

Summary of Major Changes

Enhancing Nitrate Removal in Denitrifying Woodchip Bioreactors

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Overview

This document summarizes the major changes made to the manuscript "Enhancing Nitrate Removal in Denitrifying Woodchip Bioreactors: A Comprehensive Analysis of Enhancement Strategies and Environmental Trade-offs" in response to reviewer feedback and to strengthen the scientific contribution.

1 Structural and Content Changes

1.1 New Sections Added

- **Highlights Section:** Added journal-required highlights summarizing key findings in 5 bullet points
- **Enhanced Methodology:** Expanded systematic review methodology with clear selection criteria and data analysis approaches
- **Economic Analysis:** New dedicated section analyzing cost-effectiveness across enhancement strategies (\$10.56-86/kg N removed)

1.2 Major Content Revisions

1.2.1 Abstract

- Completely rewritten for clarity and impact
- Added quantitative performance metrics (5.1-8.6 g N/m³/day for carbon dosing, 12.8-15.2 g N/m³/day for alternative media)
- Included temperature sensitivity ranges ($Q_{10} = 1.8-3.0$)
- Added cost-effectiveness data

1.2.2 Introduction

- Enhanced literature context with proper citations throughout
- Added quantitative flow rate ranges (0.1 to 10 times design flow)
- Strengthened rationale for enhancement strategies
- Improved transition between paragraphs

1.2.3 Enhancement Strategies Section

- Added quantitative performance data for each enhancement approach
- Included specific removal rate ranges
- Enhanced technical detail on carbon supplementation methods
- Expanded alternative media discussion with performance comparisons

1.2.4 Environmental Considerations

- Restructured into clear subsections: GHG emissions, phosphorus dynamics, DOC leaching
- Added mitigation strategies for each environmental concern
- Included quantitative data where available
- Enhanced discussion of pollution swapping concerns

2 Technical and Methodological Improvements

2.1 Data Integration

- Synthesized data from 70 peer-reviewed studies (previously not clearly stated)
- Added meta-analysis techniques where appropriate
- Included confidence intervals and statistical measures
- Enhanced quantitative comparisons between strategies

2.2 Performance Metrics

- Standardized removal rate reporting ($\text{g N/m}^3/\text{day}$)
- Added temperature sensitivity coefficients (Q_{10} values)
- Included cost-effectiveness analysis across all strategies
- Enhanced comparison framework for different approaches

3 Formatting and Presentation Changes

3.1 Author Information

- Removed corresponding author asterisk from author line (journal requirement)
- Simplified corresponding author designation in footer
- Updated institutional affiliations

3.2 References and Citations

- Enhanced citation coverage throughout the text
- Ensured all major statements are properly supported
- Updated reference formatting for journal requirements
- Added citations to support quantitative claims

4 Significance of Changes

4.1 Scientific Contribution

The revised manuscript provides:

- Comprehensive quantitative analysis of enhancement strategies
- First systematic economic comparison of different approaches
- Enhanced environmental impact assessment with mitigation strategies
- Clear guidance for practitioners and researchers

4.2 Practical Impact

The changes result in:

- More actionable recommendations for system designers
- Better understanding of trade-offs between enhancement strategies
- Clearer economic framework for decision-making
- Enhanced awareness of environmental considerations

5 Conclusion

These revisions substantially strengthen the manuscript by providing comprehensive quantitative analysis, enhanced methodological rigor, and practical guidance for woodchip bioreactor enhancement. The changes address reviewer concerns while advancing the scientific understanding of these important water treatment systems.

The revised manuscript maintains the original research objectives while providing significantly enhanced data synthesis, economic analysis, and practical recommendations that will benefit both the research community and practitioners implementing these technologies.