

VIETNAM WORKSHOP ON MICROSCOPY

December 17-20, 2024, ICISE, Quy Nhon, Vietnam



ABSTRACT BOOK



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Welcome Message from the Organizing Committee of VWM-2024

Dear Esteemed Participants,

It is our great pleasure to welcome you to "**XX Rencontres du Vietnam: Vietnam Workshop on Microscopy 2024 (VWM-2024)**". This event brings Vietnamese microscopists, researchers and professionals to exchange cutting-edge ideas and advanced techniques in the field of microscopy applied for life science and materials science.

Topics of the VWM-2024 focus on advanced imaging techniques such as light (epifluorescence and confocal microscopy), electron (TEM, SEM, Cryo-EM, EBSD) and atomic force microscopes (AFM), as well as image processing in life science and materials science.

Furthermore, a short training course on advanced microscopy is also provided for excellent undergraduate students, graduate students, MSc/PhD students and young scientists to gain access to advances in microscopy applied in life - and materials science.

The workshop's comprehensive program includes plenary, keynote and invited talks, oral presentations and poster sessions. We encourage you to take full advantage of this opportunity to engage with experts, build new connections, and explore collaborative efforts that will help shape the future of microscopy in Vietnam.

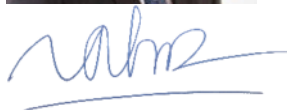
We are confident that your participation will contribute to the success of this symposium, and we eagerly look forward to an inspiring and fruitful event in the beautiful, relaxing circumstances of ICISE, Quy Nhon City, Vietnam.

Thank you for joining us, and welcome to VWM-2024!

Kind regards,

Quy Nhon, Vietnam, September 17-20, 2024

VWM's chairmen

A handwritten signature in blue ink, appearing to read 'Tran Quang Huy'.

Trần Quang Huy

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A handwritten signature in blue ink, appearing to read 'Ngô Xuân Kiên'.

Ngô Xuân Kiên

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XXth Rencontres du Vietnam: Vietnam Workshop on Microscopy 2024 (VWM-2024)
 December 17-20, 2024, ICISE, Quy Nhon, Vietnam
PROGRAM AT A GLANCE

DAY 1	
Tuesday, 17 December 2024	
8:00 – 8:30	Moving to ICISE from Seagull Hotel by shuttle buses
8:30 – 9:00	Registration
9:00– 9:30	Opening ceremony and photo
9:30 – 10:15	Coffee break and visit the sponsor's booths
PLENARY SESSION, HALL 2 (PL:45min; K: 35min; DS: 25min)	
10:15 – 12:00	1 Plenary lecture+1 Keynote lecture (K-01) + Diamond sponsor's presentation
12:00 – 13:30	Lunch
PLENARY SESSION, HALL 2 (I: 30min)	
13:30 – 15:00	3 Invited lectures (I-01; I-02; I-03)
15:00 – 15:20	Coffee break
PLENARY SESSION, HALL 2 (I: 30min; O: 20min)	
15:20 – 17:00	2 Invited Lectures (I-04; I-05)+2 Oral talks (O-01; O-02)
17:05 – 21:00	COCKTAILS and GALA DINNER
21: 00 – 21:30	Bus transfer from ICISE to Seagull Hotel
DAY 2	
Wednesday, 18 December 2024	
8:00 – 8:30	Moving to ICISE from Seagull Hotel by shuttle buses
PLENARY SESSION, HALL 1 (K: 35min; I:30min)	
8:30 – 10:00	1 Keynote lecture (K-02) + Invited lectures (I-06; I-07)
10:00– 10:20	Coffee break
10:20 – 11:00	Poster session (<i>5 min. poster presentation</i>)
PLENARY SESSION, HALL 1 (O: 20min)	
11:00 – 11:40	2 Oral talk (O-03; O-04)
11:40 – 12:00	Poster awards and Closing ceremony
12:00 – 13:30	Lunch
Training Course on Advanced Microscopy	
13:30 – 15:15	Theoretical lecture (T-01; T-02)
15:15 – 15:40	Coffee Break
15: 45 – 16:30	Practical lecture (P-03)
16:30 – 17:20	Diamond sponsor's lecture
18:00-20:00	Dinner
20:00	Bus transfer from ICISE to Seagull Hotel
DAY 3	
Thursday, 19 December 2024	
8:30 – 9:00	Moving to ICISE from Seagull Hotel by shuttle buses
Training Course on Advanced Microscopy	

9:00 – 10:30	Practical lecture 1 (P-01)
10:30-11:00	Coffee Break
11:00 – 12:00	Theoretical lecture 4
12:00 – 13:30	Lunch
13:30 – 15:00	Practical Lecture 2
15:00-15:30	Coffee break
15:30 – 17:30	Practical lecture 3
18:00-20:00	Dinner
20:00	Bus transfer from ICISE to Seagull Hotel
DAY 4 Friday, 20 December 2024	
Training Course on Advanced Microscopy	
8:30 – 9:00	Moving to ICISE from Seagull Hotel by shuttle buses
9:00– 10:00	Theoretical lecture 2
10:00-10:20	Coffee break
10:20-11:00	Theoretical lecture 2
11:30 – 12:00	Certificates of participation award
12:00 – 13:30	Lunch
14:00 – 18:00	Excursion to Eo Gió/other places in Quy Nhon

DETAILED AGENDA

DAY 1 Tuesday, 17 December 2024	
8:00 – 8:30	Moving to ICISE from Seagull Hotel by shuttle buses
8:30 – 9:00	Registration
9:00– 9:30	Opening ceremony and photo Assoc.Prof. Tran Quang Huy (Phenikaa Uni.) Representative of ICISE
9:30 – 10:15	Coffee break and visit the sponsor's booths
PLENARY SESSION, HALL 1 Chairs: Assoc.Prof. Tran Quang Huy and Assist. Prof. Dr. Pham Thanh Tri	
10:15 – 11:00	Plenary talk: Applications of Optical Microscopes in Cell Biology and Bacteriology Assist. Prof. Dr. Pham Thanh Tri Nazarbayev University, Republic of Kazakhstan
11:00 – 11:35	Keynote: Moving magnetic bits in curved nanowires with Lorentz electron microscope Dr. Hoang Duc Quang Department for Physics, Chemistry and Biology, Linköping University, Sweden
11:35 – 12:00	Diamond sponsor's talk: Principles of SEM & Applications
12:00 – 13:30	Lunch
PLENARY SESSION, HALL 1 Chairs: Dr. Hoang Duc Quang and Dr. Pham Xuan Thang	
13:30 – 14:00	I-1: The use of confocal microscopy in plant sciences Dr. Trinh Duy Chi Department of Life Sciences, University of Science and Technology of Hanoi (USTH)
14:00 – 14:30	I- 2: High-Speed Atomic Force Microscopy in studying alpha-hemolysin toxin and its variants for preventing and treating Staphylococcus aureus infections Dr. Le Thi Phuong Ngan Center for Bioscience and Biotechnology, University of Science, Ho Chi Minh City, Vietnam
14:30 – 15:00	I- 3: Electron backscatter diffraction: from principles to applications in materials science and engineering Assoc.Prof. Dr. Le Manh Tu Faculty of Materials Science and Engineering, Phenikaa University
15:00 – 15:20	Coffee break
PLENARY SESSION, HALL 1	

Chairs: Assoc.Prof. Dr Nguyen Thanh Tung and Dr. Trinh Duy Chi	
15:20 – 15:50	I-4: Nghiên cứu đặc điểm tổn thương siêu cấu trúc mô gan của người phơi nhiễm mạn tính với chất da cam/dioxin Dr. Pham Xuan Thang Institute 69, Ho Chi Minh Mausoleum Protection Command, Vietnam
15: 50 – 16:20	I- 5: Đánh giá hình ảnh thoi vô sắc của noãn trưởng thành bằng kính hiển vi ánh sáng phân cực Assoc.Prof. Dr Nguyen Thanh Tung Vietnam Military Medical Academy, Hanoi
16:20 – 16:40	O-1: Ứng dụng kỹ thuật hiển vi điện tử trên kính TEM tại Viện 69 PhD stu. Le The Tai Hanoi Medical University/ Institute 69, Ho Chi Minh Mausoleum Protection Command, Vietnam
16:40 – 17:00	O-2: Investigated structure (WO₃/MWCNT)nanocomposite via hydrothermal method for NH₃ gas sensing electrode Tran Nhat Minh Faculty of Material Technology, Ho Chi Minh City University of Technology – VNU-HCM
17:05 – 21:00	COCKTAILS and GALA DINNER
21: 00 – 21:30	Bus transfer from ICISE to Seagull Hotel
DAY 2 Wednesday, 18 December 2024	
8:00 – 8:30	Moving to ICISE from Seagull Hotel by shuttle buses
PLENARY SESSION, HALL 1 Chairs: Assoc.Prof. Tran Quang Huy and Assist. Prof. Dr. Pham Thanh Tri	
8:30 – 9:00	K-2: High-Speed Atomic Force Microscopy for Dynamic Structural Biology Assist. Prof. Dr Ngo Xuan Kien WPI Nano LSI, Kanazawa University, Japan
9:00– 9:30	I-6: Fluorescence lifetime imaging microscopy for quantitative imaging of cellular metabolites Assist. Prof. Dr Vu Quang Cong WPI Nano LSI, Kanazawa University, Japan
9:30– 10:00	I-7: Applications of TEM for analysing the interaction of nanoparticles with bacterial cells Assoc. Prof. Tran Quang Huy Phenikaa University, Hanoi
10:00– 10:20	Coffee break
10:20 – 11:00	Poster session (<i>5 min. poster presentation</i>) (Chairs: Assoc.Prof.Dr Le Manh Tu, Dr. Hoang Duc Quang)

PLENARY SESSION, HALL 1 Chairs: Dr. Trinh Duy Chi and Dr. Hoang Duc Quang	
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11:20 – 11 40	O-4: High-Performance Transparent Conductive Electrodes: Nanoscale Electrical and Structural Insight in Silver Nanowire Networks Using Atomic Force Microscopy Dr. Pham Sy Hieu Institute of Materials Science, Vietnam Academy of Science and Technology, Hanoi, Vietnam
11:40 – 12:00	Poster awards and Closing ceremony
12:00 – 13:30	Lunch
Training Course on Advanced Microscopy	
13:30 – 14:30	Theoretical lecture 1: Dynamic atomic force microscopy for characterizing adhesive and mechanical properties of nanostructured materials Assist. Prof. Dr Nguyen Kim Hung Department of Chemical Science and Engineering, Institute of Science Tokyo, Tokyo, Japan
14:30 – 15:15	Theoretical Lecture 2: Exploring Basic Life Science with Advanced Microscopies Assist. Prof. Dr. Ngo Xuan KIEN WPI Nano Life Science Institute, Kanazawa University, Kanazawa, Japan
15:15 – 15:40	Coffee Break
15: 45 – 16:30	Theoretic lecture 3: Basic and Advanced Techniques for AFM Data Analyses Dr. Le Thi Phuong Ngan/ Assist. Prof. Dr. Ngo Xuan KIEN Vietnam National University, Ho Chi Minh City, Vietnam WPI Nano Life Science Institute, Kanazawa University, Kanazawa, Japan
16:30 – 17:20	Hands-on training on the portable SEM (from the diamond sponsor)
18:00-20:00	Dinner
20:00	Bus transfer from ICISE to Seagull Hotel
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	Data Analyses Dr. Le Thi Phuong Ngan/Assist. Prof. Dr. Ngo Xuan KIEN WPI Nano Life Science Institute, Kanazawa University, Kanazawa, Japan
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18:00-20:00	Dinner
20:00	Bus transfer from ICISE to Seagull Hotel
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11:30 – 12:00	Certificates of participation award
12:00 – 13:30	Lunch
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PP-20	Enhancement of intestinal antibacterial activity through the combination of Ag NPs and ZnO NPs with BBR Hue Thi Nguyen^{1*}, Tran Quang Huy^{1,2}, Thuy Thi Thu Nguyen² ¹ <i>Faculty of Biomedical Sciences, Phenikaa University, Hanoi 12116, Vietnam</i> ² <i>Phenikaa University Nano Institute (PHENA), Phenikaa University, Hanoi 12116, Vietnam</i>	41

PL Applications of Optical Microscopes in Cell Biology and Bacteriology

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We demonstrated the capabilities of a hybrid optical-atomic force microscope, which has numerous uses in various areas of materials science and life sciences. When operating in individual mode, time-lapse imaging, often referred to as live cell imaging, can be utilized to see where a specific organelle or protein of interest is located in a cell or tissue as well as its molecular activity. Membrane fibers and bacterial biofilms can also be observed under an optical microscope by labeling them with a fluorescent dye to determine their shape and size. In contrast to optical microscopy, atomic force microscopy was originally developed to image the morphology of a material surface, using a nano probe to physically scan the surface. Additionally, it can also be used to measure the mechanical, electrical, and magnetic properties of the surface of both living and non-living samples. It has also recently been used in mechanobiology to quantify the biophysical properties of live cell and tissue specimens. An optical microscope gives us a clear view of the region we are measuring and can use fluorescence emission to show the location or activity of a specific protein of interest. The integrated arrangement allows us to correlate the biophysical properties of the living samples with their molecular activity. Throughout my talk, I'll provide several examples of how this hybrid arrangement is widely applied in biological and materials sciences research.

