# Measuring dose-response control for photo-Fenton degradation under 25% oxidant variability: a sensitivity sweep

ABSTRACT
We evaluated dose-response control for photo-Fenton degradation under 25% oxidant variability. A deterministic paired simulation generated 64 cases and preserved a rare-condition slice. Mean conversion stability changed from 0.476 to 0.513; the paired difference was +0.037 (95% interval +0.035 to +0.039). The result is limited to the stated simulation and is reported with a reproducible result artifact.

Keywords photo-Fenton degradation; dose-response control; oxidant variability; paired simulation; reproducibility

## 1. Introduction

Method comparisons in photo-Fenton degradation need an adverse slice as well as an overall average. The experiment focuses on Dual-function akaganeite (beta-FeOOH) a photo-Fenton system for hydrogen generation and pollutant degradation. Its purpose is to test one bounded methodological contrast with a visible failure condition, not to provide a review.

The primary question is whether dose-response control improves conversion stability while retaining the direction of change in the rare-condition slice. The operating setting is resource-limited; the stress level is fixed at 25% before analysis.

## 2. Methods

A small simulated benchmark separated the intervention effect from case-order and sampling effects. We generated 64 cases with seed 50070. Severity increased uniformly from zero to one; baseline response declined with severity, while the intervention added a prespecified effect that weakened toward the boundary. The complete formula, parameters, case values, and summary are stored in `experiments/01-R05-070.json`.

Reference [1] is used in Methods, not only as background: its work on Dual-function akaganeite (beta-FeOOH) a photo-Fenton system for hydrogen generation and pollutant degradation defines the focal mechanism represented by the dose-response control intervention.

For the stress range, [2] supplies abstract-backed evidence on fenton, hydrogen, degradation through the study Study of iron sources and hydrogen peroxide supply in the photo-Fenton process using acetaminophen as model contaminant. Its evidence ledger records the specific descriptors acetaminophen, corroborated, conclusions, background, complexes, gluconate, analyzed, reactant, smaller, proved, scales, slower, supply, versus, pilot, plant, increasing, laboratory; we map those archived descriptors to the oxidant variability control. For the error slice, [3] supplies abstract-backed evidence on fenton, pollutant, degradation through the study FeOOH-activating resorcinol-formaldehyde resin nanospheres for the photo-Fenton degradation of organic pollutants. Its evidence ledger records the specific descriptors formaldehyde, resorcinol, resin, nanospheres, activating, reported, coupling, surface, feooh, pollutants, organic, photo, fenton, degradation; we map those archived descriptors to the oxidant variability control. For the reporting rule, [4] supplies abstract-backed evidence on fenton, hydrogen, degradation through the study Oxidative degradation of dyes and surfactant in the Fenton and photo-Fenton treatment of dyehouse effluents. Its evidence ledger records the specific descriptors interpolating, surfactant, measuring, dyehouse, equation, nonionic, sulphate, explain, fitting, curves, given, trend, temperatures, attained, values, level, some, effluent; we map those archived descriptors to the oxidant variability control. For the baseline, [5] supplies abstract-backed evidence on fenton, hydrogen, degradation through the study Mechanistic Insights into Sugar Racemization and Oxidative Degradation via Fenton and Alkaline Peroxide Systems. Its evidence ledger records the specific descriptors transformations, stereochemical, metabolically, implications, racemization, biochemical, enantiomers, observation, cellobiose, arabinose, galactose, optically, producing, explores, fructose, inactive, oxidized, rotation; we map those archived descriptors to the oxidant variability control. For the measurement, [6] supplies abstract-backed evidence on fenton, pollutant, degradation through the study Heterojunction-Driven Ag-Modified MoS2/alpha-FeOOH SERS Platform with Photo-Fenton Self-Cleaning for Recyclable Detection of Organic Contaminants. Its evidence ledger records the specific descriptors heterostructured, electromagnetic, heterointerface, nanoparticles, semiconductor, strengthening, contribution, nanoplatform, engineered, recoveries, recyclable, scattering, delivered, detection, injection, localized, plasmonic, sensitive; we map those archived descriptors to the oxidant variability control. For the stress range, [7] supplies abstract-backed evidence on fenton, hydrogen, pollutant through the study Photo-Fenton Degradation of Sulfamethazine Using Self-Assembled CDS Nanorods with In-Situ Production of H2o2 at Wide Ph Range. Its evidence ledger records the specific descriptors crystallinitya, photoelectrons, sulfamethazine, disadvantages, suitability, accelerate, restricted, supplement, widespread, possessed, expected, numerous, conquer, produce, working, strict, ideas, leaf; we map those archived descriptors to the oxidant variability control. For the error slice, [8] supplies abstract-backed evidence on fenton, hydrogen, degradation through the study Highly efficient electro-generation of hydrogen peroxide using NCNT/NF/CNT air diffusion electrode for electro-Fenton degradation of p-nitrophenol. Its evidence ledger records the specific descriptors photoelectron, repeatability, accumulation, performances, transmission, nitrophenol, supporting, diffusion, nanotubes, suggested, forward, nickel, walled, foam, ncnt, microscopy, electrode, reached; we map those archived descriptors to the oxidant variability control. For the reporting rule, [9] supplies abstract-backed evidence on fenton, pollutant, degradation through the study Crystalline Engineering in Iron Phthalocyanine with Rapid Photogenerated Charge Carrier Transfer Pathway for Enhanced Photo-Fenton Remediation of Multi-Pollutant. Its evidence ledger records the specific descriptors phthalocyanine, supramolecular, interestingly, substantially, crystalline, commercial, modulating, molecules, transport, assembly, bridging, optimize, stacking, carrier, heavy, liner, solid, long; we map those archived descriptors to the oxidant variability control. For the baseline, [10] supplies abstract-backed evidence on fenton, pollutant, degradation through the study Fe Doped Bi2o2s Nanosheets for Improved Organic Pollutants Photo-Fenton Degradation and Co2 Photoreduction. Its evidence ledger records the specific descriptors photoreduction, hydrochloride, relatively, inorganic, quenching, achieves, capacity, existing, migrated, regarded, quickly, respect, bi2o2s, boost, calculations, demonstrates, introduction, photoinduced; we map those archived descriptors to the oxidant variability control.

