Ananay Khandelwal

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Education

The Pennsylvania State University, College of Engineering — University Park, PA
Bachelor of Science, Chemical Engineering — *Aug 2022 – Dec 2026*

- **Dean's List:** Spring 2026, Spring 2025 | **Coursework:** Thermodynamics, Transport Phenomena, Reaction Engineering, Process Control, Separations, Process Design & Economics

Technical Skills

Process Engineering: Aspen Plus (simulation, distillation, unit ops, sensitivity analysis), DWSIM, MATLAB, Mathematica, Process Safety, Process Economics
Programming & Data: Python (Pandas, NumPy, scikit-learn, Matplotlib), Excel (PivotTables, Solver, regression)
Pharma & Quality: GMP Documentation, SOP Authoring, QA/QC, Batch Record Review, Technology Transfer, Regulatory Compliance

Experience

Undergraduate Research Assistant — Data Science (Protein Modeling) — Sep 2025 – Present
The Pennsylvania State University — *University Park, PA*

- Raised mutation-effect prediction from **Spearman ρ 0.43 to 0.67** by benchmarking 5 protein embedding strategies over **ESM2**, predicting Km and kcat for human acetylcholinesterase point mutants from curated SABIO-RK kinetics.
- Implemented the featurization, training, and evaluation stack in **Python** (scikit-learn), comparing kernel-based similarity metrics over ESM2 embeddings and selecting the final model on held-out validation splits.

R&D Process Engineering Intern — May 2025 – Aug 2025
Aavis Pharmaceuticals — *Atlanta, GA*

- Cut projected utility consumption **10%** by modeling the process-air system serving granulation and coating in **Aspen Plus** (compression, heating, stream mixing), mapping temperature, pressure, and flow across 5 scenarios for lab-to-pilot scale-up.
- **Raised batch yield 11%** and reduced yield variability by isolating 4 root causes of yield and particle-size deviation across 50+ formulation runs and 8 product types in **Excel** using regression and PivotTables.
- Supported a **completed technology transfer** to pilot scale by authoring 5 **GMP**-compliant SOPs and technical reports consolidating simulation outputs with experimental results into audit-ready documentation.

Manufacturing & Quality Analytics Intern — June 2024 – Aug 2024
Ratnatris Pharmaceuticals — *Ahmedabad, India*

- Cut batch rejection rate **15%** by flagging 10+ deviations through batch-record review and driving root-cause investigations and corrective actions alongside the production team.
- Ran 20+ in-process and final-product **QA/QC** checks across 5 product lines, building structured **Excel** batch-record logs enabling full traceability, SPC trend monitoring, and audit readiness.

Projects

AI-Driven Process Simulation: Claude–DWSIM MCP Server | *DWSIM, MCP, Python* — State College, PA

- **Cut design iteration from minutes to seconds** by building an MCP server over DWSIM's .NET API with **26 structured tools**, letting a language model build flowsheets and run the solver; validated on a **46-unit maleic anhydride plant** at 80% conversion.
- Diagnosed a silent thermodynamic failure where **Peng-Robinson converged to a physically wrong answer** (activity coefficient ∼100 for water/heavy-alkane); switched separations to UNIQUAC, cutting water carryover 4.8 to 0.7 mol/s.

Batch Reactor Design & Process Safety Analysis | *Python, Reaction Kinetics, MTSR* — University Park, PA

- Designed a 50 kg/batch paracetamol reactor process, sizing a **310 L vessel** at 75% fill from stoichiometry and mass balances, modeling second-order kinetics to a 92.6-min cycle supporting 257,000 kg/yr.
- Ran a cooling-failure **runaway reaction analysis (MTSR)**, finding an 11.3°C adiabatic rise pushed the batch past its boiling point; redesigned charging to semi-batch dosing at 29.2 mol/min, closing MTSR to a 95°C target with 2.1x headroom.

Crude Oil Heat Exchanger Fouling Case Study | *Python, TEMA, Techno-Economic Analysis* — University Park, PA

- Quantified a **28% loss of recoverable duty** (roughly 20 MW) across a **15-exchanger crude preheat train** by modeling how TEMA fouling factors cut the overall heat-transfer coefficient from 485 to 350 W/m^2K.
- Translated that loss into $**2.7M/yr** of excess furnace fuel and 40,000 tonne/yr of avoidable CO_2, then modeled CapEx/ROI for an $800K mitigation program cutting ∼15,000 tonne/yr.

Leadership & Activities

Research Assistant — Jan 2023 – May 2023
Plant Village (Prof. David Hughes Lab) — *University Park, PA*

- Annotated 1,000+ plant-disease images training deep learning models for automated crop disease detection, contributing 150+ hours to a published agricultural ML dataset.