

Aayam Dhakal

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EDUCATION

Master of Science (MS) – Chemical Engineering

2025 - 2027

Cornell University | Ithaca, NY, USA

GPA: 4.28/4.30

- **Research Advisor:** Professor Shaoyi Jiang
- **Master's Thesis:** "Engineering Zwitterionic Hydrogel Platforms for Room-Temperature Extracellular Vesicle Preservation and Hematopoietic Stem Cell Expansion"

Bachelor of Engineering (BE) – Chemical Engineering

2019 - 2024

Pulchowk Campus, IOE, Tribhuvan University | Kathmandu, Nepal

Percentage: 78.61% (First Division)

- Ranked 3rd in the Chemical Engineering cohort.

RESEARCH EXPERIENCE

Graduate Researcher, Jiang Laboratory

August 2025 - Present

Cornell University | Ithaca, NY, USA

Thermoresponsive Zwitterionic Hydrogels for CD34+ HSPC Expansion

- Developing thermoresponsive PNIPAAm–poly(carboxybetaine)–PNIPAAm triblock copolymer hydrogels as an ultralow-fouling 3D platform for ex vivo expansion of umbilical cord blood-derived CD34+ hematopoietic stem and progenitor cells by tuning polymer composition, physical crosslinking density, stiffness, and viscoelasticity to maintain their primitive phenotype and minimize spontaneous differentiation.

Porous Zwitterionic Hydrogels for EV Preservation

- Engineering porous zwitterionic hydrogel matrices for extracellular vesicle enrichment and room-temperature preservation by investigating how pore architecture and transport behavior influence EV loading, recovery efficiency, structural integrity, and biological functionality.
- Demonstrated preservation of extracellular vesicle morphology for up to 17 days at room temperature and compared SBMA-based zwitterionic hydrogels with PEGDA controls, with the zwitterionic system achieving a higher EV recovery yield.

Research Assistant

December 2024 - August 2025

Kathmandu Institute of Applied Sciences | Lalitpur, Nepal

Research Project: Air Quality and Environmental Impact Assessment of Industrial Activities in South Asia

- Evaluated Combined, GENT, and MiniVol low-volume air samplers for PM_{2.5} and PM₁₀ collection and analyzed transboundary particulate pollution using MABI for black-carbon quantification.
- Integrated satellite observations with machine-learning models to estimate ground-level PM_{2.5} concentrations, achieving an R² of 0.87 and an RMSE of 5.2 µg/m³.

Undergraduate Researcher

May 2023 - March 2024

Pulchowk Campus, IOE, Tribhuvan University | Kathmandu, Nepal

- Developed a Feedforward Neural Network (FNN) model to optimize benzene–toluene distillation, simulating high-purity solvent recovery and separation processes integral to active pharmaceutical ingredient (API) and fine-chemical manufacturing; achieved a mean squared error (MSE) of 0.0028 and reduced modeled reboiler energy demand by 12 % while maintaining >90 mol % product purity.
- Developed a machine learning model using LightGBM and XGBoost to predict aqueous solubility of 9,600 drug-like compounds for formulation screening and pre-formulation design, achieving an R² of 0.91 and RMSE of 0.58 on validation data, supporting early identification of poorly soluble candidates in drug development.

PUBLICATIONS

Mahara, P., Paudel, Y., Chaudhary, P., Gaihre, S., **Dhakal, A.**, & Pandey, B. (2025). **Physio-chemical analysis of water from different altitudes of Kathmandu Valley, Nepal.** *International Journal of Energy and Water Resources*, 9, 583–596.

TEACHING & MENTORING EXPERIENCE

Teaching Assistant, BME 5750: Biomaterials and Drug Delivery in the Immune System

August 2026 - Present

Cornell University

Undergraduate Research Mentor

February 2026 - Present

Jiang Laboratory, Cornell University

- Mentor an undergraduate researcher in scientific literature review, experimental planning, laboratory procedures, data interpretation, and presentation of research findings.

Teaching Fellow, ENGR1 1165: Climate Change and You, the Engineer

August 2025 - May 2026

Cornell University

- Supported course instruction, evaluated student assignments, and provided feedback on topics related to climate change, energy systems, and engineering-based mitigation strategies.

