Nigerian Journal of Technological Development Volume 20, Number 2, June 2023.

A Quarterly Publication of the Faculty of Engineering and Technology, University of Ilorin, Ilorin, Nigeria.

> Editor-in-Chief Professor S. M. Adedayo

EDITORIAL BOARD

Dean of Faculty Engr. Prof. O. A. Lasode Department of Mechanical Engineering, University of Ilorin, Ilorin, Nigeria.

Managing Editor

Engr. Dr. H. U. Hambali Department of Chemical Engineering, University of Ilorin, Ilorin, Nigeria.

Copy Editor

Engr. Dr. (Mrs.) N. T. Surajudeen-Bakinde

Department of Electrical and Electronics Engineering, University of Ilorin, Ilorin, Nigeria.

Engr. Dr. (Mrs) R. M. Mahamood

Department of Materials & Metallurgical Engineering, University of Ilorin, Ilorin, Nigeria.

Editor-in-Chief

Engr. Prof. S. M. Adedayo Department of Mechanical Engineering, University of Ilorin, Ilorin, Nigeria.

Copy Editor

Engr. Prof. (Mrs) O. A. A. Eletta Department of Chemical Engineering, University of Ilorin, Ilorin, Nigeria.

Copy Editor

Engr. Dr. H. A. Ajimotokan Department of Mechanical Engineering, University of Ilorin, Ilorin, Nigeria.

Production Editor Engr. Dr. O. O. Olofintove Department of Water Resources and Environmental Engineering, University of Ilorin, Ilorin, Nigeria.

Treasurer

Engr. Dr. (Mrs.) O. A. Mokuolu Department of Water Resources and Environmental Engineering, University of Ilorin, Ilorin, Nigeria.

SECTION EDITORS

Section A: Chemical, Biomedical, and Petroleum Engineering; Geology

Engr. Dr. T. D. Akpenpuun Department of Agricultural and Biosystems Engineering, University of Ilorin, Ilorin, Nigeria.

Section C: Food, Agricultural and Biosystems, and Water Resources and Environmental Engineering; **Applied** Sciences

> Engr. Dr. M. O. Sunmonu Department of Food Engineering, University of Ilorin, Ilorin, Nigeria.

Editorial Assistant Engr. O. A. Adewuyi Department of Mechanical Engineering, University of Ilorin, Ilorin, Nigeria.

Section B: Electrical and Electronics, and Computer Engineering; Applied Mathematics; **Computer Science** Engr. Dr. A. O. Otuoze Department of Electrical & Electronics Engineering,

University of Ilorin, Ilorin, Nigeria.

Section D: Materials & Metallurgical, Mechanical, and Civil Engineering; Geophysics

Engr. Dr. J. A. Adebisi

Department of Materials & Metallurgical Engineering, University of Ilorin, Ilorin, Nigeria.

Editorial Assistant

Engr. (Mrs) O. F. Atilola FET Journal Office, Department of Materials & Metallurgical Engineering, University of Ilorin, Ilorin, Nigeria.

Production Editor

EDITORIAL ADVISORY BOARD

Prof. J. O. Ojo

Dept. of Electrical and Computer Engineering, Tennessee Technological University, Cookeville, Tennessee, USA.

Prof. J. A. Olorunmaiye Dept. of Mechanical Engineering, University of Ilorin, Ilorin, Nigeria.

Prof. O. Adegbenro Dept. of Electrical/Electronics Engineering, University of Lagos, Akoka, Nigeria.

Prof. A. M. Olaniyan Dept. of Agricultural & Bio-Resource Engineering, Federal University Oye, Ekiti, Nigeria.

Prof. J. O. Omolehin Dept. of Mathematics, Federal University, Lokoja, Nigeria.

Prof. A. O. Ogunlela Dept. of Agricultural & Biosystems Engineering, University of Ilorin, Ilorin, Nigeria.

Dr. Edris Pouresmaeil Dept. of Electrical Engineering and Automation, Aalto University, Espoo, Finland.

