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REVIEWER'S REPORT

Manuscript No.: IJAR- 57848

Title: OPTIMIZATION OF COMPOSTING SYSTEMS USING FOOD WASTE-DERIVED MICROBIAL CONSORTIA FOR SUSTAINABLE ENVIRONMENTAL MANAGEMENT.

Recommendation:
Accept as it is .....
Accept after minor revision.....
Accept after major revision
Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance			✓	

Reviewer Name: **ANAPANA GOPAL**

Reviewer's Comment for Publication.

General Comments

The manuscript presents a comprehensive review of food waste-derived microbial consortia and their role in optimizing composting systems for sustainable environmental management. The topic is highly relevant considering the growing challenges associated with food waste generation, greenhouse gas emissions, and the need for circular bioeconomy approaches. The manuscript covers microbial diversity, compost optimization strategies, degradation mechanisms, environmental applications, and future technological developments. While the review is informative and generally well-structured, several areas require improvement to enhance scientific rigor, critical analysis, and publication quality.

Content and Originality

Strengths

- The manuscript addresses a globally significant environmental issue and proposes a sustainable solution through microbial consortium-based composting.
- The review provides extensive coverage of food waste composition, microbial succession, compost optimization strategies, and environmental applications.
- Emerging concepts such as synthetic microbial consortia, metagenomics, transcriptomics, and microbial engineering are discussed, enhancing the novelty of the review.
- The discussion on circular bioeconomy integration strengthens the practical relevance of the manuscript.

Weaknesses

- The review is largely descriptive and lacks deeper critical evaluation of existing studies.
- Contradictory findings, limitations, and challenges associated with engineered microbial consortia are insufficiently discussed.

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- The manuscript does not clearly identify specific knowledge gaps that justify the review.
- Comparative analysis between conventional composting and engineered microbial consortium-based composting systems is limited.

Technical Quality

Strengths

- The manuscript demonstrates a strong understanding of compost microbiology and waste biodegradation processes.
- Major microbial groups including bacteria, fungi, actinomycetes, and archaea are discussed systematically.
- Mechanisms of carbohydrate, protein, lipid, and lignin degradation are explained in detail.
- Optimization factors such as aeration, particle size, inoculum application, and additives are appropriately described.

Weaknesses

- The review lacks a dedicated methodology section describing:
  - Literature search databases.
  - Keywords used.
  - Inclusion and exclusion criteria.
  - Time period covered by the review.
- Some statements require stronger quantitative evidence.
- The manuscript would benefit from summary tables comparing microbial consortia performance across different composting systems.
- Emerging AI-assisted compost monitoring is mentioned briefly but not discussed adequately despite being highlighted in the abstract.

Language and Presentation

Strengths

- The manuscript is generally written in clear scientific language.
- Technical terminology is appropriate and consistent.
- The flow between sections is logical and coherent.

Weaknesses

- Minor grammatical and typographical errors occur throughout the manuscript.
- Several paragraphs are excessively long and could be condensed for better readability.
- Formatting inconsistencies exist in headings and numbering.
- Some scientific names and taxonomic classifications should be checked for consistency with current nomenclature.

Structure and Organization

Strengths

- The manuscript follows a logical structure from introduction through conclusions and recommendations.
- Subsections are clearly organized and easy to follow.
- Environmental applications and challenges are discussed separately, improving readability.

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Weaknesses

- A dedicated review methodology section is missing.
- The manuscript contains extensive descriptive content that could be synthesized more effectively.
- A graphical framework illustrating microbial succession and compost optimization processes would significantly improve presentation.
- The recommendations section could be integrated into future research directions for better flow.

References and Citations

Strengths

- The manuscript includes numerous recent references from 2024–2026, indicating good coverage of current literature.
- References are largely relevant to composting, microbial ecology, waste valorization, and environmental sustainability.
- Several high-quality journals are cited, including *Bioresource Technology*, *Journal of Environmental Management*, *ACS Omega*, and *Heliyon*.

Weaknesses

- Reference formatting is inconsistent and should be standardized according to the journal style.
- Some references contain incomplete author listings ("et al.") where full citation formatting may be required.
- A few foundational studies on compost microbiomes and microbial ecology could be added to strengthen the literature base.
- Verification of publication years and citation details is recommended, particularly for very recent references (2025–2026).

Overall Recommendation

The manuscript presents a comprehensive and timely review of microbial consortium-based composting systems for food waste management. The topic is relevant, the literature coverage is broad, and the scientific content is generally sound. However, the review would benefit from greater critical analysis, inclusion of a review methodology, improved synthesis of findings, and enhanced discussion of future technologies and limitations.

Final Decision:

Minor to Moderate Revision