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REVIEWER'S REPORT

Manuscript No.: IJAR- 58196

Title: COMPARATIVE MOISTURE ADSORPTION BEHAVIOUR AND ISOTHERM MODELLING OF SEED POWDERS FROM FOUR BAMBARA GROUNDNUT (VIGNA SUBTERRANEA L. VERDC.) CULTIVARS FROM CÃ"TE D\'IVOIRE.

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 investigates the moisture adsorption behavior of powders prepared from four Bambara groundnut cultivars cultivated in Côte d'Ivoire. The authors determined adsorption isotherms using the static gravimetric method and evaluated three commonly used mathematical models (GAB, Oswin and Chung-Pfost) to identify the most suitable model for predicting moisture sorption characteristics. The study concludes that the GAB model best describes the adsorption behavior and provides estimates of monolayer moisture content useful for drying and storage recommendations.

The topic is relevant to food engineering, post-harvest technology and food preservation. Moisture sorption studies are valuable for designing drying processes, packaging systems and storage conditions. The manuscript is generally well organized; however, several scientific, methodological, statistical and presentation issues should be addressed before publication.

Content and Originality

Strengths

- Investigates an important underutilized African legume.
- Addresses moisture adsorption characteristics relevant to food preservation.
- Compares four cultivars rather than a single genotype.
- Evaluates three established sorption models.
- Practical implications for storage and packaging are discussed.

Weaknesses

- The novelty is only moderate.
- Similar adsorption studies on Bambara groundnut flour have already been reported.

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- The manuscript should clearly explain how the present work advances beyond previous Bambara groundnut sorption studies.
- Greater emphasis on cultivar-specific differences would strengthen originality.

Literature Review
Strengths
- Introduces hygroscopic behavior and moisture sorption principles clearly.
- Explains the importance of adsorption isotherms in food preservation.
- Discusses commonly used sorption models including GAB, BET and Oswin.

Weaknesses
Limited Recent References
The literature review relies heavily on older references.
Very few recent studies (2023–2025) on
- food powder sorption
- moisture modelling
- Bambara groundnut processing
- food drying technology

have been cited.
The manuscript should incorporate more recent publications.

Limited Critical Discussion
The review mainly summarizes previous work.
It should better identify:
- research gaps
- conflicting findings
- limitations of previous studies
- justification for selecting these three models.

Methodology
Strengths
- Experimental procedure is described systematically.
- Static gravimetric method is appropriate.
- Triplicate measurements improve reliability.
- Model fitting through nonlinear regression is appropriate.

Minor Concerns
1. Single Temperature Study
Adsorption isotherms were determined only at **29 ± 1°C**.
Temperature greatly affects moisture sorption.
Results therefore have limited applicability.
Additional temperatures (e.g., 20°C, 35°C, 45°C) would provide much stronger conclusions.

2. Lack of Physicochemical Characterization
The manuscript attributes cultivar differences to:
- protein
- carbohydrate

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- dietary fibre

composition.
However, no compositional analyses were performed.
These explanations remain speculative.

3. Particle Size
Only one particle size (0.5 mm) was used.
Particle size significantly influences adsorption characteristics.
The limitation should be acknowledged.

4. Storage Conditions
Storage recommendations are proposed although actual storage experiments were not conducted.
Shelf-life validation under real storage conditions would strengthen the study.

Statistical Analysis
Strengths
- Uses nonlinear regression.
- Reports R^2, RMSE and SEM.
- Compares model performance objectively.

Weaknesses
No Statistical Comparison Between Cultivars
The manuscript states differences among cultivars but does not report:
- ANOVA
- confidence intervals
- significance testing

It is unclear whether cultivar differences are statistically significant.

Replication
Although experiments were performed in triplicate, statistical variability is poorly presented.
Standard deviations should be reported consistently.

Residual Analysis
No residual plots are presented.
Residual analysis would further validate model fitting.

Results and Discussion
Strengths
- Adsorption isotherms are clearly interpreted.
- GAB model performance is well explained.
- Practical significance of monolayer moisture content is discussed.
- Figures are easy to understand.

Weaknesses
Overinterpretation
Several explanations regarding:

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- protein structure
- carbohydrate composition
- biochemical differences

are not experimentally verified.
The discussion should distinguish observed results from hypotheses.

Limited Comparison with Previous Studies
More comparison is needed with moisture sorption studies on:

- legumes
- pulses
- flour products
- seed powders

rather than only Bambara groundnut.

Cultivar Differences
Although four cultivars were investigated, discussion of their biological differences remains limited.
The manuscript should explain why the cultivars behaved differently.

Mathematical Modelling
Strengths

- Three established models were compared.
- GAB was appropriately identified as the best model.
- Monolayer moisture content was estimated.

Weaknesses
Limited Number of Models
Only three models were evaluated.
Additional commonly used models such as:

- Henderson
- Halsey
- Peleg
- Smith
- Modified GAB

could improve model comparison.

Model Validation
External validation using independent datasets was not performed.
Prediction accuracy therefore remains uncertain.

Figures and Tables
Strengths

- Graphs clearly show adsorption behavior.
- Figures are appropriately labelled.
- Table 3 summarizes model performance effectively.

Weaknesses

- Figure captions require grammatical correction.

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- "Comparaison" should be corrected to "Comparison."
- Units should be standardized throughout the manuscript.
- Some figure fonts are relatively small.

Language and Presentation
Minor Issues
The manuscript requires professional English editing.
Examples include:
- grammatical inconsistencies
- incorrect article usage
- awkward sentence construction
- punctuation issues
- repeated expressions

Examples include:
- "is a african legume" should be "is an African legume."
- Several sentences are excessively long and difficult to read.

Language polishing is strongly recommended.

References
Strengths
- Relevant classical literature is cited.
- References cover moisture sorption theory.
- Appropriate foundational studies are included.

Weaknesses
- Limited recent literature.
- Several references lack DOI information.
- Reference formatting is inconsistent.
- Journal names should follow the journal's prescribed style.

Specific Recommendations
Abstract
- Include statistical indicators.
- State why GAB outperformed the other models.
- Mention practical applications more clearly.

Introduction
- Better emphasize the research gap.
- Include recent literature.
- Clearly justify cultivar selection.

Materials and Methods
- Explain cultivar selection criteria.
- Include powder composition if available.
- Describe calibration of measuring instruments.

Results
- Include statistical significance among cultivars.

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- Avoid speculative explanations without supporting data.
- Discuss limitations more explicitly.

Discussion

- Compare findings with recent international studies.
- Expand implications for food storage industries.

Conclusion

- Avoid repeating results.
- Highlight industrial applications.
- Mention limitations and future research directions.

Overall Recommendation

The manuscript addresses an important issue in food preservation by evaluating moisture adsorption behavior and isotherm modelling of Bambara groundnut powders. The experimental work is systematic, and the comparison of sorption models provides useful information for optimizing drying and storage conditions. However, the manuscript would benefit from stronger statistical analyses, additional validation, a more comprehensive discussion of cultivar differences, improved English language quality, and a more thorough review of recent literature. Addressing these issues will considerably improve the scientific quality and practical value of the study.

Final Decision

Minor Revision