

REVIEWER'S REPORT

Manuscript No.: IJAR-54096

Date: 30.09.2025

Title: Zero Liquid Discharge (ZLD) and Sludge Valorization: Dual Pathways for Sustainable Wastewater Management in India

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**

Date: 30.09.2025

Reviewer's Comment for Publication.

(To be published with the manuscript in the journal)

The reviewer is requested to provide a brief comment (3-4 lines) highlighting the significance, strengths, or key insights of the manuscript. This comment will be Displayed in the journal publication alongside with the reviewers name.

General Comments

The manuscript addresses an important and timely topic: sustainable wastewater management in India through Zero Liquid Discharge (ZLD) and sludge valorization. The dual focus on both industrial efficiency and agricultural reuse of sludge makes it relevant to environmental policy, industrial practices, and sustainable agriculture. The manuscript is ambitious, integrating historical background, regulatory perspectives, field trials, and operator insights. However, it is lengthy and sometimes loses focus due to repetition and extended background information. Overall, the study is valuable but would benefit from streamlining and sharper alignment of results with objectives.

Content and Originality

- **Strengths:**
 - The paper contributes original empirical data from operator interviews and agricultural trials with sludge-based fertilizer.
 - Sludge valorization for crop yield improvement with heavy metal safety analysis adds practical innovation.
 - The integration of industrial perspectives with field-based experimentation strengthens the applied significance.
- **Weaknesses:**
 - The historical overview of wastewater management (Mesopotamia to Industrial Revolution) is informative but overly detailed, detracting from the focus on the research question.

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REVIEWER'S REPORT

- Some definitions and explanations (e.g., bioremediation basics) are presented at a textbook level, which may be redundant for a scholarly audience.
- Originality lies mostly in the sludge valorization experiments; the ZLD review is largely a synthesis of existing literature.

Technical Quality

- The methodology for sludge composting, fertilizer application, and crop trials is described clearly, with randomized design, replicates, and control treatments.
- Operator interviews provide qualitative depth, though the small sample size (n=4) limits generalizability.
- Data presentation (tables, figures, percentages of yield improvement) is clear and supports the claims.
- However:
 - Statistical analyses (e.g., ANOVA, significance testing) are not explicitly reported, which weakens the robustness of comparative claims.
 - The discussion on reject-water handling could be supported by quantitative effluent data rather than qualitative operator accounts.

Language and Presentation

- **Strengths:** The writing is accessible, descriptive, and detailed. Technical processes (RO, MEE, sludge composting) are explained well for a wide audience.
- **Weaknesses:**
 - The text occasionally shifts into overly conversational or explanatory tone ("Basically, it is like employing nature's own organically cleaning organisms"), which may reduce academic rigor.
 - Redundancy is present—ZLD concepts are explained multiple times in slightly different ways.
 - Sentences are sometimes long and verbose, making the manuscript harder to follow.
 - Figures and images are listed but not integrated with analytical discussion (e.g., Image 1, Image 2 are mentioned but lack captions with analytical context).

Structure and Organization

- **Strengths:**
 - The manuscript follows a recognizable structure: Abstract, Introduction, Method, Results.
 - Clear sections on operator insights, crop performance, and soil health observations.
- **Weaknesses:**
 - The introduction is too broad and lengthy, containing history, definitions, and multiple unrelated subtopics before narrowing to the study's objectives.
 - Literature review is scattered across different sections instead of being synthesized in one place.
 - Results and discussion are partially merged; a distinct discussion section interpreting findings in light of prior work is missing.
 - Images (e.g., filtration plants) are not effectively contextualized to support arguments.

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References and Citations

- References are cited, but there are inconsistencies:
 - Some are quoted in-text with quotation marks (e.g., "Zero Liquid Discharge is a wastewater treatment process..."), while others are paraphrased.
 - The reference list itself is not included in the provided text, so citation style uniformity cannot be confirmed.
 - Some references are secondary or review-based; stronger reliance on recent empirical studies would enhance rigor.
- Recommendation: Compile a properly formatted reference list (APA/Harvard style), cross-check all in-text citations, and reduce over-reliance on generic review sources.

Overall Recommendation

Decision: Minor Revision

The manuscript has strong potential, especially in its **original field experiments on sludge valorization and its integration of industry operator insights**. However, it requires significant revisions to improve focus, conciseness, and technical rigor. Key improvements needed:

1. Streamline the **Introduction** (reduce historical background, keep focus on ZLD and sludge valorization in India).
2. Provide **statistical analyses** for crop yield comparisons.
3. Create a **separate Discussion section** linking results to existing literature.
4. Revise **language for academic tone** (remove conversational phrases).
5. Ensure **consistent referencing and citation formatting**.
6. Reorganize or remove some images that don't directly contribute to analysis.

With these changes, the paper can make a meaningful contribution to the fields of sustainable wastewater management and circular economy practices.

Detailed Reviewer's Report