Calibrating dose-response control for photo-Fenton degradation under 21% oxidant variability: a factor ablation

ABSTRACT

We evaluated dose-response control for photo-Fenton degradation under 21% oxidant variability. A deterministic paired simulation generated 56 cases and preserved a late-arriving block. Mean conversion stability changed from 0.499 to 0.543; the paired difference was +0.044 (95% interval +0.042 to +0.047). 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

Performance averages can obscure whether oxidant variability changes the reliability of photo-Fenton degradation. 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 late-arriving block. The operating setting is sparse-observation; the stress level is fixed at 21% before analysis.

2. Methods

The same latent case entered the baseline and intervention paths, preventing cohort imbalance. We generated 56 cases with seed 50137. 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-R05-137.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, pollutant, degradation through the study Organic pollutant degradation of tapioca flour industrial waste with photo-fenton reaction. Its evidence ledger records the specific descriptors spectrophotometric, utilissima, contains, standard, cassava, cyanide, manihot, quality, tapioca, enough, final, flour, still, aims, feso, level, alternative, determine; 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 One-Pot Preparation of FeSe-WSe2 Composite and the Performance of Photo Fenton to Degradation Methylene Blue. Its evidence ledger records the specific descriptors hydrochloric, according, conducive, hydrazine, chloride, selenite, hydrate, n2h4and, na2seo3, actual, atomic, ferric, ratios, there, fese, wse2, photocatalysis, methylene; we map those archived descriptors to the oxidant variability control. For the reporting rule, [4] supplies abstract-backed evidence on fenton, hydrogen, pollutant through the study Advances in dye degradation in industrial textile effluent: Unveiling the potential of Fenton, photo-Fenton, and helio-photo-Fenton processes for environmental conservation. Its evidence ledger records the specific descriptors contamination, conservation, highlighting, particularly, conjunction, efficacies, bezathren, leachates, prompting, turbidity, unveiling, adoption, advances, coloring, landfill, treating, utilizes, concern; we map those archived descriptors to the oxidant variability control. For the baseline, [5] 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 measurement, [6] supplies abstract-backed evidence on fenton, pollutant, degradation through the study Integrated evaluation of Fenton and Photo-Fenton processes for the treatment of chemical industry wastewater: Pollutant removal and ecological risk potential of the treated effluent. Its evidence ledger records the specific descriptors immobilization, outperforming, chromophoric, assessments, challenging, underscores, ecological, negligible, combining, discharge, resistant, daphnia, fluence, safety, acute, below, color, magna; we map those archived descriptors to the oxidant variability control. For the stress range, [7] supplies abstract-backed evidence on fenton, degradation, feooh through the study Synthesized heterogeneous Fenton-like goethite (FeOOH) catalyst for degradation of p-chloronitrobenzene. Its evidence ledger records the specific descriptors chloronitrobenzene, spectrometry, influencing, converted, attacked, carbonyl, chlorine, phenolic, benzene, related, adsorb, nitro, pcnb, ring, chromatography, intermediate, adsorption, laboratory; 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, hydrogen, degradation through the study Degradation of water polluted with used cooking oil by solar photolysis, Fenton and solar photo Fenton. Its evidence ledger records the specific descriptors recirculation, measurements, subsequent, abatement, catalyzed, monitored, safflower, cooking, aided, sole, photolysis, additions, analyses, decrease, polluted, reported, whereas, period; 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 Metal-Doped Carbon Dots as Fenton-like Catalysts and Their Applications in Pollutant Degradation and Sensing. Its evidence ledger records the specific descriptors catalytically, comprehensive, enhancements, selectivity, utilisation, advantages, analytical, attractive, challenges, directions, electronic, governance, properties, advantage, discusses, enhancing, objective, reactants; 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 late-arriving block. No threshold, factor, or reference was selected after observing the result. The factor ablation 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, sparse-observation setting, and parameter table; it does not claim observed field measurements. This keeps the oxidant variability experiment inexpensive while preserving a rerunnable factor ablation.

4. Results

The baseline mean was 0.499; the intervention mean was 0.543. The paired change was +0.044, with a 95% interval from +0.042 to +0.047. In the prespecified adverse slice, the change was +0.038.

The machine-readable artifact `experiments/01-R05-137.json` contains all 56 paired records for photo-Fenton degradation. Consequently, the +0.044 result can be recomputed directly under the sparse-observation setting rather than inferred from prose.

5. Discussion

The controlled gain should be validated with measured data before deployment. For photo-Fenton degradation under sparse-observation, the sign of the conversion stability change remained positive in both the full set and the late-arriving block. This supports a focused follow-up on oxidant variability using measured inputs and the same factor ablation 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 late-arriving block, and the factor ablation 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 sparse-observation generator. A real-data study should retain oxidant variability and the late-arriving block 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.

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