

## Ibrahim Muntaqa Tijjani Usman, PhD

Environmental Engineer | Specialist in Bio-Based Materials, LCA & Water Treatment | PhD (UTP)

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[https://scholar.google.com/citations?user=4nN\\_5SgAAAAJ&hl=en&authuser=2](https://scholar.google.com/citations?user=4nN_5SgAAAAJ&hl=en&authuser=2)

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### Education

**PhD in Civil Engineering - Environmental Engineering and Management** | *Universiti Teknologi PETRONAS (UTP), Malaysia* | 2025

- **Thesis:** *Comparative Study of Three Grafted Plant-Based Natural Coagulants (PBNCs) for Water Treatment*
  - Engineered and patented a microwave-grafted plant-based coagulant achieving **99% turbidity removal** and **70% lower sludge volume** compared to alum.
  - **Advanced Analyses:**
    - **Sludge Volume Index (SVI):** Quantified sludge reduction in treated water.
    - **Antimicrobial Testing:** IDEXX Colilert assays with coagulants achieving 100% *E. coli* and total coliform removal.
    - **Toxicology (LC50):** MATLAB-based Trimmed Spearman-Kärber method for Plant/Animal Safety.
    - **TOPSIS Decision Modeling:** Ranked coagulants by efficiency, cost, and sustainability.
  - **Sustainability Metrics:** Life-cycle assessment (LCA) and cost analysis (CA) using Simapro and openLCA.

**MSc in Water & Environmental Engineering (Distinction)** | *University of Surrey, UK* | 2015

- **Thesis:** *Evaluation of Pollution and Potential Treatment Techniques for Wienerberger Brick Industry*
  - Designed a coagulation-flocculation and advanced filtration system, towards reducing industry freshwater use by 40%.
- **Key Modules:**
  - **European Water Cycle Study Tour:** Analysed water management systems in Lake Constance (Germany), Karlsruhe (Germany), and Baden-Baden (Germany).
  - **Environmental Health:** Authored a report on fluoride's health impacts and defluoridation strategies.
  - **ArcGIS Facility Siting:** Resolved conflicting objectives (proximity to rivers vs. population density) using weighted spatial analysis and evaluated saline water intrusion into groundwater in a given coastal community.
  - **Centralized/Decentralized Systems:** Designed water/wastewater facilities for forecasted population growth.

**BEng in Irrigation Engineering** | *Bayero University Kano, Nigeria* | 2012

- **Thesis:** *Design of Greywater Irrigation System Using Bio-Sand Filter* (99% turbidity reduction).
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### Professional Experience

**Lecturer** | Bayero University Kano, Nigeria | 2025–Present

- Taught courses: Solid Waste Engineering and Air Pollution (UG), Engineer in Society (UG), Advanced Agricultural Land Drainage (PG).
- Mentoring 2 undergraduate project on Life cycle of solid waste treatment systems.

**Graduate Research Assistant** | Universiti Teknologi PETRONAS, Malaysia | 2021–2024

- Collaborated closely with UTP's research staff, laboratory technologists, and project teams across multiple disciplines, ensuring full familiarity with laboratory protocols, safety compliance, and equipment handling.
- Led R&D for enhanced plant-based natural coagulants, with one coagulant filed for patent for surface water and industrial/municipal wastewater. The coagulant achieved 99% and 90% harvesting efficiencies for microalgae in freshwater and seawater, respectively.
- Assisted supervision of 3 MSc theses on reverse osmosis-LCA and produced water treatment.
- Conducted POCs and authored 5+ peer-reviewed journal articles.
- Taught courses: Hydrology, Water Supply Engineering, Introduction to Renewable Energy Technologies, Solid Waste Management, Environmental and Wastewater Laboratory techniques, and Hazardous Waste Management.

**Assistant Lecturer** | Bayero University Kano, Nigeria | 2018–2021

- Taught courses: *Hydraulics, Agricultural Waste Management, Water Supply Engineering, Environmental Laboratory Techniques.*
- Mentored 10+ undergraduate projects on sustainable water/wastewater systems.

**Research Intern**

University of Surrey, UK | 2015

- Collaborated with Wienerberger Brick Industry to design a closed-loop wastewater treatment system.

Water Board Kano, Nigeria | 2010

- Assisted in water quality monitoring and chemical dosage optimisation. Worked with Engineers on treatment plant operation and maintenance.

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**Technical Expertise**

**Water/Wastewater Treatment**

- Coagulation-flocculation, membrane filtration, bio-sand filters, sludge management.
- Industrial process design, hydraulic modeling, decentralized systems, energy audit.

**Analytical & Modeling Tools**

- **Lab:** Jar testing, TSS/BOD/COD analysis, IDEXX Colilert, LC50 assays, Spectrophotometry, heavy metal analysis.
- **Software:** Python, MATLAB, ArcGIS/QGIS, AutoCAD, Simapro, openLCA, Design Expert.

