

# Thanuka Sandeepa Ranatunga Henaka Ralalage

## Contact

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## Education

### **Ph.D. in Chemistry** (2024-Present)

Department of Chemistry, Temple University, Philadelphia, USA

Advisor: Prof. Eric Borguet

Current GPA: 4.00/4.00 (100 %)

### **Bachelor of Science Honors in Chemistry** (2019-2023)

Department of Chemistry, University of Sri Jayewardenepura (USJ), Sri Lanka

Overall GPA: 3.66/4.00 (91.5 %)

Chemistry GPA (Major): 3.64/4.00

Physics GPA (Minor): 3.70/4.00

Polymer Science and Technology GPA (Minor): 3.71/4.00

## Research Experience

### **Graduate Research Experience**

Advisor: Prof. Eric Borguet

#### Project Description:

Understanding how structural and electronic changes in photocatalytic materials influence their activity. One major direction involves studying semiconductor photocatalysts such as  $\text{WO}_3$ ,  $\text{TiO}_2$ ,  $\text{CeO}_2$ ,  $\text{NiO}$ ,  $\text{ZnO}$ , and defect-engineered metal oxides to understand how oxygen vacancies, doping, photoinduced lattice distortions, and proton trapping affect light absorption, charge-carrier behavior, photocatalytic activity, and dark catalytic processes. Also interested in COFs and metal-loaded COFs as tunable platforms for photocatalysis, where the framework structure and metal active sites can be designed to improve catalytic performance.

Another part of my research focuses on molecular level catalysis in MOFs and related metal oxyhydroxide systems. In this work, I investigate how the metal node, organic linker, Lewis acidity, metal speciation, and formation of metal oxo/hydroxo active sites influence catalytic hydrolysis reactions. These studies are applied to biologically and chemically important bond-cleavage reactions, including ATP phosphate bond hydrolysis, cholesteryl ester hydrolysis, general ester hydrolysis, and ring-opening reactions.

Overall, my research aims to connect material structure, defect chemistry, and active-site properties with catalytic function.

### **Current Projects:**

1. “Oxygen Vacancies in WO<sub>3</sub>: Enhancement or Deactivation in Photocatalytic Detoxification of Phosphate Toxins?; **Thanuka S. R. Henaka Ralalage**, Sharan Dhar, Hao Li, and Eric Borguet
2. Oxygen-Vacancy-Enhanced Visible-Light Photocatalysis for Alcohol Oxidation and hydrodeoxygenation with WO<sub>3</sub>; **Thanuka S. R. Henaka Ralalage**, Marwa Abuseneneh, Sharan Dhar, Hao Li, and Eric Borguet
3. “Metal-Oxyhydroxide Catalyzed Phosphate Bond Hydrolysis: A Biomimetic Approach to Enzyme-Like Reactivity”; **Thanuka S. R. Henaka Ralalage**, Camilla Tahirova, Randy Espinal, Sharan Dhar, Hao Li, and Eric Borguet
4. “Biomimetic Catalysis of Carboxylic Ester Bond Hydrolysis utilizing Metal Oxyhydroxides ”; Adrian Mykhnych, **Thanuka S. R. Henaka Ralalage**, and Eric Borguet
5. “Harnessing Metal-Organic Framework Nodes as Nanozymes for Epoxide Ring-Opening Reactions”; Stephen M Autieri, Thanuka S. R. Henaka Ralalage, and Eric Borguet

### **Undergraduate Research Project**

Advisors: Prof. Nilwala Kottegoda, Dr. Imalka Munaweera, Dr. Dilushan R. Jayasundara

**Thesis Title:** Photocatalytic Food Packaging Based on Graphene Oxide Incorporated Iron Titanate Derive from Natural Ilmenite; Focused on enhancing the photocatalytic activity of ilmenite (iron-titanate) derived from natural ilmenite for food packaging applications.

## Key Skills

### Research Skills

- Proficient in operating analytical instruments and applying materials characterization techniques, including powder X-ray diffraction (PXRD), Fourier-transform infrared spectroscopy (FTIR), Raman spectroscopy, thermogravimetric analysis (TGA), UV–visible–NIR spectroscopy, diffuse reflectance spectroscopy (DRS), and scanning electron microscopy (SEM) to analyze the structural, optical, and chemical properties of materials.
- Experienced in NMR spectroscopy, including  $^1\text{H}$  NMR,  $^{31}\text{P}$  NMR, and 2D NMR techniques such as HMBC and HMQC, for monitoring reaction progress, identifying products/intermediates, and studying catalytic reaction mechanisms.
- Experienced in operating and maintaining ultra-high-vacuum (UHV) systems for surface science experiments, including sample preparation, gas dosing, temperature-programmed infrared spectroscopy (TPIR), temperature-programmed desorption mass spectrometry (TPDMS), adsorption/desorption studies, and molecular-level investigation of catalytic materials.
- Expertise in environmentally friendly and sustainable methods of material synthesis, such as microwave-assisted synthesis using Microwave reactors (Anton Paar Monowave 400).
- Skilled in using research software tools, including Mnova for NMR data processing, Igor Pro for scientific data analysis, ChemDraw for chemical structure drawing, RStudio for data analysis and statistical modeling, Zotero, EndNote and Mendeley for reference management, Origin for data visualization and analysis, and MATCH!, APEX, DIFFRACT.EVA, and PDXL2 for PXRD data analysis.

## Other Skills

- Strong presentation and communication skills.
- Great at working collaboratively as part of a team.
- Experienced in mentoring undergraduate researchers and supporting their research training.
- Effective leadership and problem-solving skills in fast-paced research environments.
- Methodical and detail-oriented approach to tasks and responsibilities.
- Sound decision-making abilities with strong planning and organizational skills.