Keywords: *Optical microscope, atomic force microscope, live cell imaging, mechanobiology, biosensors*

K-01 Moving magnetic bits in curved nanowires with Lorentz electron microscope

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Abstract: A magnetic domain wall is a boundary area between two magnetic material regions with different magnetic moments. Such domain walls is considered as an entity that can propagate under the influence of an external force field such as a continuous/pulsed magnetic field or an electric current. These given neighboring regions with different magnetic moments are defined as bit states, i.e. ‘up’/‘down’, ‘left’/‘right’ or ‘1’/‘0’ in writing/reading processes of the recording information devices. The structures containing these bits of information are being developed rapidly at the nanoscale level, thus visualizing such movements of that bit information in the real space that requires various advanced imaging techniques like microscopes which use various light sources such as laser, hard X-rays, ion/electron beams. In this work, we will address some features related to one of the above microscope techniques, Lorentz transmission electron microscopy (LTEM). Therein, magnetic bits in patterned ferromagnetic nanowires were created and visualized with the defocused (Fresnel) and in-focused (DPC) modes of the Glasgow LTEM. The content of this work focuses on the following aspects: (i) introducing a simulation method of creating/moving magnetic domain walls with the OOMMF software; (ii) patterning ferromagnetic nanowires using electron beam lithography and focused ion beam techniques; (iii) such magnetic bits are created and propagated in those patterned nanowires under continuous and pulsed magnetic fields with LTEM; (iv) a correlation between experimental data observed from the Glasgow LTEM and OOMMF simulation; (v) some general conclusions/remarks related to the LTEM technique in creating/propagating magnetic bit information in ferromagnetic nanowire structures and a couple of research directions being carried out by some research groups.

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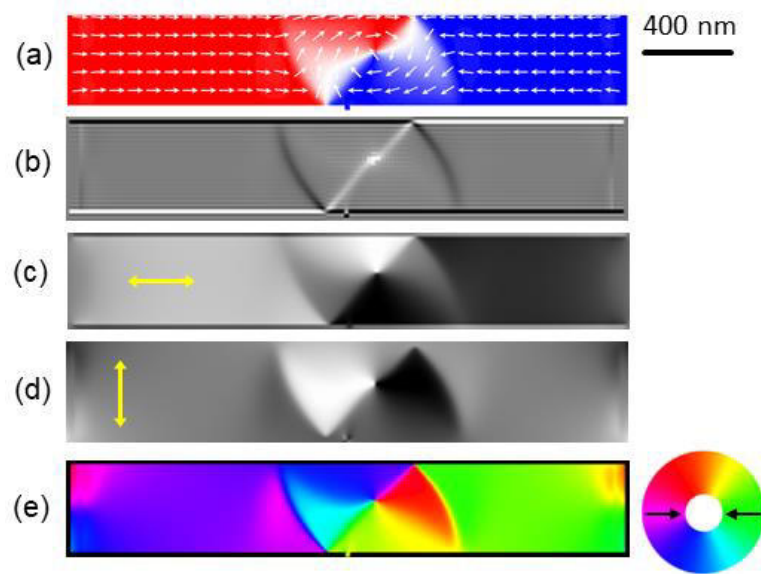


Figure: (a) The vortex domain wall image which was simulated using the OOMMF software and its Fresnel (b) and DPC images (c-e) that were analyzed with the Digital Micrograph™ and MatLab tools where the magnetic contrast of those images are intuitively visualized.

Keywords: Lorentz TEM, Fresnel and DPC images, magnetic domain walls, ferromagnetic nanowires, nanomagnetism

K-02 High-Speed Atomic Force Microscopy for Dynamic Structural Biology

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Abstract: High-speed Atomic Force Microscopy (HS-AFM), developed by Toshio Ando at Kanazawa University in 2008, has become a prominent tool in Nano Life Science. Operating in tapping mode, HS-AFM allows simultaneous imaging of the dynamics, structures, and functions of biomolecules in solution. Unlike conventional AFM, which is limited by slow scanning speeds, HS-AFM achieves sub-second temporal resolution, capturing biomolecules and cells in action during their functional processes. Its use of a soft and ultra-small cantilever minimizes interference with the biomolecules' structures and dynamics, enabling real-time, high-resolution imaging of individual nanomachines in operation.

In this talk, I will provide an overview of HS-AFM, covering its principles, applications, and the advantages and limitations of the method in exploring nano-scale life sciences. Additionally, I will share case studies highlighting the successful application of HS-AFM to address various biological questions. Finally, I will discuss the current advancements in HS-AFM technology and explore its future potential.

Keywords: *High-speed AFM, small cantilever, fast scanner, tapping mode, dynamic structural biology*

I-01 The use of confocal microscopy in plant sciences

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Abstract: Confocal fluorescent microscopy has revolutionized plant science by enabling detailed visualization and analysis of cellular structures and processes, molecular interactions, and cell growth with remarkable spatial and temporal resolution. The most significant aspect of confocal microscopy is its optical sectioning capability, which uses a pinhole aperture to block out-of-focus light, allowing only light from a specific focal plane to reach the detector. While the use of confocal microscopy has been common in laboratories of developed countries, it is still limited in Vietnam. Here I would like first to introduce the basis of confocal microscopy, then illustrate its usage with my recent research. I will show how confocal microscopy helps to analyze gene expression pattern and genetic interactions, to quantify gene expression variability between cells, to observe the dynamics of cellular components such as microtubules, and finally, to quantify growth of cells and tissues over many days. With this talk, I hope to inspire researchers in plant sciences to exploit this powerful tool to explore and solve multiple problems in the field.

Keywords: *confocal microscopy, gene expression pattern, growth rate, growth pattern, microtubules, quantitative biology*

I-02 High-Speed Atomic Force Microscopy in studying alpha-hemolysin toxin and its variants for preventing and treating *Staphylococcus aureus* infections

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Abstract: *Staphylococcus aureus* is a highly virulent, antibiotic-resistant pathogen responsible for severe infections worldwide. Among its virulence factors, alpha-hemolysin (Hla) plays a critical role in pathogenesis by forming transmembrane pores on host cell membranes, leading to cell lysis. Understanding the pore formation mechanism of Hla and exploring strategies to neutralize its activity is vital for developing preventive and therapeutic interventions. Hla is a pore-forming toxin, initially secreted as a monomeric protein and binds to lipid membranes. This is followed by oligomerization and the formation of a pre-pore structure, which transitions into a membrane-inserted pore. However, the detailed kinetics of these steps remain poorly understood, leaving gaps in our knowledge of Hla's action. To address this, our research utilized High-Speed Atomic Force Microscopy (HS-AFM) to elucidate Hla's pore formation process in real-time. HS-AFM revealed the binding of Hla monomers, oligomerization on lipid surfaces, and the transition from pre-pore to pore formation. To further explore potential therapeutic avenues, we investigated Hla variants, including HlaH35A, HlaH35L, and HlaH35LH48L, which lack hemolytic activity. HS-AFM imaging demonstrated that single-site mutants (HlaH35A, HlaH35L) retained some oligomerization ability, while double mutants (HlaH35LH48L) remained monomeric. This highlights the critical role of the His35-His48 region in Hla oligomerization and pore formation. To evaluate the ability to neutralize the Hla hemolytic toxin on rabbit RBCs by Hla mutants, we mixed Hla with the HlaH35A, HlaH35L, and HlaH35LH48L at ratios of 10:1 and 5:1 (w:w). Hemolytic activity of Hla was significantly reduced using HlaH35A and HlaH35L at a 5:1 (w:w) ratio. These findings underscore the utility of HS-AFM in revealing dynamic structural transitions of Hla and its variants, providing valuable insights into its pore-forming mechanism. Moreover, Hla variants like HlaH35A and HlaH35L are promising candidates for developing supportive treatments for *S. aureus* infections.

Keywords: HS-AFM, alpha-hemolysin, *Staphylococcus aureus*, HlaH35A, HlaH35L, HlaH35LH48L

I-03 Electron backscatter diffraction: from principles to applications in materials science and engineering

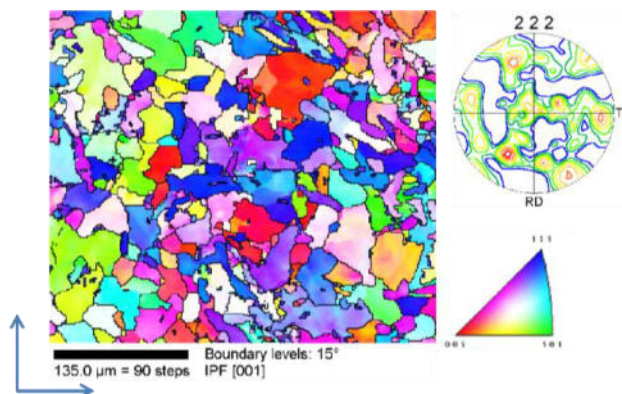
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Abstract: Electron backscatter diffraction (EBSD) is versatile technique to study microstructure and crystallographic orientations of materials from nano to microscale [1-2]. By analyzing EBSD measurements, researchers can obtain important information to understand the relationship between the properties of crystalline materials and their internal structure. This work provides key knowledge about EBSD as a Scanning Electron Microscope (SEM)-based technique focusing on aspects such as: principles of EBSD measurements, sample preparation, data analyses, and applications in materials science and engineering. It is worth mentioning that the key to success for the proper application of EBSD depends on the quality of the sample preparation procedure, which requires experience and deep understanding of both the nature of the material and the technique. Moreover, typical examples of using EBSD measurements to explain, correlate, and to estimate physical-chemical, and mechanical properties of the material will be explained in detail.

Keywords: sample preparation for EBSD, microtexture measurements, crystallographic (grain) orientation.



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I-04 Nghiên cứu đặc điểm tổn thương siêu cấu trúc mô gan của người phơi nhiễm mạn tính với chất da cam/dioxin

Phạm Xuân Thắng¹, Nguyễn Bá Vượng², Nguyễn Linh Toàn²

¹ Ban Quản lý Lăng Chủ tịch Hồ Chí Minh.

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Tóm tắt:

Mục tiêu: xác định các đặc điểm tổn thương siêu cấu trúc của tế bào gan, nhu mô gan trên các bệnh nhân được chẩn đoán có phơi nhiễm mạn tính với dioxin.