- **Sustainability & Environmental Assessment Tools:**

- Life Cycle Assessment (LCA): Simapro, openLCA
- Cost Analysis (CA) and Technoeconomic Analysis (TEA)
- Circular Economy Metrics, Water Stress Index

**Innovation & IP**

- **Patent-Pending Coagulant:** Enhanced plant-based coagulant (trademark filed).
  - **Decision-Making Models:** TOPSIS for multi-criteria decision making.
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## Selected Publications

- **Tijjani Usman, I.M., Takaijudin, H.B., Lau, W.J., Ho, Y-C.** *Comparative Life Cycle Assessment of Energy and Coagulant Innovations in Real and Modelled Water Treatment Plants 2025.* (Submitted for publication)
- **Tijjani Usman, I.M.;** Ho, Y-C.; Lam, M-K.; Show, P.-L.; Sujarwo, W. Continuous-Flow Grafting of LENFLOC™ Coagulant for Water Treatment toward Circular Economy. *Water* 2023, 15, 2484. <https://doi.org/10.3390/w15132484>.
- **Tijjani Usman, I.M.;** Lee, F.-W.; Ho, Y.-C.; Khaw, H.-P.; Chong, Q.-W.; Kee, Y.-M.; Lim, J.-W.; Show, P.-L. Evaluation of *Annona diversifolia* Seed Extract as A Natural Coagulant for Water Treatment. *Sustainability* 2023, 15, 6324. <https://doi.org/10.3390/su15076324>.
- **Tijjani Usman, I.M.;** Ho, Y.-C.; Baloo, L.; Lam, M.-K.; Show, P.-L.; Sujarwo, W. Comprehensive Review of Modification, Optimisation, and Characterisation Methods Applied to Plant-Based Natural Coagulants (PBNCs) for Water and Wastewater Treatment. *Sustainability* 2023, 15, 4484. <https://doi.org/10.3390/su15054484>.
- **I.M. Tijjani Usman,** Y-C. Ho, L. Baloo, M-K. Lam, W. Sujarwo. A comprehensive review on the advances of bioproducts from biomass towards meeting net zero carbon emissions (NZCE), *Bioresource Technology*, Volume 366, 2022, 128167, <https://doi.org/10.1016/j.biortech.2022.128167>.

## Conference Proceedings

- *POCER 2022 (Malaysia):* Modification of plant-based coagulants for drinking water treatment.
- *International Conference on Research and Innovations in Engineering (Nigeria):* Wienerberger wastewater treatment design.

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## Peer Review & Editorial Activities

- **Reviewer**, Clean Technologies and Environmental Policy, Springer Nature (2024)
- **Reviewer**, Discover Water, Springer Nature (2024)
- **Reviewer**, Scientific Reports, Springer Nature (2024)
- **Reviewer**, Journal of Environmental Engineering, ASCE (2024)
- **Reviewer**, Waste and Biomass Valorisation, Springer Nature (2023)

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## Projects

### Life Cycle Assessment of Conventional Water Treatment Plant | Universiti Teknologi PETRONAS | 2024

- Conducted a process-audit to evaluate energy and chemical consumption for LCA towards sustainable alternatives.

### GIS-Based Water Treatment Facility Siting | University of Surrey | 2015

- Applied ArcGIS weighted overlay analysis to resolve conflicting siting criteria (proximity to rivers, population exposure).

### Fluoride Impact Mitigation | University of Surrey | 2015

- Recommended defluoridation techniques (activated alumina) and policy changes to reduce fluorosis risks.

### Greywater Bio-Sand Filter | Bayero University Kano | 2011

- Achieved 99% turbidity reduction (1925 NTU → 21 NTU) for home irrigation.

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## Professional Memberships

- **Graduate Engineer**, Board of Engineers Malaysia (**BEM**)
  - **Graduate Technologist**, Malaysia Board of Technologist (**MBOT**)
  - **Registered Engineer**, Council for the Regulation of Engineering in Nigeria (**COREN**)
  - **Graduate Member**, Institute of Civil Engineers (**GMICE**)
  - **Corporate Member**, Nigerian Institution of Agricultural Engineers (**MNIAE**)
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### Awards, Grants & Honors

- **Gold Award Winner**, MTE IIA, 24<sup>th</sup> Malaysia Technology Expo™ | 2025.
  - **GOT Award**, Universiti Teknologi PETRONAS | 2025.
  - **Winner**, PETRONAS CHESS Innovation Challenge (Circular Economy Category) | 2024.
  - **Graduate Research Assistant** - Water, Energy, and Carbon Dioxide from Carbon Capture and Storage (Water Treatment): A Life Cycle Assessment. Universiti Teknologi PETRONAS | 2023–2024.
  - **Graduate Research Assistant** - Natural Coagulants in Water Treatment (FGRS Grant). Universiti Teknologi PETRONAS | 2021–2023.
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### Languages & IT Proficiency

- **Languages:** English (Proficient), Hausa (Proficient).
  - **Software:** MATLAB, ArcGIS, AutoCAD, MS Office, Simapro, openLCA, Design Expert.
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### Referees

- Ts. Dr. Ho Yeek Chia (PhD Supervisor) | yeekchia.ho@utp.edu.my
- Prof. Farouk Mohammed K. (Academic Mentor) | mkfarouk@fukashere.edu.ng
- Engr. Dr. Babangida Nuraddeen M. (mentor) | nmbabangida.civ@buk.edu.ng