

REVIEWER'S REPORT

Manuscript No.: IJAR- 59236

Title: Physicochemical and microbiological characterisation of effluent from a faecal-sludge treatment plant in Adjagbo, Benin, West Africa,

Recommendation:

Accept after minor revision

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

Reviewer's ID: Bilquees Hamza

Detailed Reviewer's Report

The manuscript presents an empirical investigation into the physicochemical and microbiological quality of effluent discharged from the Adjagbo faecal-sludge treatment plant located in the municipality of Abomey-Calavi, Benin. The study addresses a critical urban environmental health issue in West Africa: evaluating whether treated faecal sludge and liquid fractions meet regulatory standards for environmental discharge into receiving water bodies (such as the Togba watercourse and Lake Toho) or for agricultural reuse/irrigation.

The methodology tracks effluent quality across four distinct sampling stages along the treatment train—raw sludge (\$B_0\$), buffer basin (\$B_1\$), maturation lagoon inlet (\$B_2\$), and polishing lagoon outlet (\$B_3\$)—across four seasonal campaigns (May, September, December 2023, and February 2024). The analytical framework combines standard AFNOR methods, membrane-filtration/colony-enumeration for microbiological indicators, one-way ANOVA for seasonal effects, and Principal Component Analysis (PCA) to evaluate parameter correlations.

The main empirical finding of the study is that while physical sedimentation and lagooning achieve substantial reductions in physical and organic loads, the final discharged effluent (\$B_3\$) remains severely contaminated:

- Physical and Organic Parameters:** Mean total suspended solids (TSS) reached 2,873.87 mg/L during the rainy season and 2,167.85 mg/L during the dry season. Final outlet BOD\$B_3\$ (36.75–

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48.5 mg O₂/L) and COD (201.5–339 mg O₂/L) consistently fail to meet WHO and Beninese discharge limits (30 mg/L and 90 mg/L, respectively).

2. **Nutrients:** Ammonium and total phosphate levels at the outlet far exceed national and WHO thresholds (e.g., TP reaches 11.32–20.86 mg/L against a standard of 2–3 mg/L), presenting severe risks of eutrophication.
3. **Microbiological Quality:** Concentrations of *Escherichia coli* (10.25 to 1.35×10^6 CFU/100 mL) and faecal coliforms (7,086 to 4.27×10^6 CFU/100 mL) vastly exceed the standard threshold of $\leq 1,000$ CFU/100 mL for unrestricted agricultural irrigation.

The paper addresses a highly practical and relevant topic. However, significant editorial, technical, and analytical inconsistencies throughout the text require major revisions before the manuscript can be considered suitable for formal publication.

Key Strengths

1. **Practical and Contextual Relevance:** The research aligns directly with national infrastructure initiatives (such as Benin's Government Action Programme 2021–2026) and addresses pressing public health and environmental risks tied to urban sanitation.
2. **Multi-Stage Longitudinal Sampling:** Sampling across four distinct stages (B₀ to B₃) across both rainy and dry seasons allows for a clear evaluation of where specific treatment mechanisms succeed or fail along the treatment train.
3. **Biodegradability Assessment:** The calculated mean COD-to-BOD₅ ratio of 1.74 offers useful operational insight, confirming the predominantly domestic origin and high biological treatability of the organic waste.

Revision Requirements

1. Inconsistencies and Reporting Errors in Data Tables and Text

- **Abstract vs. Data Tables:** In the Abstract (Lines 16–22), mean TSS, BOD₅, COD, and *E. coli* values are reported as overall dataset/plant means (e.g., rainy season TSS of 2,873.87 mg/L, BOD₅ of 2,805.75 mg/L) rather than specifically distinguishing final outlet (B₃) values. This gives the misleading impression that the final discharged effluent has a TSS of over 2,000 mg/L, whereas Table 2 shows B₃ TSS is 64.17 mg/L (rainy) and 50.00 mg/L (dry). The Abstract must be rewritten to explicitly report the **final effluent (B₃)** values alongside initial concentrations.
- **Table 2 Data Formatting Errors:** In Table 2, several data cells under columns B₁, B₂, and B₃ suffer from truncated numbers or missing entries (e.g., Wet season NO₂ at B₃ lists "4 8.52", Dry season NO₂ shows empty entries, and TP shows truncated numbers like

