Angel Paul Tenezaca Solano

Chemical Engineer • Processes • Research • Data • Applied AI

Loja, Ecuador

Executive Profile

Chemical Engineer with a multidisciplinary background and experience in applied and computational research, process modeling and simulation, water treatment, chemical data analysis, and the development of PFD/P&ID technical documentation. Experienced in the technical evaluation and validation of AI systems, experimental analysis, quality control and assurance, and the development of digital solutions for education and science communication. Proficient in Python, Aspen Plus, AutoCAD, and Excel for engineering problem-solving, data processing, and decision-making support.

Processes | Research | PTAR / PFD-P&ID | Data & Python | Applied AI | Digital Product | STEM Tutoring

Education and Recognition

Chemical Engineering — UTPL
2021-2026
Loja, Ecuador

Scientific Publication — First Author

Oxygen-Vacancy-Induced Electronic Structure Modulation in $ZnTiO_3$ Perovskite

International Journal of Molecular Sciences, 2026.

Certificates and Professional Development

- **CEDIA Fondo AVANTE No. 13** — Biosynthesis of gold nanoparticles using plant extracts and UV-Visible characterization.
- **Practical Distillation Workshops — UTPL** — equipment operation, separation principles, and technical documentation.
- **Academic Seminar on Mine Tailings — UTPL / AIDA, 2026** — appropriate risk management in Latin America.

01

PROFIL

Areas of Expertise and Professional Focus

1 Computational Research and Scientific Writing

Electronic modeling, materials simulation, results analysis, and quantitatively supported technical writing.

2 Process and Reactor Engineering

Material and energy balances, thermal auditing, kinetic modeling, and reactor configuration selection.

3 WWTP, Documentation and Instrumentation

Process-line reconstruction, PFD/P&ID development, equipment and instrument identification, and safety analysis.

4 Chemical Data, Python and AI Auditing

Dataset preparation, RDKit/SMILES workflows, quantitative checks, and reproducible STEM benchmarks.

5 Scientific Digital Product

Branding, content architecture, HTML/CSS/JS, WordPress/WPCode, SEO, and interactive resources.

6 STEM Tutoring and Technical Materials

Problem design, reference solutions, didactic diagrams, and a verification-based teaching methodology.

Computational Research and Scientific Article on $ZnTiO_3$

OBJECTIVE

Investigate the structural, electronic, and photovoltaic behavior of $ZnTiO_3$ with oxygen vacancies and translate the findings into a technically substantiated scientific paper.

MY CONTRIBUTION

Conducted DFT modeling and computational post-processing, analyzed output files, reconstructed the band structure and density of states, estimated electron affinity and permittivity, and developed the manuscript's technical discussion.

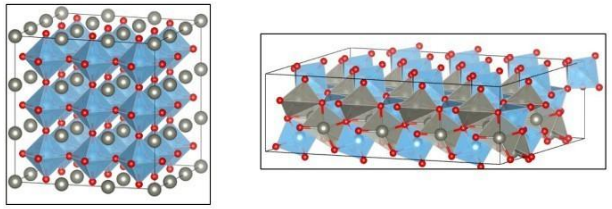
RESULTS

The study showed that oxygen vacancies significantly modify the electronic structure of $ZnTiO_3$. The band gap decreased from 2.957 to 1.475 eV, while electron affinity was estimated at 3.770 eV and static permittivity at 10.5 ± 2.0. Overall, these results indicate that oxygen defects can tune the material's electronic and optical properties and promote characteristics relevant to photovoltaic-device integration. The main conclusion was that vacancy control is a viable strategy for modulating $ZnTiO_3$ and expanding its potential as a functional material for solar applications.

SKILLS DEVELOPED

Scientific modeling; DFT results analysis; Python post-processing; materials interpretation; scientific writing.