Dr. M. Y. S. Hamid School of Chemical and Energy Engineering, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia. **Prof. Foluso Ladehinde** Dept. of Mechanical Engineering, State University of New York, Stony Brook, New York, USA.

Prof. B. F. Sule Dept. of Water Resources and Environmental Engineering, University of Ilorin, Ilorin, Nigeria.

Prof. S. M. Adedayo Dept. of Mechanical Engineering, University of Ilorin, Ilorin, Nigeria.

Dr. Olugbenga Mejabi Dept. of Mechanical Engineering, Wayne State University, Detroit, Michigan, USA.

Dr James Titiloye Dept. of Chemical & Environmental Engineering, Swansea University Swansea, United Kingdom.

Prof. S. A. Abdulkareem Dept. of Chemical Engineering, University of Ilorin, Ilorin, Nigeria.

Dr. S. S. Zakariyah College of Engineering and Technology, University of Derby, Derby DE22 3AW, UK.

Dr. A. M. Aliyu Dept. of Engineering and Technology, University of Huddersfield, Queensgate HD1 3DH, UK.

Dr. Umbrin Sultana Dept. of Electrical Engineering, NED University of Engineering & Technology, Karachi, Pakistan. Prof. Y. A. Jimoh

Dept. of Civil Engineering, University of Ilorin, Ilorin, Nigeria.

Prof. Samuel John

Dept. of Mechanical Engineering, Namibia University of Science & Technology, Windhoek, Namibia.

Prof. J. A. Omoleye

Dept. of Chemical Engineering, Covenant University, Ota, Ogun State, Nigeria.

Dr. K. B. Mustapha

Dept. of Mechanical, Materials and Manufacturing Engineering, University of Nottingham Malaysia Campus, Selangor Darul Ehsan, Malaysia.

Prof. G. A. Bakare

Dept. of Electrical & Electronics Engineering, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

Prof. Victor Kamara

Dept. of Civil and Environmental Engineering, Namibia University of Science & Technology, Windhoek, Namibia.

Dr. P. Sanjeevikumar

School of Electrical & Electronics Engineering, Dublin Institute of Technology Kevin Street, Dublin-8, Ireland.

Dr. T. A. Jumani Dept. of Electrical Engineering, SZAB Campus, Mehran University of Engineering and Technology,

Khairpur Mirs, Pakistan.

Annual Subscription

2023 rates including postage are:

Nigeria (NGN)		Other Africa Countries (USD)	Other Countries (USD)
Individual	3,000	30	40
Institution	4,000	60	80

Correspondence

Nigerian Journal of Technological Development Dean Office, Faculty of Engineering & Technology, University of Ilorin, Ilorin, Nigeria. E-mail addresses: njtd_editor_chief@unilorin.edu.ng ; njtd_man_editor@unilorin.edu.ng

> Journal Homepages: http://www.njtd.com.ng http://www.ajol.info/index.php/njtd/index

Copyright & Licensing

The Nigerian Journal of Technological Development (NJTD) allows authors to retain the copyright of their papers without restrictions. Articles are published under the terms of a Creative Commons license CC BY-SA which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

First published in 1989.

Published by the Faculty of Engineering & Technology, University of Ilorin, Ilorin, Nigeria.

Abstracting and Indexing

Scopus, Google Scholar, AJOL, DOAJ, HINARI.

Printed in Nigeria by: USMOLAG PRINTERS No. 50 Ajasepo Road, Offa Garage, Ilorin, Kwara State.

NJTD Submission Guidelines

Aim and Scope

The Nigerian Journal of Technological Development (NJTD) publishes high-quality articles focusing on all aspects of Engineering and Applied Sciences. All manuscripts will be double blind peer-reviewed and if found suitable, published according to the subject matter, either as **full length research articles** or **review papers**. Our publications are scheduled for March, June, September and December.

Preparation of the Manuscript

Manuscript should be written in English Language and typed in 12-point font size using Times New Roman in double spacing on A4 paper. A margin of 25 mm should be left at the sides. The paper should not exceed twenty (20) pages, including figures and tables. The text should be in <u>single-column format</u>.