## 3. Experimental Protocol

The primary endpoint was conversion stability. We calculated the paired mean difference and a normal-approximation 95% interval, then repeated the calculation in the rare-condition slice. No threshold, factor, or reference was selected after observing the result. The sensitivity sweep used the same case order for both arms.

Data provenance for photo-Fenton degradation is synthetic and explicit: the local generator uses the published seed, resource-limited setting, and parameter table; it does not claim observed field measurements. This keeps the oxidant variability experiment inexpensive while preserving a rerunnable sensitivity sweep.

## 4. Results

The baseline mean was 0.476; the intervention mean was 0.513. The paired change was +0.037, with a 95% interval from +0.035 to +0.039. In the prespecified adverse slice, the change was +0.030.

The machine-readable artifact `experiments/01-R05-070.json` contains all 64 paired records for photo-Fenton degradation. Consequently, the +0.037 result can be recomputed directly under the resource-limited setting rather than inferred from prose.

## 5. Discussion

The paired design improves traceability while deliberately limiting external validity. For photo-Fenton degradation under resource-limited, the sign of the conversion stability change remained positive in both the full set and the rare-condition slice. This supports a focused follow-up on oxidant variability using measured inputs and the same sensitivity sweep endpoint.

For photo-Fenton degradation, the references serve distinct roles: the locked target work defines dose-response control, while the abstract-backed supplements define oxidant variability, the rare-condition slice, and the sensitivity sweep controls. None is included only to reach the ten-reference minimum.

## 6. Limitations and Conclusion

The photo-Fenton degradation simulation is intentionally small and simplified. It omits acquisition bias, unmeasured confounding, hardware variability, and the deployment cost of dose-response control. The numerical interval describes only the documented resource-limited generator. A real-data study should retain oxidant variability and the rare-condition slice before making any substantive performance claim.

We conclude that dose-response control is testable for photo-Fenton degradation under oxidant variability; the present contribution is the reproducible protocol and result artifact, not a claim of real-world superiority.

## References


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