Đối tượng: Các mẫu sinh thiết gan được lấy từ các bệnh nhân với chẩn đoán có phơi nhiễm mạn tính với dioxin. **Phương pháp nghiên cứu:** Nghiên cứu mô tả, cắt ngang. Nghiên cứu siêu cấu trúc tế bào và nhu mô gan: trên kính hiển vi điện tử truyền qua (JEM 1400, JEOL) và kính hiển vi điện tử quét (JSM 5410LV – JEOL). **Kết quả:** Các tổn thương siêu cấu trúc của tế bào gan ở người phơi nhiễm mạn tính với dioxin bao gồm: Các mitochondria tăng đậm độ điện tử đồng đều, biến dạng, đứt gãy màng, xuất hiện các mitochondria thể kính, nhiều hình dạng, kích thước khác nhau (elíp, dài, có nhánh, quả tạ...). Bên trong chứa 1-3 hạt hình cầu đậm độ điện tử cao, có các đường tinh thể. *Lưới nội bào không hạt* giãn rộng tăng số lượng, giãn nhẹ, bao quanh, đôi khi nằm sát mitochondria. Xuất hiện các thể đa màng dạng xoắn trong bào tương tế bào nhu mô gan. Tổn thương thành phần cấu tạo mô gan phơi nhiễm mạn tính với dioxin chủ yếu là sự xâm nhập của các tế bào viêm ở các mức độ khác nhau. Hình ảnh thâm nhập của các dải xơ vào khoảng Disse, khoảng gian bào tế bào nhu mô gan. **Kết luận:** các tổn thương của gan người phơi nhiễm mạn tính với dioxin chủ yếu được thấy ở mức độ siêu cấu trúc với những thay đổi bên trong tế bào, các bào quan tham gia vào quá trình chuyển hóa và sinh năng lượng dẫn tới làm mất chức năng của các bào quan này, gây tổn thương tế bào. Nhu mô gan biểu hiện các tổn thương của quá trình viêm không đặc hiệu.

Từ khóa: siêu cấu trúc, tế bào gan, dioxin, kính hiển vi điện tử truyền qua, kính hiển vi điện tử quét.

I-05 Đánh giá hình ảnh thoi vô sắc của noãn trưởng thành bằng kính hiển vi ánh sáng phân cực

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Tóm tắt

Mục tiêu: Đánh giá vị trí thoi vô sắc trong noãn trưởng thành, hình thái phôi của thụ tinh trong ống nghiệm.

Đối tượng và phương pháp: nghiên cứu tiền cứu mô tả cắt ngang 250 noãn của bệnh nhân được chỉ định làm thụ tinh ống nghiệm. Sử dụng kính hiển vi ánh sáng phân cực quan sát thoi vô sắc của noãn trưởng thành (noãn MII), thực hiện thụ tinh bằng kỹ thuật ICSI. Đánh giá tỉ lệ thụ tinh và chất lượng phôi.

Kết quả: trong 218 noãn MII thì có 170 noãn MII nhìn thấy thoi vô sắc (77,98%), trong đó có 115 noãn (67,65%) có thoi vô sắc nằm ngay dưới hoặc gần thể cực 1, 55 noãn (32,35%) có thoi vô sắc lệch so với thể cực 1 từ 30° đến 180°. Noãn MII nhìn thấy thoi vô sắc có tỉ lệ thụ tinh và tỉ lệ phôi tốt (69,41% và 61,02%) cao hơn so với noãn MII không nhìn thấy thoi vô sắc (39,58% và 36,84%), sự khác biệt có ý nghĩa thống kê với $p < 0,001$ và $p < 0,05$.

Kết luận: Vị trí thoi vô sắc có thể thay đổi so với vị trí thể cực 1. Nhóm noãn nhìn thấy thoi vô sắc có tỉ lệ thụ tinh và tỉ lệ chất lượng phôi tốt cao hơn nhóm noãn không nhìn thấy thoi vô sắc.

Từ khoá: ICSI (tiêm tinh trùng vào bào tương noãn), noãn metaphase II, kính hiển vi ánh sáng phân cực, thoi vô sắc.

I-06 Fluorescence lifetime imaging microscopy for quantitative imaging of cellular metabolites

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Abstract: Real-time quantification of cellular metabolites is crucial for understanding their roles in cellular processes. In this workshop, I will present the advancements in fluorescence lifetime imaging microscopy (FLIM) for quantitative imaging of cellular metabolites in living cells. Specifically, I will discuss the principles and recent developments of FLIM-based biosensors for measuring calcium ions (Ca^{2+}), adenosine triphosphate (ATP), guanosine triphosphate (GTP), and the GTP-to-guanosine diphosphate (GDP) ratio. This technique provides a powerful tool for investigating cellular metabolism with high precision and accuracy.

I-07 Applications of TEM for analysing the interaction of nanoparticles with bacterial cells

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Abstract: This talk will present the information on the interaction between nanoparticles and bacterial cells observed under the transmission electron microscope (TEM). There are 3 types of nanoparticles including silver nanoparticles (AgNPs), iron oxide nanoparticles (Fe_3O_4 NPs) and zinc oxide nanoparticles (ZnONPs) tested with Gram-negative and Gram-positive bacterial strains. The ultrathin sectioning method was used to cut fixed bacterial cells into sections before TEM observation. The results showed changes in the cell membrane as well as the cytoplasm under the influence of different types of nanoparticles. The ultrastructural study could provide the meaningful information to explain the interaction mechanism of nanoparticles to bacterial cells.

Keywords: nanoparticles, TEM, ultrathin sectioning, bacterial cells

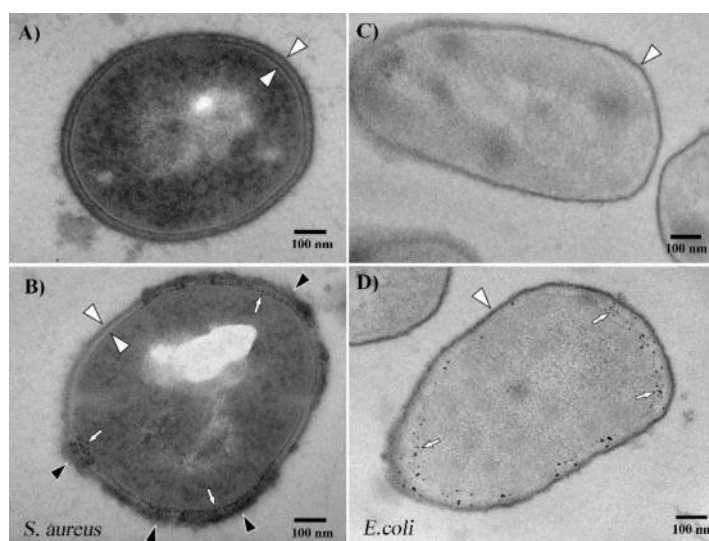


Figure: TEM Images of cross-sections of *S.aureus* before (A) and after (B) treatment with AgNPs; and *E. coli* before (C) and after (D) treatment with AgNPs

O-01 Report on application of electron microscope technique on TEM - JEOL - JEM1400 at 69 Institute

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Abstract: Since its inception in the 1930s, electron microscopy has made a revolution in the development of science and technology across various fields such as medicine, biology, and materials science. Transmission electron microscopy (TEM) has been an important tool for evaluating ultrastructures at the nanoscale in samples such as cells, organelles, bacterial tissues, viruses, nanoparticles, and crystals. The JEOL JEM 1400, a highly advanced and modern instrument, enables observation samples at magnifications of up to 50,000x, allowing the detection of extremely small structures as small as 20 - 30 nm. The Morphology Department, 69 Institute, Hanoi has applied various sample preparation techniques to study and analyze biomedical specimens, including cellular structures, organelles, skin tissues, muscles, bones, blood, sperm, blood vessels, internal organs, bacteria, viruses, and nanoscale particles. The standardized sample preparation protocols ensure clear and accurate imaging results that effectively support the research process.

Keywords: Transmission electron microscopy, ultrastructure

O-02 Investigation of WO₃/MWCN nanocomposite structures via the hydrothermal method for NH₃ gas sensing electrode

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Abstract: In this study, we investigated the properties of Wolfram (VI) oxide load on a multi-walled carbon nanotube (WO₃/MWCNT) via different synthesis conditions (reactant ratio and reaction time). It is including two-step reaction: (i) acid-precipitation method to make WO₃ powder, and (ii) hydrothermal method in Teflon-Autoclave to make the WO₃/MWCNT nanocomposites. To evaluate the structure and characterization of materials, X-ray diffraction (XRD) results confirmed the structure according to crystal lattice plane, and Scanning electron microscopy (SEM) images clarified the surface morphology nanoplates and nanorods. Moreover, Fourier transform infrared spectroscopy (FTIR) and Raman spectrum confirmed characteristic bonding peak identification of MWCNT bonds and characteristic vibrations of W-O-W in the nanocomposite. This approach offers a promising strategy for NH₃ gas sensing electrode via coated onto the silicon substrate.

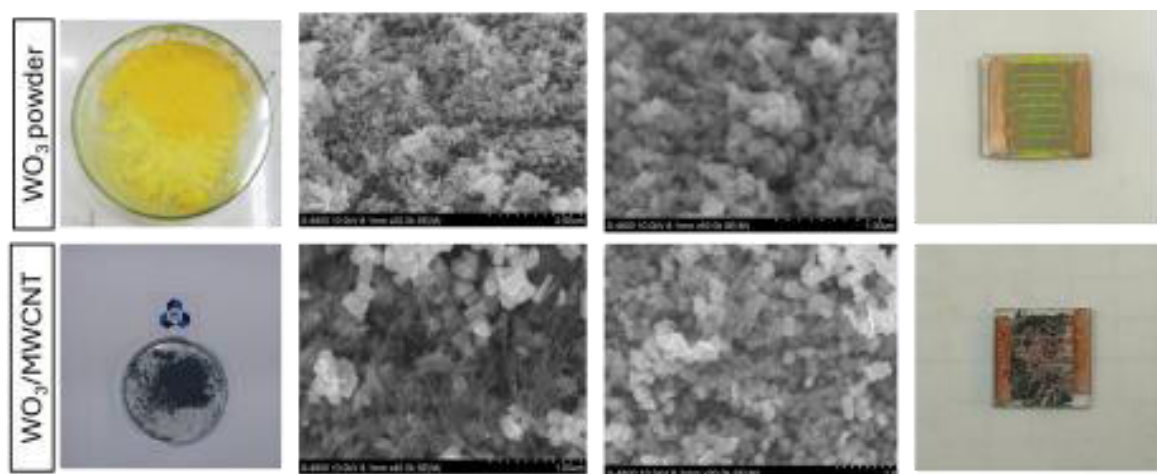


Fig. 1. WO₃ and WO₃/MWCNT nanocomposite image; SEM image; and electrode preparation
Keywords: WO₃/MWCNT nanocomposite; SEM; gas sensor.

O-03 My research needs Advanced Microscopy Imaging

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Abstract: Recently, our laboratory has been focused on several biomedical research including nanobiotechnology, vaccine and cellular targeting, nutraceuticals and cosmeceuticals, recombinant proteins, and bioinformatics. In nanobiotechnology, immunomagnetic beads are exploited to isolate cells for transplant, microorganisms for quick detection; quantum dots are used for cell labeling; and biocompatible nanoparticles for topic drug delivery. Due to the lack of confocal microscopy, we can not visualize subcellular distribution of quantum dots in cancerous cells. In vaccine and cellular targeting, M cells in the small intestine are on target for developing oral vaccine; and surface display on probiotics (baker yeast, lactic-acid bacteria) for vaccine delivery. Again, confocal microscopy is required for subcellular distribution of M-cell targeting antigens. In nutraceuticals and cosmeceuticals, natural compounds are screened for gut microbiota modulation, melanogenesis inhibition, or for combating multidrug-resistant bacteria. For detailed characterization of drug-treated bacteria, daily access to transmission electron microscopy (TEM) and scanning electron microscopy (SEM) is an utmost need. In recombinant proteins, material-binding proteins or peptides are screened for biosensor development, which requires atomic force microscopy (AFM) for subcellular structure visualization. In bioinformatics, cloud-based tools are exploited to annotate the next-generation sequencing data, and to execute molecular docking and molecular simulations for peptide-based vaccine development. With *in silico* prediction, cryogenic electron microscopy is required for further validation the prediction macromolecules. In this talk, I will briefly present recent data on selected topics and the quest for Advanced Microscopy Imaging.