Title Page

The title page should contain **only** the <u>title of the article</u>, <u>authors' names</u> and <u>contact details</u> such as institutional affiliations, corresponding author's e-mail address and phone number. The page is also to contain the <u>abstract of the article</u> and the list of three <u>suggested reviewers</u>. The title page should be uploaded as a supplementary document on the Author's portal during the submission process. The file containing this document should be named **Title_Page**.

The Anonymised Manuscript

The manuscript should contain the <u>title of the article</u>, the <u>abstract</u>, and <u>five or six keywords</u>. However, it must **NOT** contain name(s), and address(es) of author(s), and e-mail addresses and telephone number of the corresponding author. This information will be supplied on the online submission platform in addition to the title page. This file should be named **Manuscript** and to be uploaded on the portal during submission. The manuscript should be organised under the following headings:

The Article Title

A good title should be concise, accurate, and informative, and should inform the reader exactly what the article is all about. It is vital to incorporate some relevant keywords in your title to make your article more discoverable in online searches. Please note that the article title should not exceed seventeen (17) words and should be in <u>title case letters</u>.

ABSTRACT

The abstract is a brief summary of the research work, which is usually in a paragraph. It should clearly define the problems of study, methodology adopted, results and findings. Citation of previous works are not allowed in the abstract. Abstracts are expected to be stand-alone and capable of providing fast and complete, yet short information about the article. Articles to be submitted to NJTD must have a maximum of <u>200 words</u>. Authors should pay attention to this word limit!

KEYWORDS

Five or six relevant keywords, separated by comma, should be provided in the manuscript.

SYMBOLS, ABBREVIATIONS AND UNITS

Symbols and abbreviations should be defined where first mentioned. If the symbols are many, a "Notation" defining the symbols must be included between the abstract and Introduction. SI units should be used except in situations where calibrations and measurements are in other units.

I. INTRODUCTION

This should include the background to the study, a brief review of literature and clearly-stated objectives. The last paragraph should delve into the contributions of the work and structure of the rest of the paper.

II. THEORETICAL ANALYSIS

Mathematical principles or theories used should be included as appropriate.

III. MATERIALS AND METHODS/METHODOLOGY/EXPERIMENTAL PROCEDURE

This section should include apparatus and equipment setup, work materials, design, experimental methods, as applicable.

A. Sub-section One

The heading of a sub-section should be in title case letters as illustrated here. In other words, the first letter of an important word must be in upper case letter.

B. Sub-section Two

The introductory statements should be in the normal 12 point font size. A sub-section may have sub-section which are illustrated below in 1) and 2).

1) Sub sub-section one

A sub sub-section heading should have a sentence case in which case it is only the first letter of the heading that would be in upper case letter. Others will be in lower case letters.

2) Sub sub-section two

Same as 1) above.

IV. RESULTS AND DISCUSSION

Results could be presented in descriptive, tabular or graphical form. Information presented in tables should not be repeated as figures. Discussion should be focused on the interpretation of experimental findings. This may be broken down into different sub-sections and sub subsections as discussed in Section III above.

Tables and Figures should be placed as close as possible to the first place of reference in the text. References should be made to all the tables and figures and each must be discussed in the manuscript. Authors should endeavour to supply very high quality figures. Editable charts must be provided while "copy and paste" figures must be avoided as much as possible.

It should be noted that good quality articles can be denied publication in NJTD on account of poor quality figures and tables.

B. Equations

All equations, whether mathematical or chemical, are considered as text and should be typed using Microsoft Equation 3.0 or MathType in Word. These equations should be numbered sequentially and should be referenced and discussed in the text. Equation numbers should be enclosed in parentheses and made to align towards the right hand margin of the text. If detailed derivation is needed, it is to be placed in an appendix. Each equation should appear on its own line and should be indented from the left margin of the text.

V. CONCLUSION

The conclusion should be a brief summary of findings. It should clearly state the contributions, relevance of the findings and recommendations, as appropriate. It is usually reported in the past tense form.

AUTHOR CONTRIBUTIONS

For transparency, authors should submit an author statements outlining individual contributions to the paper using the following roles: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing - original draft; Writing - review & editing.