Programming Workshop Instructor and Mentor

2023

Students' Society of Chemical Engineering, Pulchowk Campus

- Organized and instructed a five-day Python workshop for 80 students and led a five-day MATLAB workshop for 50 participants, strengthening programming and computational problem-solving skills for chemical engineering applications.

HONORS, AWARDS, LEADERSHIP & SERVICE

Honors and Academic Recognition

- Inducted into The **Honor Society of Phi Kappa Phi** in recognition of academic excellence as a top-performing graduate student at Cornell University, 2026.
- Received the **SSOChE Annual Award** for contributions to the advancement of chemical engineering as a member of the program's pioneer cohort and the first Executive President of SSOChE; presented by the Secretary, Ministry of Industry, Commerce and Supplies, Government of Nepal, 2024.
- Selected as a **top-performing student** for an academic visit to the Indian Institute of Technology Roorkee, where I engaged with faculty members and researchers and gained exposure to ongoing laboratory research, 2023.

Leadership and Service

President, Students' Society of Chemical Engineering (SSOChE)

2023 - 2024

Pulchowk Campus, IOE, Tribhuvan University

- Elected President of SSOChE and led its formal registration with the District Administration Office, serving as the society's first Executive President.
- Coordinated a national-level chemical engineering symposium and exhibition attended by approximately 1,000 participants, including academics, government officials, industry representatives, and journalists. Promoted awareness of the role of chemical engineers in the public and private sectors and advocated for greater professional representation.
- Organized a blood donation campaign at Pulchowk Campus in coordination with Jaycees Nepal and led the collection and distribution of winter clothing, food, financial assistance, and essential relief supplies to communities affected by the magnitude 6.4 Jajarkot earthquake on November 3, 2023.

PROFESSIONAL EXPERIENCE

Sahas Multipurpose Pvt. Ltd. | Kathmandu, Nepal

August 2024 - August 2025

Quality Assurance and Quality Control Manager

- Led water quality management by developing and implementing protocols for local distribution and international export, ensuring full compliance with PRP, OPRP, and HACCP standards while reducing non-conformities during internal audits by 25 % and facilitating an export agreement with a UAE distributor for 10,000 liters of bottled water per month.
- Conducted monthly QA audits to uphold water quality standards and streamlined logistics and order management with distribution teams, improving on-time delivery performance by 15 %.

First Choice Food Pvt. Ltd. | Rupandehi, Nepal

May 2024 - July 2024

Production Engineering Intern

- Implemented process improvements in fryer operation and CIP scheduling, reducing off-spec production by 5% and increasing yield by approximately 3% through tighter process control and analysis of temperature fluctuations and downtime.

Varun Beverage Limited | Kathmandu, Nepal

October 2023 - December 2023

QA Engineering Intern

- Captured and analyzed daily production data to identify and correct adverse variations, establishing an in-line reporting system that reduced response time to equipment failures and breakages by 21 %.
- Conducted specialized quality assurance tests, including secure seal (closure seal test machine), drop (1.8m cylindrical pipe), burst (burst tester), brim-full (weighing balance), stress crack (NaOH tray), brix (refractometer), gas volume (Zahm and Nagel machine), height (height gauge), and torque measurements, ensuring compliance with PAP chart standards and product guidelines, while delivering timely reports on test deviations to senior management to facilitate rapid corrective actions and maintaining quality benchmarks.
- Gained experience in plant operations, closely monitoring ammonia-based cooling systems, precise syrup formulations, and product manufacturing processes to maintain process integrity.

PROFESSIONAL LICENSURE

Registered Chemical Engineer, Nepal Engineering Council | Registration No. 87036

TECHNICAL SKILLS

- Biomaterials:** Polymer synthesis (ATRP, RAFT, photopolymerization), lyophilization
- Cell Culture:** 2D and 3D cell culture
- Characterization:** NMR, Rheology, GPC, SEM, DLS, NTA, LC–MS
- Programming & Modeling:** Python (NumPy, pandas, Matplotlib, scikit-learn, TensorFlow, and PyTorch), MATLAB, and C
- Chemical Drawing:** ChemDraw
- Process Simulation & Plant Design:** Aspen Plus, DWSIM, AutoCAD Plant 3D