Keywords: *Confocal Microscopy, Cryo-EM, TEM, SEM, AFM*

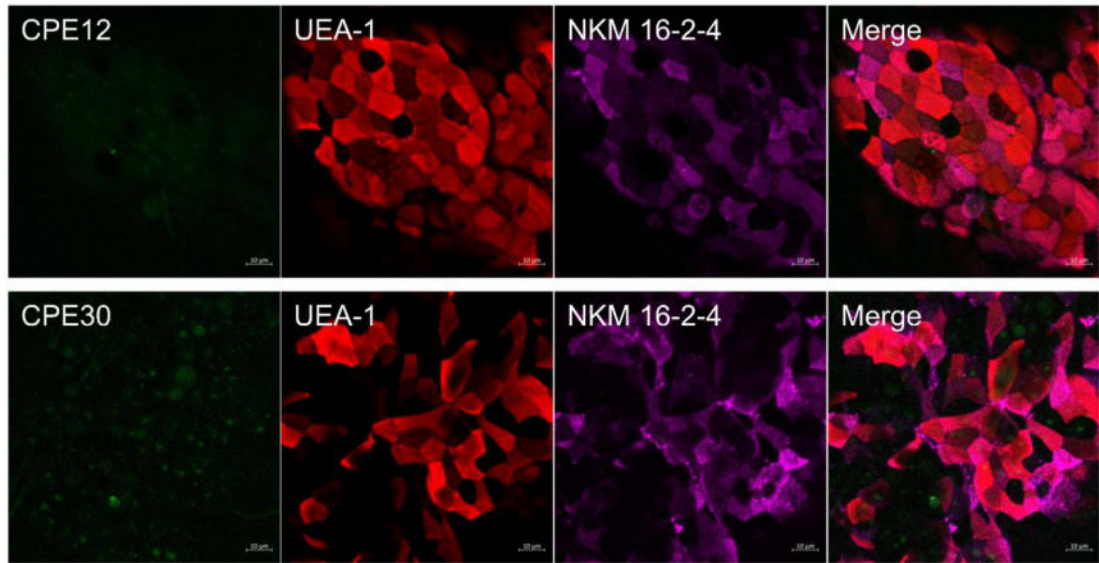


Figure 7: Ex vivo binding assay of CPEs to murine intestinal M cells.

Murine Peyer's patches were initially fixed and permeabilized. CPE-GFPs were incubated with the fixed Peyer's patches. Samples were then incubated with M cell-specific Abs NKM 16-2-4 (purple) and UEA-1-Rhodamine (red) to locate murine M cells. Scale bar: 10 μm [1]

O-04 High-Performance Transparent Conductive Electrodes: Nanoscale Electrical and Structural Insight in Silver Nanowire Networks Using Atomic Force Microscopy

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Abstract: This study utilized conductive atomic force microscopy (c-AFM) to investigate the nanoscale electrical properties of silver nanowire (AgNW) networks, offering an in-depth characterization of their percolation pathways. The resistivity of an individual AgNW was determined to be approximately $12.35 \mu\Omega\cdot\text{cm}$, and nanoscale conductivity mapping revealed efficient current transport over $1000 \mu\text{m}$ in the network. Additionally, c-AFM highlighted significant differences in resistance between X- and Y-type nanojunctions, attributed to variations in wire-wire contact. These results of c-AFM at nanoscale electrical behaviors, provide crucial insights for optimizing AgNW networks and promising alternative to indium tin oxide (ITO) in flexible optoelectronic devices.

Keywords: silver nanowire, transparent conductive electrodes, atomic force microscopy, conductive atomic force microscopy

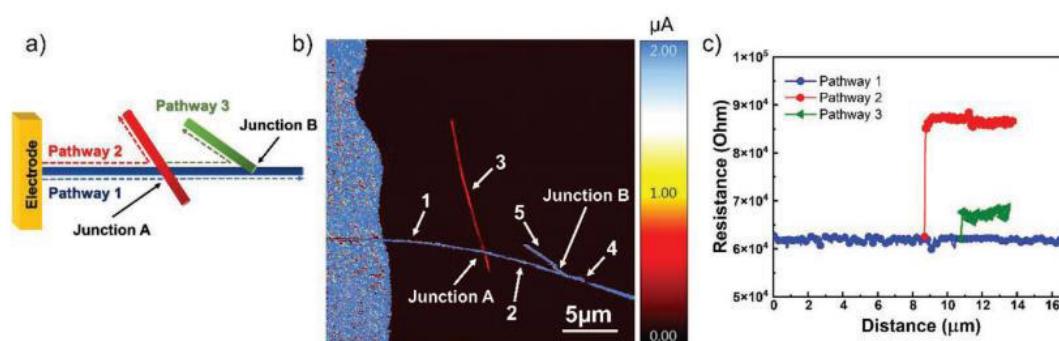


Figure: Resistance behavior of different nanojunctions in AgNWs film. a) Schematic of analyzed conductive pathways. b) The current pattern of a main AgNW contacted to electrode and displaying two kinds of nanojunctions. c) Electrical resistance evolution of the conductive pathways, strongly dependent on the X- or Y-junctions.

PP-01 Melting process of amorphous germanene

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Abstract: This study investigates the solid-liquid phase transition of amorphous germanene in detail using molecular dynamics (MD) simulations. An amorphous germanene model consisting of 10,000 Ge atoms interacting via the Stillinger-Weber (SW) potential was gradually heated at a rate of $4 \times 10^{10} \text{ K.s}^{-1}$ up to 4000 K to achieve a completely melted state. The obtained results are analyzed to elucidate the phase transition process of the amorphous germanene model through the changes in thermodynamic properties and structural characteristics. The melting temperature of amorphous germanene is determined to be 1450 K, which is lower than that of crystalline germanene reported in previous studies (1540 K for the perfect model and 1670 K for the model with defects). Additionally, structural properties such as radial distribution function, ring size distribution, coordination number distribution, and bond angle distribution are thoroughly investigated during the melting process.

Keywords: *solid-liquid phase transition, amorphous germanene, molecular dynamics simulation, melting temperature.*

Acknowledgements: This work is funded by the Vietnam National Foundation for science and Technology Development (NAFOSTED) under Grant 103.01-2021.31.

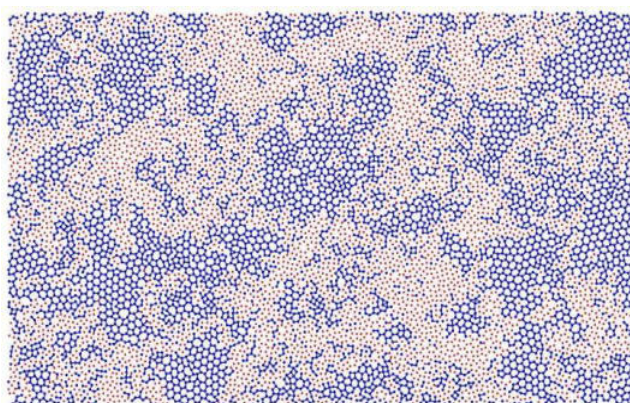


Figure: The 2D visualizations of germanene

PP-02 Investigation of the morphology, surface structure, mechanical properties of bio-polymer film incorporated with nanomaterial for extended riping time of fruit

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Abstract: In recent years, Vietnamese fruits have seen significant development in terms of production quantity and diversity of types, highly appreciated by most markets. However, due to the perishable nature of tropical fruits caused by natural factors like bacteria, mold, and viruses, long-distance transportation poses a major challenge. In this study, we have developed advanced bio-polymer film based on the combination of advanced nano-materials such as nano ZnO, and nano Ag, with bio-polymer Carboxymethyl cellulose for preservation avocado. The morphology and surface structure, mechanical properties such as stiffness, and roughness play an important role in determining its effectiveness in protecting and extending the ripening time of fruits. In this study, we utilized equipment such as an optical microscope, a scanning electron microscope (SEM), and an atomic force microscope (AFM),... for investigation that properties. Research results indicate that the coating extends the ripening period from 7 days to 35 days, minimizing damage and preserving high nutritional value throughout storage, unlocking the export potential for avocado.

Keywords: *bio-polymer film, CMC, nano-materials, optical microscope, scanning electron microscope, atomic force microscope.*

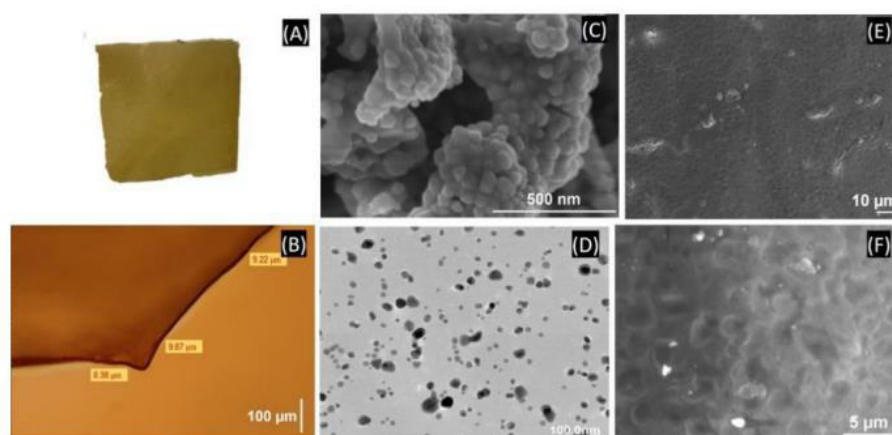


Figure 1. (A) Image taken by a phone camera of the CMC-ZnO-Ag biopolymer film; (B) Optical microscopy of the CMC-ZnO-Ag biopolymer film; (C) SEM image of ZnO powder; (D) TEM image of the solution containing Ag NPs in TSC surfactant solution; and (E, F) SEM images of the CMC-ZnO-Ag biopolymer film.

PP-03 Impact of Nano ZnO Morphology on the Sensitivity of Fluorescent Biosensors

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Abstract: ZnO nanorods (NRs) and ZnO nanotubes (NTs) synthesized via the hydrothermal method were employed for enzyme-free fluorescent glucose detection. The impact of ZnO nanostructure morphology on the sensitivity of the fluorescent biosensor was investigated. As the glucose concentration increased, the fluorescence intensity at the ZnO emission peak decreased. The sensitivity of the fluorescent biosensor using ZnO nanorods was $2.3\% \text{ mM}^{-1}$, with a lower detection threshold of 1 mM and a detection range of 1 – 20 mM. In contrast, the biosensor using ZnO nanotubes exhibited a sensitivity of $3.5\% \text{ mM}^{-1}$, a lower limit of detection (LOD) of 70 μM , and a detection range of 0.1 – 15 mM.