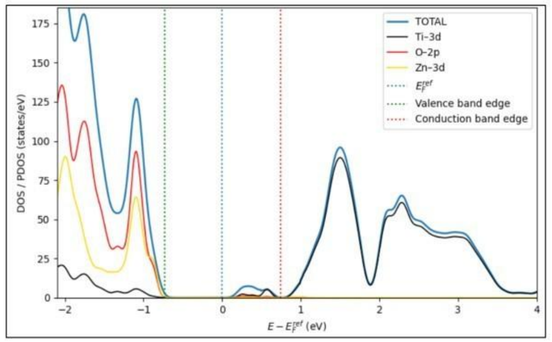
Results



Nota. A la izquierda se muestra la supercelda cúbica y a la derecha, la hexagonal; ambas

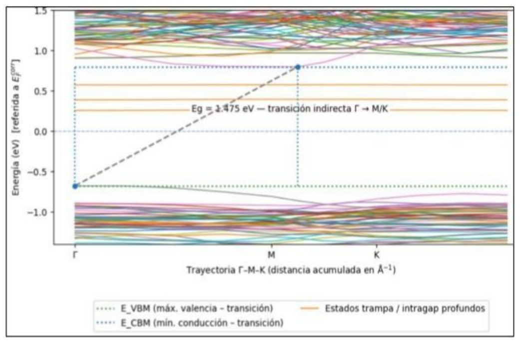
Evaluated supercells; structural basis.

Proyección de orbitales atómicos del $ZnTiO_3$



DOS and orbital projection; main electronic analysis.

Estructura de bandas del $ZnTiO_3$



Band structure; indirect band gap.

Cited Parameters

2.957 → 1.475 eV
Band-gap Reduction

3.770 eV
Electron Affinity

10.5 ± 2.0
Static Permittivity

1D Simulation with SCAPS-1D

OBJECTIVE

Translate the properties of the modeled material into a theoretical solar cell and evaluate its photovoltaic behavior based on performance criteria and physical limitations.

MY CONTRIBUTION

Designed the cell architecture, adjusted optical and electronic parameters, evaluated sensitivity to absorber thickness, and reviewed the effects of traps and donor states on device response.

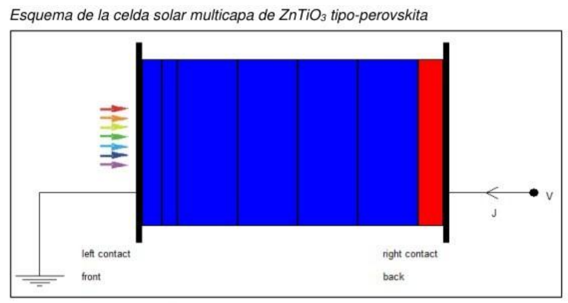
RESULTS

The simulation achieved a maximum efficiency of approximately 7.65%, while absorption remained around 26% for a 300 nm absorber thickness. Sensitivity analysis showed that material thickness is one of the device's main limitations: approximately 2300 nm was estimated to reach 90% absorption and 4600 nm for 99%. These results indicate that photovoltaic performance depends not only on the electronic properties of $ZnTiO_3$, but also on adequate geometric optimization of the absorber to maximize radiation capture and improve the cell's overall response.

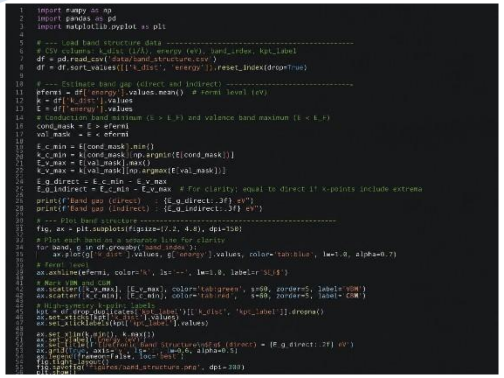
SKILLS DEVELOPED

SCAPS-1D; device modeling; sensitivity analysis; photovoltaic performance interpretation.

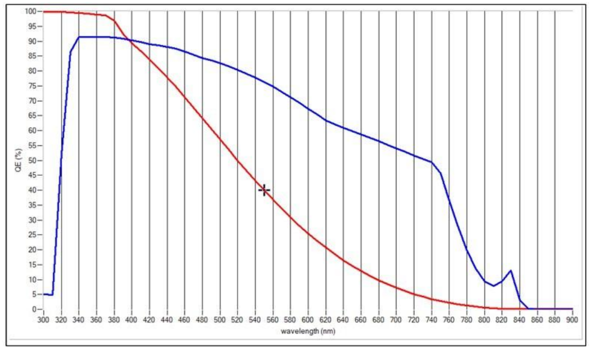
Results



Modeled Cell Architecture



Code developed in Python.



EQE vs. thickness; absorber limitation.