## Publications

1. Oxygen Vacancies in  $\text{WO}_3$ : Enhancement or Deactivation in Photocatalytic Detoxification of Phosphate Toxins? by **Thanuka S. R. Henaka Ralalage**, Sharan Dhar, Kai Shen, John Vohs, and Eric Borguet - Manuscript in preparation for Angewandte Chemie
2. Metal-Ion Catalyzed ATP Hydrolysis: A Biomimetic Approach to Enzyme-Like Reactivity; **Thanuka S. R. Henaka Ralalage**, Camilla Tahirova, Randy Espinal, Sharan Dhar, Hao Li, and Eric Borguet - Manuscript in preparation for Angewandte Chemie
3. Biomimetic Catalysis of Carboxylic Esters Hydrolysis by Metal Oxyhydroxides; Adrian Mykhnych, Thanuka S. R. Henaka Ralalage, Eric Borguet - Manuscript in preparation for ACS Catalysis
4. Harnessing Metal Oxyhydroxides as Nanozymes for Epoxide Ring-Opening Reactions; Stephen Autieri, **Thanuka S. R. Henaka Ralalage**, and Eric Borguet\* - Manuscript in preparation for RSC Dalton Transactions
5. Graphene Oxide/Natural Ilmenite Nanocomposites as Coatings for Preserving Perishable Fruits; **Thanuka Ranatunga**, Dilushan R. Jayasundara, Imalka Munaweera, Nilwala Kottegoda (Abstract submitted to ACS Spring 2024, Abstract ID: 3997473)

## Presentations

1. “Effective and Safer Visible-Light-Active Photocatalytic Strategy for CWA Detoxification Based on Modified WO<sub>3</sub> Nanoparticles”, **Thanuka S. R. H. Ralalage**, and Eric Borguet, Sep 2025, YCC 2026 Philadelphia, PA
2. “Are Defects Always Beneficial in Photocatalysis? Insights from Organophosphate Detoxification”; **Thanuka S. R. H. Ralalage**, Sharan Dhar, and Eric Borguet, Apr 2026 Catalysis Club of Philadelphia Annual Conference 2026, Philadelphia, PA
3. “Graphene Oxide/Natural Ilmenite Nanocomposites as Coatings for Preserving Perishable Fruits”; **Thanuka Ranatunga**, Dilushan R. Jayasundara, Imalka Munaweera, Nilwala Kottegoda , ACS Spring Conference 2024. (Virtually)

## Teaching Experience

### **Graduate Teaching Assistant, Temple University, USA (2024-Present)**

1. Graduate Teaching Assistant – Lab Instructor for Post-baccalaureate General Chemistry-I, (Summer-1, 2026). Course Faculty: Dr. James D. Bloxton, Dr. John B. Michel
2. Graduate Teaching Assistant – Lab Instructor for Physical Chemistry-II, (Fall, 2025) Course Faculty: Dr. Jun Han
3. Graduate Teaching Assistant – Recitation Instructor for Chemistry for Engineers, (Fall, 2025). Course Faculty: Dr. Robert Levis
4. Graduate Teaching Assistant – Recitation Instructor for Chemistry for Engineers (Spring, 2025). Course Faculty: Dr. Hai-Lung Dai
5. Graduate Teaching Assistant – Lab Instructor for General Chemistry-I, (Fall, 2024). Course Faculty: Dr. John B. Michel

### **Teaching Contributions and Duties**

- Prepared quizzes and worksheets to reinforce key chemistry concepts and evaluate student understanding.

- Explained and expanded on theoretical concepts from lectures to help students develop a deeper understanding of the material.
- Led problem-solving sessions that connected chemistry principles to practical engineering applications.
- Provided individualized support during recitations by answering questions and guiding student discussions.
- Graded exams, assignments and post-lab reports, offering constructive feedback to support student learning and improvement.
- Supervised and proctored undergraduate examinations while maintaining academic integrity standards.
- Explained the theoretical background of laboratory experiments to strengthen students' understanding of experimental objectives.
- Demonstrated laboratory techniques and procedures to promote accurate, safe, and effective laboratory practices.

**Teaching Assistant, University of Sri Jayewardenepura, Sri Lanka (2023– 2024)**

As a Teaching Assistant - Physical Chemistry

- Demonstrated laboratory practical sessions for the B.Sc. General Degree and Honors degree programs in Physical Chemistry
- Supported lecturer-in-charge in conducting practical exams.
- Prepared questions and answers for prelab tests.
- Graded lab reports.
- Invigilated undergraduate exams.

**Administrative Support Experience:**

Supported administrative activities, including drafting formal letters, newspaper articles, and proposals.

## Academic Achievements

### Honors and Awards (University of Sri Jayewardenepura)

- Chemical Industries Colombo (CIC) Ltd. Cash award – 2022  
Awarded for the undergraduate with the highest GPA in the junior year examination of B.Sc. (Honors) in the Chemistry degree program.

## Extracurricular Activities

### Memberships in societies at USJ

1. The Chemical Society, Department of Chemistry, USJ
  - Role: Active Member - Duration: 2019 - 2023
2. The Polymer Society, Department of Polymer Sciences, USJ
  - Role: Active Member - Duration: 2019 - 2023
3. AIESEC in USJ
  - Role: Active Member (OGT B2C Team) - Duration: 2021 - 2022

### Team Leader

- Led the school chess team at the Sri Lanka Inter School Chess Championship 2010 (Division B) and won 1st Runners-Up Place.
- leader in one of the interdepartmental quiz programs conducted by the Genetic and Molecular Biology Department of the university in 2020, where my team secured first place.

### Chess Player

- Equal second Place in National Youth Rapid Chess Selection 2010 of Colombo District.