Keywords: ZnO nanostructures, non-enzymatic sensor, fluorometric sensor, glucose sensing, photoluminescence quenching

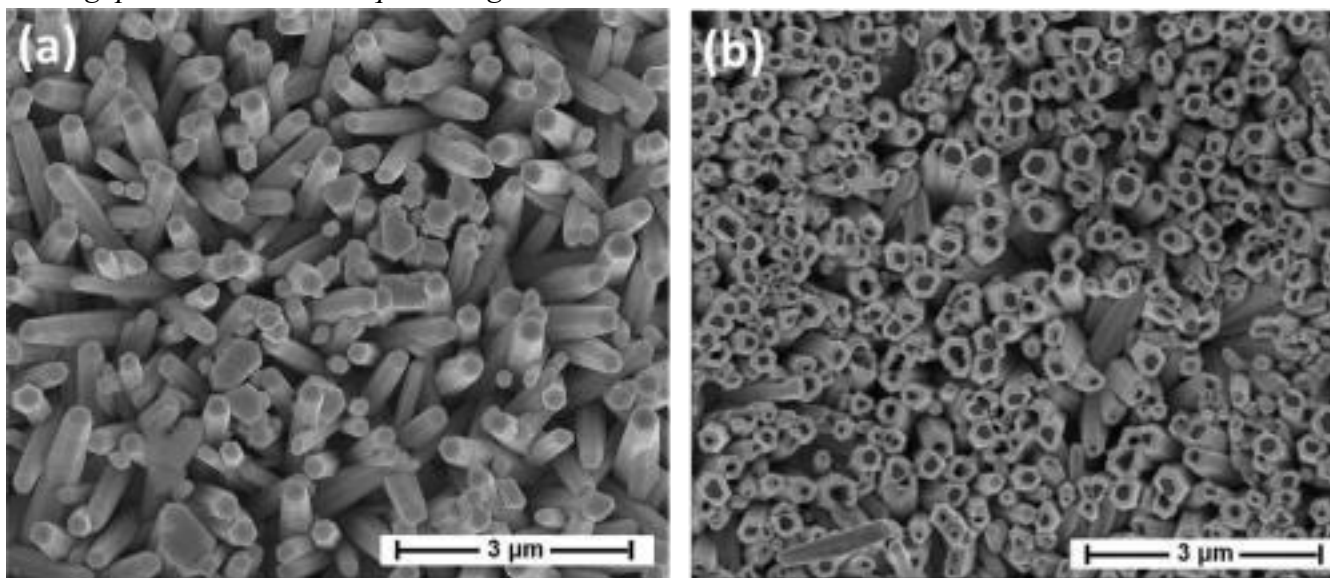


Figure 1: Top view SEM images of (a) the ZnO NRs and (b) the ZnO NTs grown on PCB substrates

PP-04 Morphological study of phytopathogenic fungi by stereo microscope and microscope

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Abstract: Determining fungi scientific names is a significant challenge in biology and taxonomy. Fungi are highly diverse in terms of color, shape, structure, and habitat. These characteristics can vary significantly based on environmental conditions and the specific stages of fungal development. This study describes how to prepare specimens and shows some microscopic images of fungal structures using a stereo microscope and microscope. The study provides a more thorough perspective of fungi's unique structures that extend beyond the general form of the spore. The microscopic images shown in this study are from the Botryosphaeriaceae, Aspergillaceae, Glomerellaceae, Nectriaceae, Pleosporaceae, Sporocadaceae, and Trichosphaeriaceae families. Furthermore, the study discusses the constraints of using a microscope to observe fungal morphology, as well as the necessity for help from more powerful microscopes such as electron microscopes.

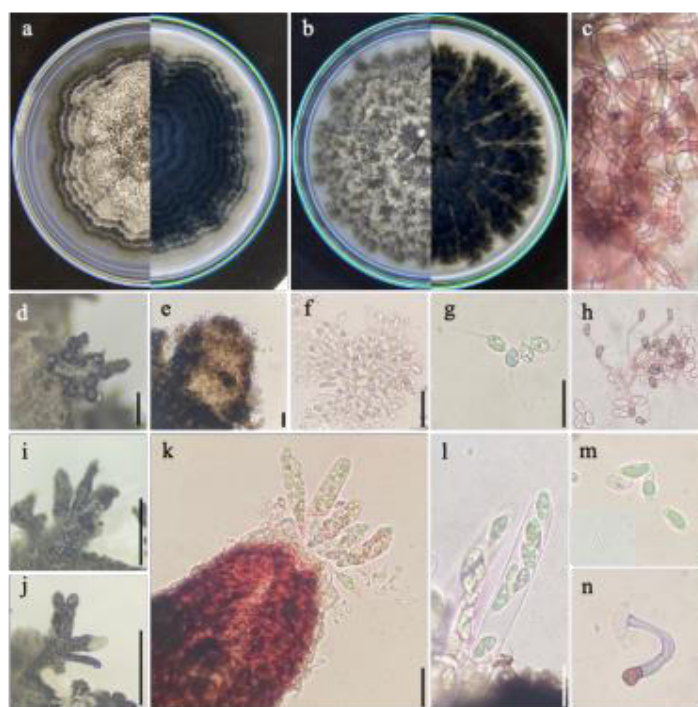


Figure: Anamorph and teleomorph characteristics of *Phyllosticta capitalensis*.

a, b Two colony morphologies on PDA (left-above, right reverse) **c** Hyphae have septate **d, e** Conidiomata **f** Conidiogenous cells and conidiophores **g** Conidia with apical appendage **h** Conidia germinate and form appressoria **i, j** Ascomata **k** Asci release from the tip of ascomata **l** Ascus elongation **m** Ascospores and spermatia **n** Ascospore germinate and form appressoria. **Scale bar:** c, f-h, k-n = 25 µm; d, i, j = 1 mm; e = 250 µm.

PP-05 The effect of Ag on optical properties of SiO₂-coated ZnS nanoparticles

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Abstract: ZnS/SiO₂ nanocomposites were synthesized by a co-precipitation method combining the Stöber method and the reduction process from zinc acetate and sodium sulfide solutions in the presence of tetraethyl orthosilicate (TEOS). SEM images showed that the ZnS coated with surfactant (TSC) and SiO₂, the particle morphology became more uniform with an average size of about 150 nm. The morphology of the particles improved significantly with a more clearly defined spherical structure. Regarding the optical properties, the photoluminescence (PL) spectra showed that the luminescence intensity of SiO₂ - coated ZnS was reduced compared to that of ZnS. As Ag nanoparticles decorated on ZnS/SiO₂ nanocomposites, besides bands at 450 nm attributed to vacancies, interstitial in ZnS host, there appeared band at 545nm. Using ZnS/SiO₂ -Ag nanocomposites, the fluorescence intensity of Rhodamine 6G (R6G) at 545 nm increased up to 250 times with the R6G concentrations ranged from 0.1 to 100 ppm.

Keywords: ZnS, nanoparticle, ZnS/SiO₂ -Ag, absorption, photoluminescence.

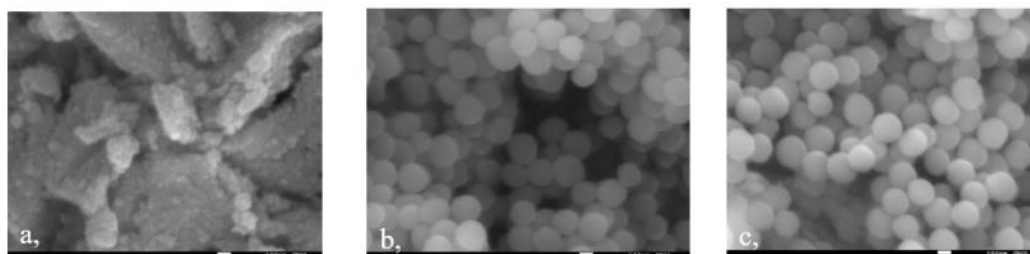


Figure: SEM images of (a)TSC-coated ZnS nanoparticles and (b)SiO₂-coated ZnS/TSC and (c)Ag decorated on SiO₂-coated ZnS/TSC

PP-06 Phân lập và tuyển chọn vi khuẩn lactic ứng dụng trong lên men sữa chua đậu tương

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Tóm tắt: Nghiên cứu được thực hiện nhằm phân lập và tuyển chọn các chủng vi khuẩn lactic có tiềm năng ứng dụng trong sản xuất sữa chua đậu tương. Từ 17 mẫu lên men tự nhiên, 51 chủng vi khuẩn lactic có khả năng lên men sữa chua đậu tương đã được phân lập. Dựa trên kết quả phân tích chất lượng sữa chua, 10 chủng tiềm năng nhất đã được sàng lọc và định danh bằng phương pháp MALDI-TOF/MS, xác định thuộc ba loài: *Enterococcus faecium*, *Lactococcus lactis*, và *Streptococcus equinus*. Trong số đó, chủng *Lactococcus lactis* K1 được đánh giá là vượt trội nhờ khả năng sinh trưởng nhanh, an toàn sinh học và tạo ra sữa chua đậu tương có chất lượng cao. Đặc biệt, chủng này có khả năng sản sinh exopolysaccharide với hàm lượng đáng kể (1.381,7 mg/kg). Sản phẩm sữa chua đậu tương tạo ra bước đầu đã nhận được phản hồi tích cực từ người tiêu dùng, cho thấy tiềm năng ứng dụng thương mại của chủng vi khuẩn này.

Từ khóa: Vi khuẩn lactic, đặc tính sinh hóa, sữa chua đậu tương

ISOLATION AND SELECTION OF LACTIC ACID BACTERIA FOR USE IN SOY YOGURT PRODUCTION

Abstract: This study aimed to isolate and select lactic acid bacteria strains with potential for soy yogurt production. A total of 51 strains capable of fermenting soy milk into yogurt were isolated from 17 naturally fermented samples. Based on the quality analysis of the resulting soy yogurt, 10 strains were shortlisted and identified using MALDI-TOF/MS, classifying them into three species: *Enterococcus faecium*, *Lactococcus lactis*, and *Streptococcus equinus*. Among these, *Lactococcus lactis* K1 was identified as the most promising strain due to its high growth rate, biological safety, and ability to produce high-quality yogurt, including a significant amount of exopolysaccharide (1,381.7 mg/kg). The soy yogurt produced using this strain received positive initial responses from consumers, highlighting its potential for commercial application.

Keywords: Lactic acid bacteria, biochemical characterization, soy yogurt.

PP-07 Investigation of structural changes in amorphous germanene under compression

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Abstract: In this work, structural evolution of amorphous germanene under biaxial compression was investigated in detail using molecular dynamics (MD) simulations. An amorphous germanene model consisting of 10,000 Ge atoms, obtained by rapid quenching in a previous study, was subjected to biaxial compression. The results demonstrate significant structural changes in the amorphous germanene during compression, as revealed by the analysis of structural properties such as ring distribution, coordination number distribution, bond length distribution, and bond angle distribution. Notably, the final compressed model exhibits a large number of three-membered rings, leading to the formation of a triangular amorphous germanene structure. Our findings reveal an amorphous-to-amorphous phase transition in germanene.

Keywords: amorphous germanene, molecular dynamics simulation, compression, triangular amorphous germanene, amorphous-to-amorphous phase.

Acknowledgements: This work is funded by the Vietnam National Foundation for science and Technology Development (NAFOSTED) under Grant 103.01-2021.31.