Cited Parameters

≈7.65%
Peak Efficiency

≈26%
Absorption at 300

≈2300 / 4600 nm
90% / 99% Absorption

04 Experimental Photocatalysis and Preparation of Functional

EXPERIMENTAL WORK

OBJECTIVE

Evaluate photocatalytic processes and convert experimental evidence into traceable, comparable, and technically interpretable results.

MY CONTRIBUTION

Worked on sample preparation, irradiation, UV-Vis monitoring, kinetic fitting, and mechanistic discussion; I also integrated sol-gel preparation as experimental support for the research line.

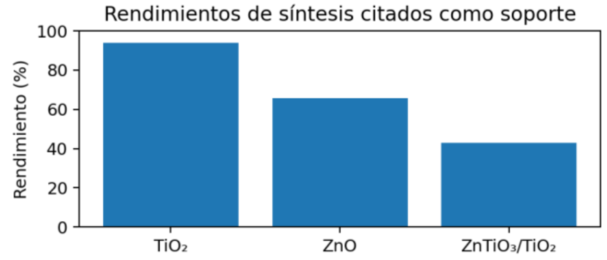
RESULTS

Experimental monitoring through UV-Vis spectra enabled comparative degradation curves and kinetic fits to evaluate the photocatalytic behavior of the synthesized materials. Sol-gel synthesis achieved yields of 93.86% for TiO_2, 65.69% for ZnO, and 42.88% for $ZnTiO_3/TiO_2$. The results linked material preparation and composition to photocatalytic response and supported interpretation of the degradation process through experimental evidence and kinetic analysis.

SKILLS DEVELOPED

Experimental work; UV-Vis monitoring; kinetic analysis; comparative interpretation; technical writing.

Results

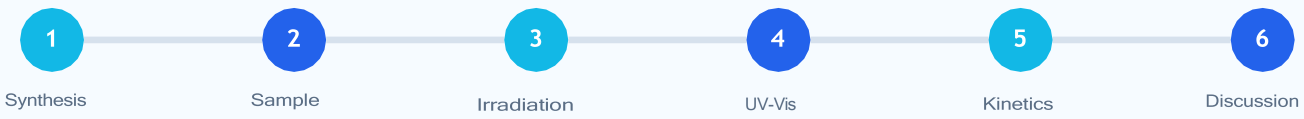


Synthesis yields; experimental support.

Experimental Results

- Cleaned UV-Vis datasets
- Comparative degradation curves
- Kinetic fits
- Supported mechanistic discussion

Experimental Workflow



This diagram summarizes the complete workflow from sample preparation to result interpretation.

05

Loja WWTP:
process, PFD/P&ID and operational safety

WATER & INSTRUMENTATION

OBJECTIVE

Document the operation of the Loja WWTP across process, instrumentation, monitoring, and safety.

MY CONTRIBUTION

Reconstructed the process line, worked with PFD/P&ID, identified equipment and instruments, reviewed water-quality variables, and analyzed noise as well as mechanical and electrical risks associated with operation.

RESULTS AND RATIONALE

Structured technical documentation of the wastewater treatment process was produced through process diagrams, PFDs, and P&IDs, integrating operating stages, equipment, flow lines, instrumentation, and monitoring points. The analysis identified critical operating variables, established the functional location of instruments, and recognized key points for process control and safety, complemented by laboratory-analysis support for monitoring water-quality parameters. This strengthened technical traceability and the overall understanding of plant operation.

