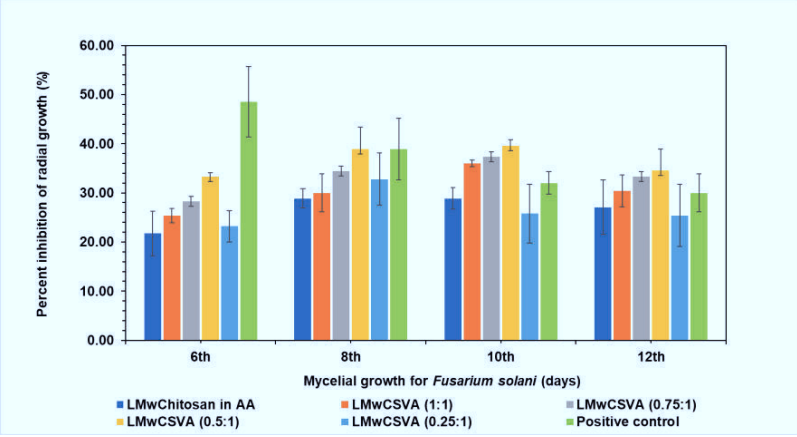

Figure 2: Percentage inhibition of radial growth of *F.solani* by the action of the modified CS with vanillic acid at 1.0 mg/mL at day 6th, 8th, 10th and 12th

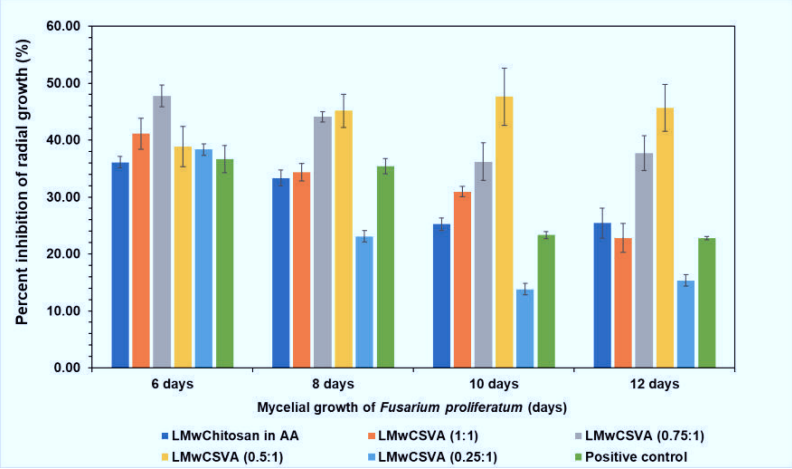

Figure 3: Percentage inhibition of radial growth of *F.proliferatum* by the action of the modified CS with vanillic acid at 1.0 mg/mL at day 6th, 8th, 10th and 12th

4. CONCLUSION

In conclusion, vanillic acid grafted chitosan was successfully prepared using different ratio of VA and LMwCS. LMwCSVA (0.5:1) that composed the highest amount of vanillic acid (74.6 mg VAE/g VA-g-chitosan), exhibited the highest antifungal activity towards *F. solani and F. proliferatum* at concentration at 1.0 mg/mL on day 12th compared to the other modified chitosan.

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