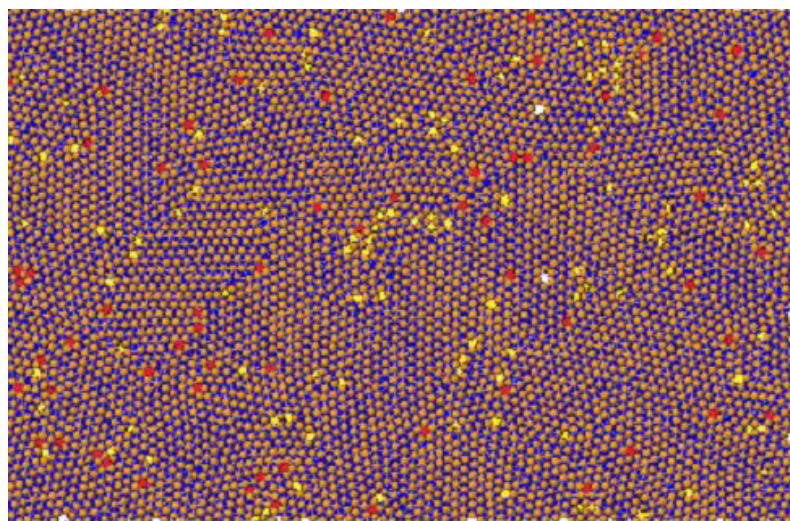


Figure: The 2D visualizations of germanene

PP-08 Prokaryotic expression of chimeric GFP-hFc protein as a potential immune-based tool

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Abstract: Along with the development of modern biotechnology, the discovery of marker proteins is one of the leading strategies molecular biology. Green Fluorescent Protein (GFP) derived from jellyfish *Aequorea victoria* can absorb ultraviolet to blue light and emit green fluorescence, which possesses many benefits. It has been utilized as a marker to study gene expression, protein trafficking, targeting, location, and interactions. Moreover, GFP is not toxic to most types of cells and can be recognized without harming the cell. In addition, GFP is resistant to heat, detergents, alkaline pH, and high salt concentrations. Thus, GFP has been widely used in transgenic monitoring systems and promoter activity evaluation of gene expression. From the potentials above, we conducted to fuse hFc-tag of IgG with GFP to form chimeric protein GFP-hFc expressed in *Escherichia coli* with many outstanding advantages. From the immunology perspective, the hFc-tag is a part of the antibody structure that facilitates the interaction with immune cells and activates immune reactions of macrophages, complements, and opsonization. Besides, hFc-tag also specifically binds to protein A/G as an application for detecting protein A/G-coated magnetic beads to separate pathogens, target and deliver drugs to organs. Therefore, GFP-hFc could be deployed as a recombinant protein model in detecting and tracking target of interest, rerouting magnetic beads, and stimulating immune responses. In this present study, we proceeded to fuse *gfp-hfc* gene into pET-28a to create a recombinant pET-28a-*gfp-hfc* vector. The expression of GFP-hFc was induced by IPTG and confirmed using SDS-PAGE and followed by Western blot probed with 6xHis antibodies. This chimeric protein was utilized in specific binding experiments with protein A/G-coated magnetic beads using a fluorescence microscope. The protein exhibited the biological properties of fluorescence blue emission when observed under a fluorescence microscope and the specific association of fusion hFc-tag with protein A/G-coated magnetic beads. Due to its fluorescence and binding ability, GFP-hFc could be used as a model molecule for monitoring molecule detection studies, tracking nanoparticle migration and distribution, or stimulating immune responses.

Keywords: GFP; hFc-tag; GFP-hFc; protein A/G-coated magnetic beads; fluorescence microscope.

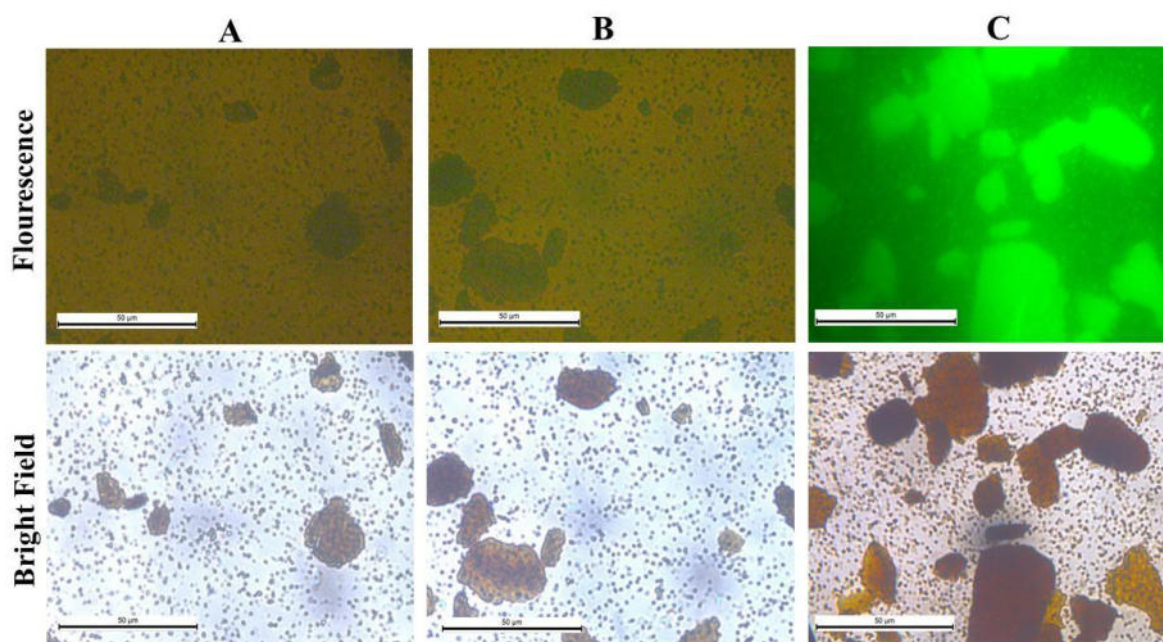


Figure: Detection of GFP-hFc interaction with protein A/G-coated magetic beads by fluorescence microscope. A, PBS; B, GFP; C, GFP-hFc [1]

Reference:

[1]. Nguyen, T. T., Vo-Nguyen, H. V., & Tran-Van, H. (2021). Prokaryotic expression of chimeric GFP-hFc protein as a potential immune-based tool. *Molecular Biology Research Communications*, 10(3), 105.

PP-09 Influence of morphology on electrochemical response of spinel MCo₂O₄ (M = Zn, Cu, Mn) based electrochemical sensing platform towards Carbendazim pesticide

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Abstract: In this work, the spinel structures MCo₂O₄ (M = Zn, Cu, Mn) were fabricated by a microwave assisted hydrothermal method. X-ray diffraction (XRD), Raman spectra, and Scanning electron microscopy (SEM) techniques were conducted to evaluate the structure and characterization of materials. Besides, the effect of morphology on the Carbendazim (CBZ) oxidation peak current on the spinel structure MCo₂O₄ (M = Zn, Cu, Mn)-based electrochemical sensing platform with two morphologies, including nanosheets and nanorods, was investigated. Among these morphologies, nanorods displayed outstanding electrochemical activity owing to the unique porous structure and large specific surface area. However, due to the small pores size, MnCo₂O₄ displayed a significant increase in their electrochemical response toward CBZ detection. Under the same conditions, the MCo₂O₄-based CBZ electrochemical sensor reached an electrochemical response of 39.78 μ A, the highest in the three proposed electrochemical sensing platforms. This study provides valuable insights into the morphology-dependent sensing properties of spinel MCo₂O₄ (M = Cu, Zn, Mn) towards CBZ pesticide, which is helpful to the design of novel MCo₂O₄ (M = Cu, Zn, Mn)-based electrochemical nanosensors.

Keywords: *Electrochemical sensor, Morphology, Nanosheets, Nanorods, Carbendazim*

PP-10 Expressing red fluorescent protein on the surface of *Escherichia coli* using C-terminal domain of autotransporters

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Abstract: Surface display technology enables the presentation of biological molecules on a substrate surface through the linkage of specific membrane attachment structures to target molecules. This technology finds applications in numerous fields, including medicine, agriculture, environmental science, and biotechnology. Currently, surface display systems in Gram-positive bacteria and yeast are well-known for their role as platforms for surface expression and as “factories” for producing recombinant proteins with diverse membrane-anchoring motifs. Meanwhile, Gram-negative bacteria have long been used as efficient systems for recombinant protein production, with notable advantages in various applications. In Gram-negative bacteria, secretion systems facilitate the extracellular release of biological molecules. Among these systems, the type V secretion system (T5SS) is particularly notable, it not only secretes proteins but can also anchor proteins to the outer membrane. The type Va motif within T5SS represents a promising protein-anchoring secretion system. To illustrate its potential, we expressed the red fluorescent protein mRFP on the surface of *E. coli* SHuffle® non-T7 Express. This was achieved by constructing the pHEA-mRFP vector, allowing for mRFP expression upon induction with 0.5 mM IPTG. We then verified protein expression through SDS-PAGE electrophoresis, membrane fractionation, and further confirmation by Western blot analysis. Once mRFP expression was confirmed in the *E. coli* SHuffle® non-T7 Express, we observed the cells under a fluorescence microscope to detect the red fluorescence of the surface-expressed mRFP protein. For this purpose, we used the ECLIPSE Ti2 inverted fluorescence microscope (Nikon) with an appropriate excitation wavelength to visualize mRFP on the bacterial cell surface.

Key words: Autotransporter; mRFP; C-terminal of EhaA, fluorescence microscope

PP-11 Fabrication of SERS Substrate Using Ag-SiO₂ nanocomposite for Glucose Detection

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Abstract: SERS substrates were fabricated from the Ag-SiO₂ nanocomposite synthesized via the Stober method combined with the reduction process. SEM images revealed that the SiO₂ particles were spherical with an average size of 128 nm, and the Ag nanoparticles have an average size of approximately 14 nm, distributed relatively uniformly on the surface of the SiO₂ particles. With this structure, the SERS performance can be optimized for glucose detection due to its ability to selectively recognize molecules and provide sharp Raman signals from functional groups in glucose molecules. In our investigations, glucose (D) was detected at concentrations ranging from 20 ppm to 1 ppm, with a characteristic peak observed at 1331 cm⁻¹.

Keywords: Ag-SiO₂, Nanocomposite, SERS, Glucose

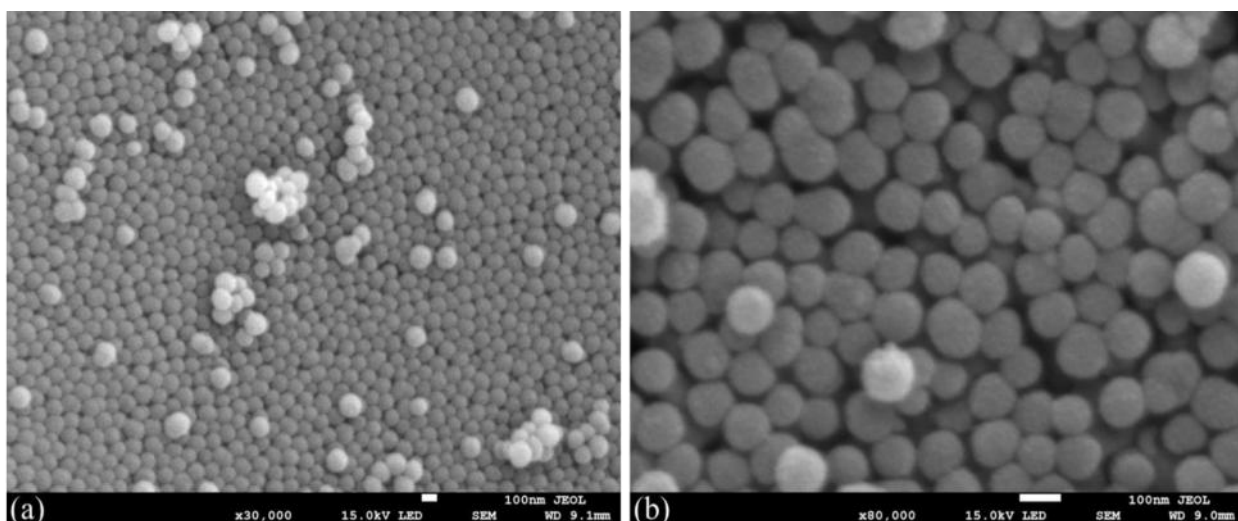


Figure: SEM Images of (a) SiO₂ and (b) Ag-SiO₂

PP-12 Fabrication, investigation of optical properties, and application of carbon quantum dots synthesized from orange peel by hydrothermal method in agriculture and disinfection

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Abstract: Carbon quantum dots (CQDs) are classified as 0D materials. They exhibit remarkable properties, including chemical stability, water dispersion, small size, and high photoluminescence. These advantages make CQDs applicable in various fields, such as biomedicine, energy, electronics, and environmental science. CQDs were synthesized using a simple hydrothermal method from orange peels. After synthesis, their optical properties were analyzed using UV-Vis absorption spectroscopy and photoluminescence (PL) spectroscopy. The results showed that CQDs exhibited blue emission with an emission peak at 414 nm and a corresponding absorption peak at 303 nm. Fourier-transform infrared spectroscopy (FT-IR) confirmed the presence of functional groups such as OH, N-H, C=O, and CH on the samples' surfaces. Notably, the synthesized CQDs achieved a quantum yield of up to 13.2%. The antibacterial activity of CQDs was evaluated, with the best results observed against *Escherichia coli*, where the inhibition zone diameter reached 1.6 cm. Beyond their antibacterial properties, the CQDs demonstrated a remarkable ability to promote root growth and biomass accumulation in *Abelmoschus esculentus* (okra), *Vigna radiata* (mung bean), and *Crassula ovata* (jade plant) compared to the control group. With these exceptional characteristics, CQDs synthesized from orange peels present a promising new direction for green agriculture, offering the potential for a more sustainable future in this field.