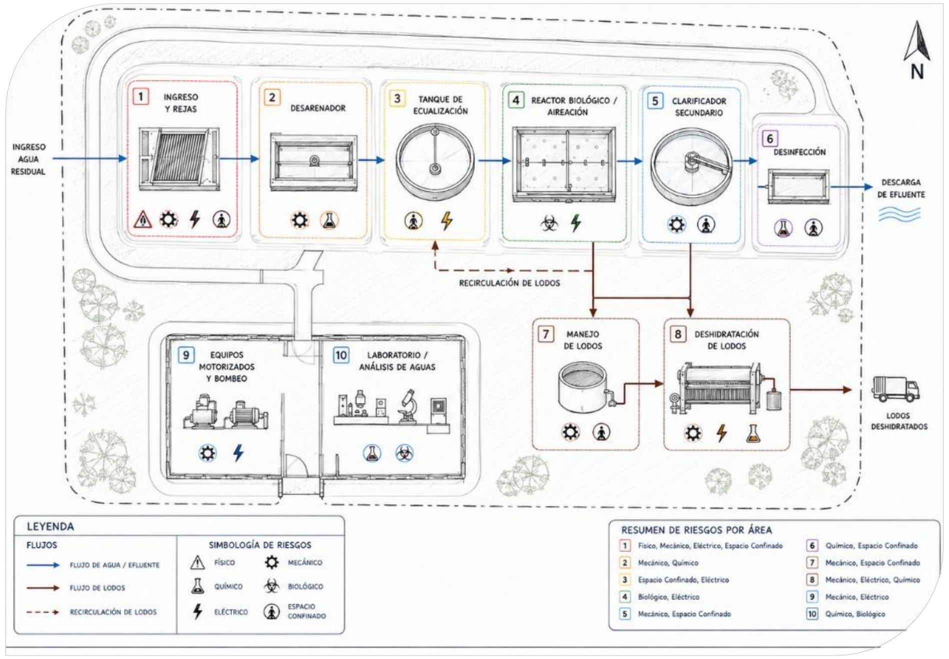
SKILLS DEVELOPED

Water treatment; technical documentation; instrumentation; monitoring; industrial safety.

Results

Process Line

Inlet → Pretr. → Bio. → Clarif. → RAS/WAS → UV → Outlet



Water Analysis

Determination of pH, COD, BOD₅, TSS, and other water-quality parameters.

Monitoring

pH • cond. • turbidity • organics • metals • hardness

Safety

noise • mechanical/electrical • operating conditions

Evaluation of AI and STEM Benchmark Design

OBJECTIVE

Evaluate whether an AI system reasons correctly in chemical engineering problems, beyond producing convincing text.

MY CONTRIBUTION

Designed benchmark cases and reference answers; applied checks for units, order of magnitude, physical constraints, and independent verification with Python.

RESULTS

A reproducible system for technically evaluating AI-generated responses was established using benchmarks, ground-truth definitions, *consistency* checks, and documented feedback. This approach enabled magnitude errors to be detected, assumptions to be validated, results to be compared with reliable references, and review criteria to be standardized. As a representative case, a 4.5 GW energy estimate was identified as incompatible with the process scale; independent verification placed the requirement in the kW range. The main result was an evaluation workflow capable of improving the traceability, reliability, and technical quality of AI responses.

SKILLS DEVELOPED

AI auditing; benchmark design; Python; error analysis; physical reasoning.

Results

Evaluation System Workflow

1. Benchmark
2. Ground truth
3. Checks
4. Physics
5. Python
6. Feedback

System Results

Benchmarks	Reproducible STEM cases
Reference Answers	Ground truth
Unit / magnitude / constraint checks	
Structured Feedback	error + cause + fix

Notes

Kinetics, Balances and QSSA
Benchmark Coverage

Multiple STEM domains covered.

4.5 GW vs kW
Secondary Example

Representative activity within the technical-audit workflow.

07

Process Modeling and Reactor Design

SIMULATION & VALIDATION

OBJECTIVE

Solve and audit process-design problems by combining simulation, balances, kinetics, and engineering physical constraints.

MY CONTRIBUTION

Modeled thermal cases, compared CSTR/PFR designs, and worked with multiple Van de Vusse reactions to reinforce balance and design practice.

RESULTS

The analysis evaluated the thermal and design behavior of different process systems by comparing magnitudes, reactor configurations, and opportunities for energy improvement. These evaluations identified relevant performance differences, sizing criteria, and potential optimization strategies by integrating energy-balance principles, reactor design, and result validation. The results provided a technical basis for comparing alternatives, detecting inconsistencies, and guiding improvements based on efficiency, feasibility, and physical consistency.

SKILLS DEVELOPED

Aspen Plus; material and energy balances; reactor design; kinetic modeling; cross-validation.

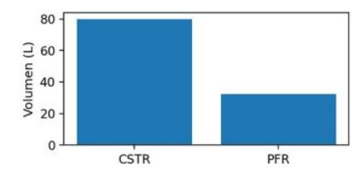
Results

Thermal Audit

~25.4 kW

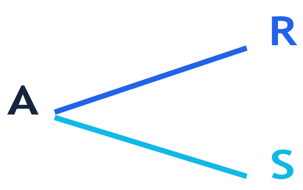
-16.6% target

Reactor Design



CSTR 80 L vs. PFR 32.19 L; comparative reactor sizing.