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"98765" in lower rows). The authors must thoroughly audit and re-format Table 2 to ensure all numerical values, standard deviations, minimums, and maximums are accurately and completely presented.

- **Table 3 Data Omissions:** In Table 3, the columns for Total Coliforms under the Dry Season are completely blank for \$B_0\$, \$B_1\$, \$B_2\$, and \$B_3\$. The missing raw data or summary statistics must be inserted.
- **Table 4 Missing ANOVA Rows:** In Table 4 (ANOVA results), the rows for TSS, Total Coliforms, and *E. coli* have missing \$p\$-values across several sampling stations. All calculated \$p\$-values must be provided or explicitly marked if non-calculable.

2. Methodological & Analytical Clarifications

- **Distinction Between Standards:** The text occasionally conflates drinking water standards, general environmental discharge limits, and unrestricted agricultural irrigation guidelines (e.g., Lines 190–195). The revised manuscript must establish a dedicated table comparing observed \$B_3\$ final effluent values against specific Beninese Standards and WHO Guidelines for (a) Treated Wastewater Discharge and (b) Unrestricted Agricultural Irrigation.
- **Nitrate (\$NO_3^-\$) Interpretation:** The manuscript states in places that nitrate levels are within recommended limits, yet Table 2 and Section results show maximum values reaching 89.60 mg/L (wet) and 129.30 mg/L (dry), which exceed the 50 mg/L WHO threshold. The text must clearly distinguish between mean values and maximum peak discharges.
- **PCA Presentation and Discussion:**
 - The abbreviation "FEC" mentioned in the text (Line 279) is undefined and should be standardized to Faecal Coliforms.
 - Figure 3.18 shows variable vectors, but the authors must provide a complete PCA Eigenvalue and Loading Table listing exact contribution percentages for Dim 1 and Dim 2 to substantiate the narrative claims in Lines 228–241.

3. Textual Duplication and Structural Clean-up

- **Redundant Sections:** Lines 213–241 ("Seasonal effects" and "Principal component analysis") are repeated almost verbatim in Lines 242–292 under "Analysis of variance" and "Principal component analysis". The duplicate subsections must be merged into a single, cohesive Results section.
- **Editorial Review Notes in Text:** The manuscript contains visible reviewer/editorial instructions within the main narrative (e.g., Line 194: *"the manuscript should clearly distinguish between..."*; Line 240: *"however, the final manuscript should include..."*; Line 278: *"This interpretation should*

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be checked..."; Line 353: "The chemical notation... should be verified..."; Line 387: "Nevertheless, the proposed treatment strategy should be reconsidered."). All internal review notes and self-referential instructions must be removed, and the narrative updated accordingly.

Formatting Corrections

- Figure Quality:** Figures A through I (seasonal variation charts) and Figure 3.18 are low-resolution and contain French labels (e.g., "Saison Pluvieuse", "Saison Sèche", "DCO", "MES"). Re-render all figures in high-resolution with consistent English labeling (e.g., "Rainy Season", "Dry Season", "COD", "TSS").
- Chemical Nomenclature:** Standardize chemical notations across text, tables, and figures (e.g., use BOD_5 consistently instead of mixing BOD_s , BOD_s , or DBO_5).
- Reference Citations:** Ensure all missing in-text citations (e.g., "consistent with those reported by who observed..." at Line 333, "reported by ." at Line 368 and Line 385) are fully populated with author names and publication years.

Final Recommendation

Decision: Minor Revisions.