Keywords: carbon quantum dots, orange peel, agriculture, antibacterial, hydrothermal method.

PP-13 Assessing the ultrastructural characteristics of formalin-fixed tissues

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Abstract: Transmission Electron Microscopy (TEM) is an invaluable tool for visualizing ultrastructural features of tissues and plays a significant role in disease diagnosis and biomedical research. This study investigates the feasibility of using formalin-fixed, paraffin-embedded (FFPE) tissues for TEM analysis by reprocessing paraffin blocks. Tissue samples, including skin, muscle, and renal allograft tissue from a chronic allograft injury patient, were prepared and imaged via TEM following optimized protocols. Key findings indicate that ultrastructural morphology such as intact cell membranes, nuclei, and organelle structures was well-preserved in both fresh and FFPE reprocessed samples. TEM images demonstrated high contrast and sharpness, providing reliable data for tissue evaluation and pathological diagnostics. For renal allograft tissues, critical features like thickened basement membranes and electron-dense deposits were discernible, highlighting the method's diagnostic potential. The study concludes that FFPE samples can serve as a valuable resource for both retrospective and prospective TEM analyses, offering imaging quality comparable to freshly prepared specimens. Future research should focus on refining reprocessing techniques to further enhance diagnostic accuracy and broaden research applications, particularly in pathology and tissue ultrastructure studies.

Keywords: Transmission Electron Microscopy, ultrastructure, biological specimens, paraffin-embedded tissues

PP-14 High-performance glucose sensor using ZnO/CuO nanocomposites and FOX assay

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Abstract: Nanomaterials have garnered significant attention due to their unique properties and potential applications in various fields, including electronics, medicine, and energy. This study focuses on the synthesis, characterization, and glucose sensing application of ZnO/CuO nanocomposites. ZnO/CuO nanocomposites were synthesized using a two-step hydrothermal method. The synthesized nanocomposites were characterized using scanning electron microscopy (SEM), X-ray diffraction (XRD), and Raman scattering to determine their morphological and structural properties. The results indicated that ZnO/CuO nanocomposites exhibited a high crystallinity and surface area. Furthermore, ZnO/CuO nanocomposites integrated with the ferrous oxidation-xylenol orange (FOX) assay for absorption-based glucose detection. This sensor achieves a sensitivity of 0.202 mM^{-1} , a detection limit of 0.08 mM , and a wide linear range of $0\text{--}4 \text{ mM}$. The FOX-based sensor also shows excellent selectivity towards glucose compared to other sugars.

Keywords: ZnO/CuO, nanocomposites, hydrothermal, glucose sensor, FOX assay.

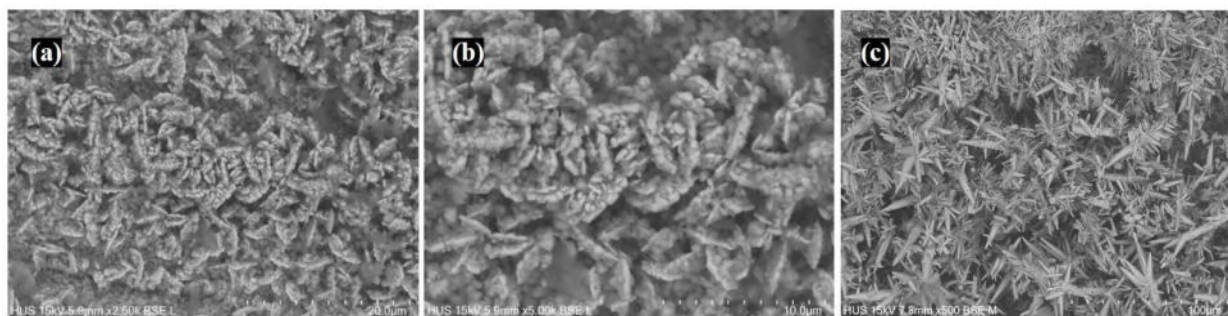


Figure 1: SEM images of (a, b) CuO nanoparticles and (c) ZnO/CuO nanocomposites.

PP-15 Modification of the surface of TFC-PA film by α -MnO₂/UiO-66-NO₂ material to improve the bio-blocking ability of the membrane

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Abstract: To address the issue of declining filtration performance in thin-film composite polyamide (TFC-PA) membranes caused by biofouling from microorganisms, recent studies have focused on surface modification. This involves incorporating antimicrobial materials onto the membrane surface to inhibit microbial growth. Among these materials, α -MnO₂/UiO-66-NO₂ has emerged as a promising candidate. Its core-shell structure offers unique advantages: α -MnO₂ provides strong antimicrobial activity due to its high oxidative capacity, while UiO-66-NO₂, a metal organic framework material, features high porosity, excellent water stability, and nanochannel structures that smoothen the membrane surface, thereby enhancing filtration performance. Furthermore, UiO-66-NO₂ strengthens the interaction between α -MnO₂ and the organic PA membrane surface. In this study, PA membranes were modified with α -MnO₂/UiO-66-NO₂ using an interfacial polymerization technique involving m-phenylenediamine (MPD) and trimesoyl chloride (TMC) solutions on a polysulfone (PSf) support layer. The materials and membranes were characterized using X-ray diffraction (XRD), attenuated total reflectance infrared spectroscopy (ATR-IR), scanning electron microscopy (SEM), and contact angle measurements. The results confirmed the successful synthesis of α -MnO₂/UiO-66-NO₂ and the α -MnO₂/UiO-66-NO₂/TFC-PA membrane. The modified membrane exhibited a threefold increase in filtration performance compared to the base membrane, with a 15 % improvement in selectivity. Its biofouling resistance, with 0,1 wt % of the material incorporated, improved by 62,5 % relative to the base membrane. Additionally, the membrane demonstrated outstanding antibacterial activity, achieving greater than 99 % efficacy against both gram-negative and gram-positive bacteria.

Some outstanding results

Material UiO-66-NO₂ and α -MnO₂/UiO-66-NO₂

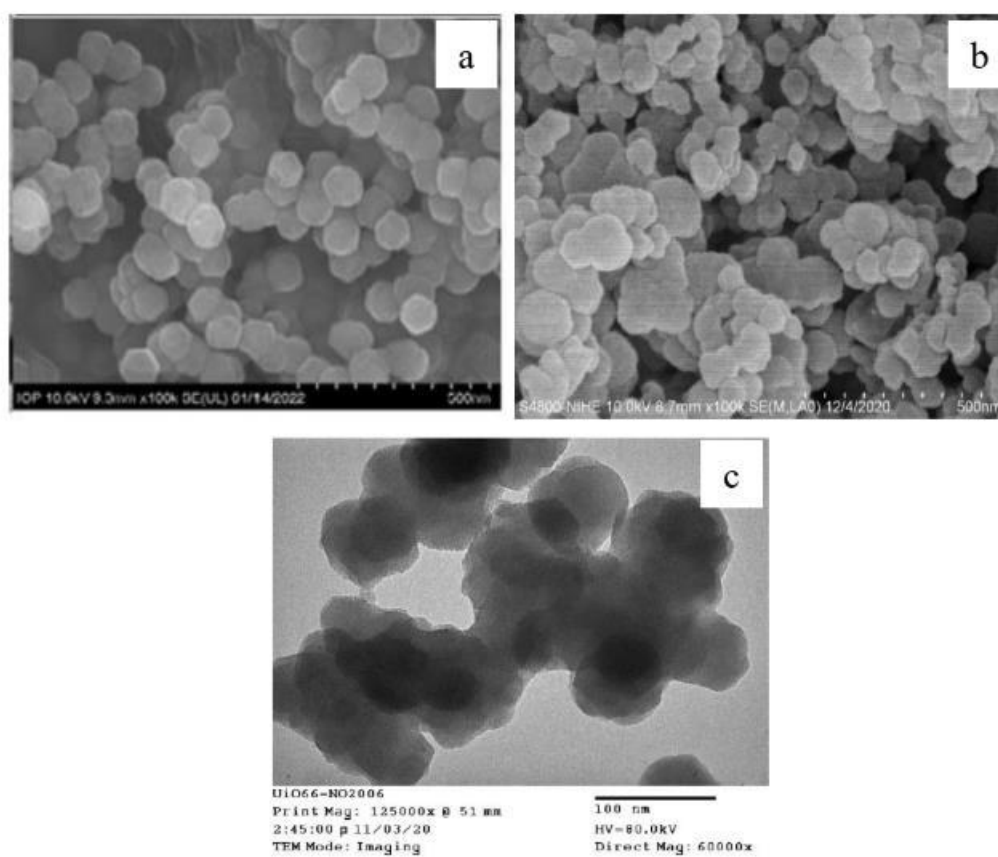


Figure 1: (a) SEM image of UiO-66-NO₂, (b) SEM image of α -MnO₂/UiO-66-NO₂, (c) TEM image of UiO-66-NO₂

Membrane α -MnO₂/UiO-66-NO₂/TFC-PA

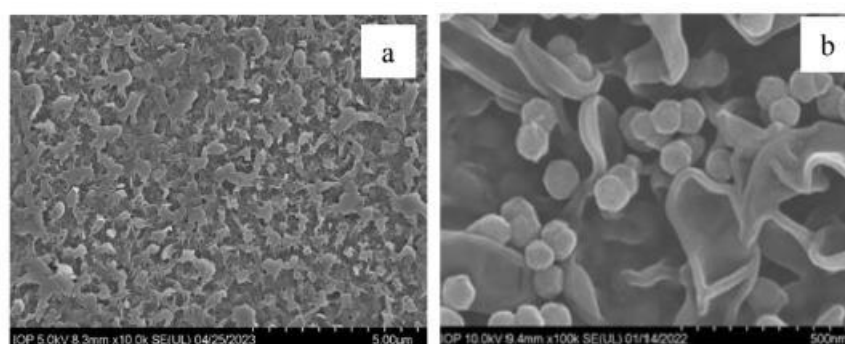


Figure 2: (a) SEM image of TFC-PA membrane, (b) SEM image of α -MnO₂/UiO 66-NO₂/TFC-PA membrane

PP-16 Effects of ABS (Acrylonitrile Butadiene Styrene) 3D printing plastic on Embryonic Development in a Model of Zebrafish (*Danio rerio*)

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Abstract: Acrylonitrile Butadiene Styrene (ABS) plastic, produced via 3D printing using digital light processing (DLP-ABS) technology, is extensively utilized in various applications. However, there exists a significant gap in research pertaining to the environmental implications of discarded DLP-ABS plastic waste. This investigation aims to assess the toxicity of leachates from DLP-ABS plastic products, referred to as release-ABS, focusing on its embryotoxic effects on zebrafish lines AB and Tg(fli1:EGFP). The concentration of release-ABS was quantified utilizing thermogravimetric analysis (TGA). Toxicological assessments revealed lethal concentration (LC50) at 6.16 µg/mL and effective concentration (EC50) at 5.079 µg/mL, with observed morphological anomalies including hemorrhage, darkened yolk, pericardial edema, hypopigmentation, and tail deformities. Vasculogenic assessment of transgenic larvae indicated that release-ABS adversely affects angiogenesis through the bone morphogenetic protein (BMP) signaling pathway. Furthermore, release-ABS concentrations reached 445 µg/mL after 96 hours of exposure, demonstrating lethality to all embryos. This study highlights the potential environmental risks associated with DLP-ABS plastic waste, emphasizing the urgent need for stringent waste management strategies.