Multiple Reactions



Van de Vusse reaction networks; broaden the project coverage.

Cited Parameters

~25.4 kW

Thermal Balance

Consistent-scale therma l audit.

80 vs 32.19 L

CSTR / PFR

Same problem, two reactor configurations.

-59.8%

Relative Reduction

PFR volumetric advantage.

Multiple Cases

Coverage

Multiple exercises, not a single case.

08 Cheminformatics and Data Preparation for ML

OBJECTIVE

Convert unstructured molecular information into consistent, traceable, and reusable chemical data for computational analysis and downstream machine-learning workflows.

MY CONTRIBUTION

Worked with .mol files, programmatic reading in RDKit, conversion to SMILES, organization in CSV, and cleaning of parsing and encoding errors.

RESULTS

An automated preprocessing pipeline was developed for data preparation, cleaning, and transformation, aimed at ensuring consistency before subsequent analysis or modeling stages. The process enabled inconsistencies to be identified and corrected, structures to be standardized, and input-data quality to be validated, reducing manual intervention and improving workflow reproducibility. The result was a more consistent and traceable dataset together with a reproducible preparation process that reduces errors and strengthens the reliability of subsequent analyses.

SKILLS DEVELOPED

Python; RDKit; SMILES; cleaning and normalization; debugging; reproducible dataset preparation.

Results

Chemical Data Pipeline

1. .mol
2. RDKit
3. SMILES
4. CSV
5. ML-ready

Preparation Controls

- structural
- representation
- normalization
- error cleaning

Highlighted

RDKit + Python
Technologies

SMILES / CSV
Representation

No ML Metrics Clarification

Ciencia Esencial: Brand, Digital Product & Science Communication

OBJECTIVE

Design and deploy from scratch a science-communication platform integrating technical content, interactive tools, a distinctive identity, and an architecture prepared for growth and monetization.

MY CONTRIBUTION

Defined the domain, brand, information architecture, and editorial structure; developed modules with WordPress, WPCode, HTML, CSS, and JavaScript; organized Posts, Calculators, and Resources; integrated SEO, privacy/cookies, and AdSense readiness.

RESULTS

A digital science-communication platform was established with a defined identity and content architecture. Technical content, interactive tools, editorial structure, and coherent navigation were integrated into a single product. This provided a scalable foundation for scientific communication and educational resources, with direct involvement in its design and implementation.

SKILLS DEVELOPED

Product ownership; educational UX; scientific front-end; SEO; branding; instructional-tool design.

Results

CIENCIA
ESENCIAL

Official project visual identity.

Mission and Approach

Mission: explain science and engineering with clarity and rigor.

Vision: build an independent, scalable scientific platform focused on educational

Slogan: “Where light ends, knowledge continues.”

Product Architecture

1. Content
2. Calculators
3. Resources

Technologies and Features

WordPress · WPCode · HTML · CSS · JavaScript · SEO · cookies / privacy · Scientific UX

STEM Tutoring and Technical Material Development

OBJECTIVE

Transform complex university-level problems into clear, verifiable learning experiences tailored to each student's specific difficulty.

MY CONTRIBUTION

Developed tutoring and materials in kinetics, thermodynamics, balances, mass transfer, and plant design; prepared original problems, reference solutions, step-by-step explanations, corrective feedback, and visual resources.

RESULTS AND RATIONALE

The learning strategy made it possible to identify recurring errors more quickly, reinforce the concepts that caused the greatest difficulty, and progressively guide practice toward more independent problem-solving. Combining explanation, practice, and feedback supported stronger conceptual understanding and a greater ability to verify one's own results. Based on this experience, a reusable bank of problems, solutions, and resources was structured to preserve and replicate the strategies that proved most useful throughout the learning process.

SKILLS DEVELOPED

University tutoring; instructional design; technical writing; problem-solving; scientific visualization; pedagogical adaptation.

Results

Areas and Types of Content Covered

1. Kinetics
2. Thermodynamics
3. Balances
4. Mass Transfer
5. Plant Design
6. Reactor Engineering
7. Automatic Control
8. Calculus
9. Linear Algebra

Material Types

- original problems
- reference solutions
- step-by-step guides
- visual resources

Tutoring Method

1. **Diagnose** identify the exact point of failure
2. **Explain** rebuild the key concept
3. **Solve** develop the solution
4. **Verify** confirm through an independent method