Keywords: *Zebrafish, Toxicity, 3D printing, Acrylonitrile Butadiene Styrene, polymer waste.*

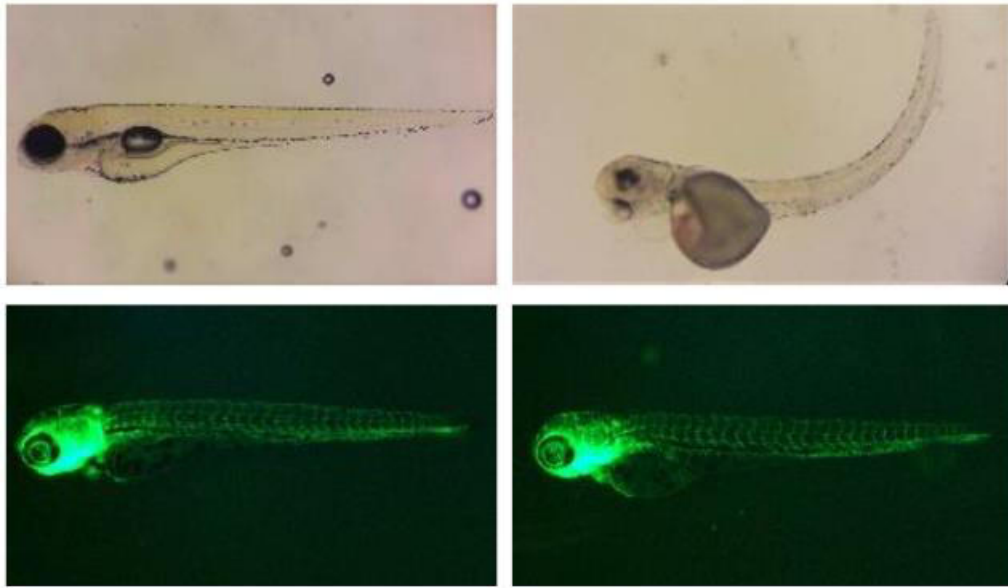


Figure: Stereo Microscopic images of (a) control zebrafish and (b) ABS-exposed zebrafish. Fluorescence Microscopic images of (c) control zebrafish and (d) ABS-exposed zebrafish.

PP-17 Development of Nano Biomembrane for Wound Healing Applications

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Abstract: Open wounds pose a significant challenge to current healthcare systems, particularly in cases of burns and large-area wounds. Conventional methods for treating and protecting wounds, from mild to severe, are often time-consuming and come with limitations that hinder the patient's recovery process. To address these issues, this research aims to develop a protective nanofiber membrane made from mixed polymer materials combined with stem cell therapy. Polymer nanofiber membranes were fabricated using a custom-designed electrospinning device developed by our research team. The morphology, size, surface structure (coverage), and mechanical properties, such as tensile strength, of the polymer fibers play a critical role in supporting the wound healing process. Fluorescently dyed polymer fibers were analyzed using optical microscopy, fluorescence microscopy, and ImageJ was applied to evaluate the coverage percentage (surface area coverage) of the bio-nanofiber membranes. The coverage over a unit area of the wound (maximum approximately 80%) affects its breathability (pore size around $10\text{ }\mu\text{m} \pm 5\text{ }\mu\text{m}$) and fluid resistance of the membranes further ensures their suitability for wound treatment and patient care. In addition to accelerating wound healing, the membranes can also provide direct hemostasis on the wound, demonstrating that polymer membranes are a promising avenue of research.

Keywords: *bio-nanofiber membrane, polymer, electrospinning, optical microscope, fluorescence microscopy, ImageJ.*

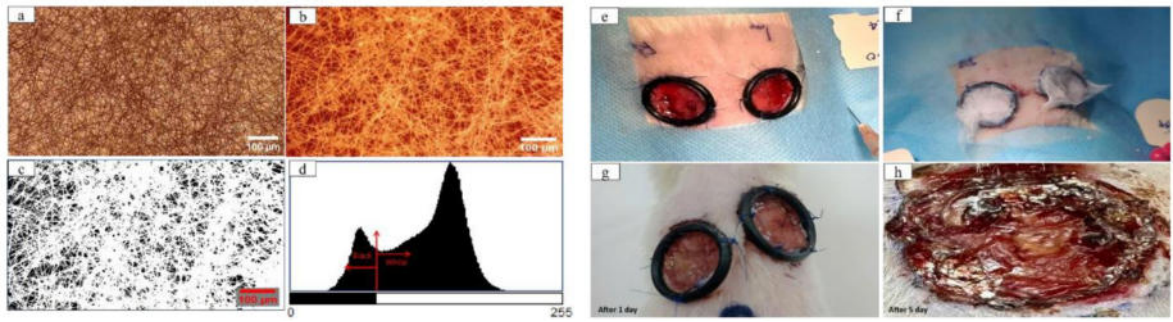


Figure: Optical microscope image (a) and fluorescence microscopy image (b) of polymer membrane; Microscopic image processing on ImageJ software (c); Coverage ratio results of polymer membrane (d); Images of experimental wounds created on mice (e); Image of polymer membrane spraying on wound (g); Experimental wound images after 1 day (g) and 5 days (h).

PP-18 Development of Magneto-Luminescent Microspheres for Biosensing Using Fluorescent Microscopy

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Abstract: The microspheres were synthesized using a mixture of polydimethylsiloxane (PDMS) and curing agent (ratio 10:1); Rhodamine B (RhB) dissolved in acetone (1 mg/mL); and nickel ferrite oxide (NiFe₂O₄, NFO) with masses of 1/40, 1/80, 1/160 of the mass of PDMS, respectively. The manufacturing process used a microfluidic channel system to produce the microspheres, which were then imaged. Microscopy provided detailed images, which aided in determining the dependence of the luminescent properties on the amount of NFO. These particles have potential for use as biosensors, as they can be coupled to the substances that needs to be detected and analyzed and then converted into quantifiable optical signals. Fluorescence microscopy is an effective tool for observing and quantifying the optical properties of particles, and then can be calculated the concentration of the substances.

Keywords: Magneto-luminescent microspheres, fluorescent microscopy, PDMS, NiFe₂O₄, Rhodamine B, luminescence intensity.

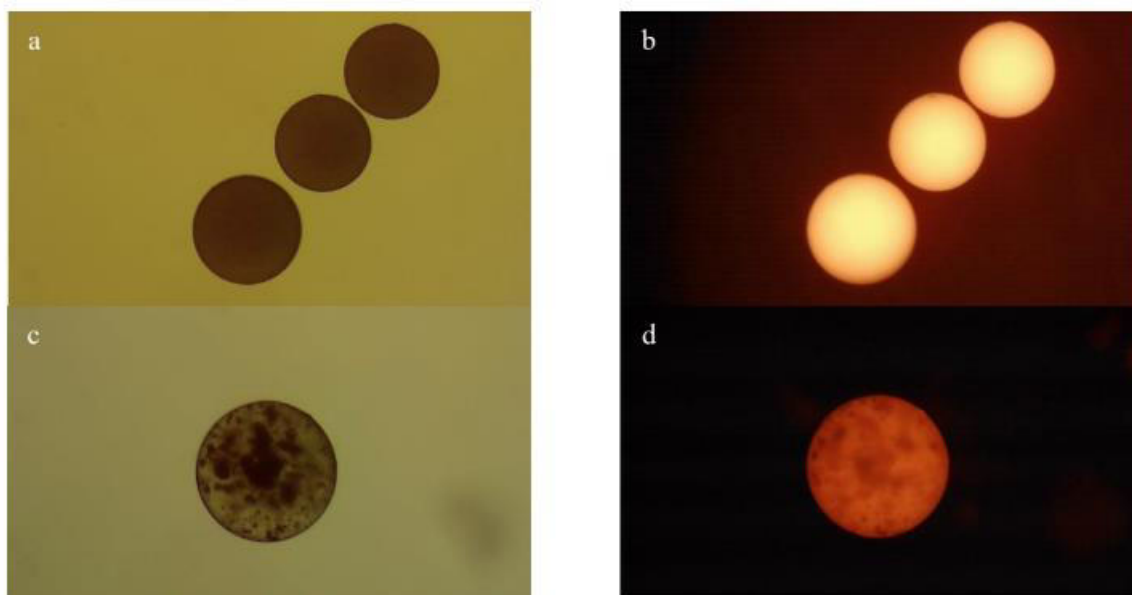


Figure: Microscope Images of (a) PDMS spheres with no NFO and (c) PDMS spheres with NFO. Fluorescent Microscope Images of (b) PDMS spheres with no NFO and (d) PDMS spheres with NFO

PP-19 Antibacterial activity of Sulfur and Nitrogen co-doped carbon nanoparticles

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Abstract: Antimicrobial resistance has emerged as one of the world's most significant public health challenges. Sulfur and nitrogen co-doped carbon nanoparticles (SN-CNPs) are a novel class of carbon-based nanoparticles with antibacterial capabilities that could serve as a viable alternative to existing antimicrobial treatments. Carbon nanoparticles are generally harmless and less toxic than many metal-based nanoparticles, making them suitable for biomedical applications. The synthesis of SN-CNPs using renewable resources satisfies the rising need for eco-friendly products. This study investigates the efficacy of SN-CNPs in inhibiting bacterial growth by determining its minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) against *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. The MIC and MBC for these bacterial strains are found to be 200 µg/mL and 400 µg/mL, respectively. These results show that SN-CNPs are effective at inhibiting bacterial growth, as demonstrated by the low MIC and MBC values. Future studies will focus on the ability of SN-CNPs to suppress bacterial biofilm formation as well as their efficacy in dissolving bacterial biofilms.

Keywords: *carbon-based nanoparticles, Sulfur and Nitrogen co-doped carbon nanoparticles, antibacterial properties, and alternative antibacterial agents.*

PP-20 Enhancement of intestinal antibacterial activity through the combination of Ag NPs and ZnO NPs with BBR

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Abstract: Conjugation with a metal nanoparticle is one of the methods to enhance the antibacterial ability of antibacterial drugs. This study synthesized AgNPs and ZnONPs particles by electrochemical method with benign reducing agent, then combined with BBR NPs. Electrostatic interaction in this combination affects the particle formation process, the particles are formed with small size and core-shell structure. The BBR NPs, AgNPs and ZnONPs components all have antibacterial properties, however Ag/BBR NPs and ZnO/BBR NPs show stronger antibacterial properties than the components when tested independently. The bactericidal activity of the ZnO/BBR complex against MRSA was showed at a two-fold dilution (corresponding to 2.5 g/L BBR and 10 mg/L ZnO). Meanwhile, the bactericidal activity of the Ag/BBR complex against *S. enteritidis* and MRSA was obtained at a two-fold dilution (corresponding to 2.5 g/L BBR and 92.5 mg/L Ag) and a four-fold dilution (corresponding to 1.25 g/L BBR and 46.25 mg/L Ag). Through ultra thin cross-sections TEM images, it is possible to observe major changes in the morphology and microstructure of bacterial cells treated with Ag/BBR NPs and ZnO/BBR NPs.

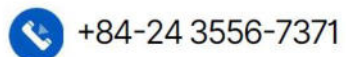
Keywords: *Berberine, nanoparticles, antibacterial, microscopy*



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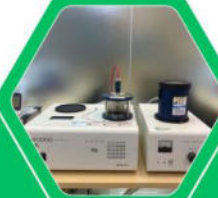
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