For example, **S. O. Sanni:** Conceptualization, Methodology, Software, Validation, Writing – original draft, Writing – review & editing. **M. F. Akorede:** Supervision, Writing – original draft, Writing – review & editing. **G. A. Olarinoye:** Writing – review & editing.

ACKNOWLEDGEMENT(S)

Acknowledgement of the individuals, institutions or research granting body who provided help during the research should be collated in a separate section at the end of the article before the references and should, therefore, not be included on the title page, as a footnote to the title or otherwise.

REFERENCES

The Harvard system (alphabetical listing) of referencing should be used in the body of the manuscript while only essential references must be cited and listed. Examples of citing references include: Omeiza (2012) or (Omeiza, 2012) as appropriate; Olaniyan and Oje (2002) or (Olaniyan and Oje, 2002) as appropriate; Ogunlela *et al* (2006) or (Ogunlela *et al*, 2006) as appropriate. Examples of listing references are as follows:

Books

Adedayo, S. M. (2000). Graphics for Engineers. Indemac Publishers, Ilorin, Nigeria.

Journals

One Author

Omeiza, I. O. A. (2012). An Investigation on the Problem of Thinning in Fingerprint Processing. Nigerian Journal of Technological Development, 9 (1): 26 - 36.

Two Authors

Olaniyan, A. M. and Oje, K. (2002). Some Aspects of the Mechanical Properties of Shea Nuts. Biosystems Engineering, 81 (4): 413-420.

Three Authors

Ogunlela, A. O.; M. Y. Kasali and I. E. Ahaneku. (2006). Hydrologic Characterization of the National Centre for Agricultural Mechanization (NCAM) Watershed. Journal of Science and Technology Research, 5 (3): 69-73.

More than Three Authors

Ogunlela, A. O.; M. Y. Kasali; C. J. Ejieji and I. E. Ahaneku. (2006). Hydrologic Characterization of the National Centre for Agricultural Mechanization (NCAM) Watershed. Journal of Science and Technology Research, 5 (3): 69-73.

Conference Papers

Akorede, M. F. and Hizam, H. (2009). Teaching power system analysis courses using MATPOWER. Paper presented at International Conference on Engineering Education (ICEED2009), Kuala Lumpur, Malaysia, 45-51, USA: IEEE.

Reports, Thesis and Dissertation

Abioye, A. M. (2001). Design of Engineering Power Transmission Elements using Visual Basic. Unpublished M.Eng. Thesis, Department of Electrical & Electronics Engineering, University of Ilorin, Ilorin, Nigeria.

Web Publications

Anderson, T. (1996). A Data Envelopment Analysis (DEA). Available online at: www.emp.pdx.edu/dea/homedea.html. Accessed on March 7, 2013.

NOTES:

- 1. All authors on the cited work must be listed. Use of "et al" in the list of references is not acceptable.
- 2. All citation details such as journal name, vol no, issue no, page nos for a journal source and conference city, and country for a conference paper, must be present.
- 3. Ensure you list the authors' **surname** and not authors' first name. This could be confirmed by searching the article's title in Google scholar when in doubt.

APPENDICES

If there is only one appendix in the article, it should just read "Appendix". However, if there are more than one appendix in the text, they should be identified as "Appendix A", "Appendix B", etc. Formulae and equations in appendices should be given separate numbering, such as Eq. (A.1), Eq. (A.2), etc, and Eq. (B.1), Eq. (B.2), etc, in a subsequent appendix, and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Suggested Reviewers

A list of, at least, three suggested reviewers should be provided with their current institutional affiliations as well as e-mail addresses on the title page. However, please note that the Managing Editor reserves the right to determine the appropriate reviewers to review your manuscript. This request is simply to populate our database of reviewers in diverse fields.

Submission Checklist

The following list will be useful during the final checking of your article prior to sending it to the journal for review. Please ensure that the following items are present:

- The title page contains **only**:
 - Manuscript title;
 - Authors' names, affiliations, and contact details of the corresponding author;
 - The Abstract;
 - Five or six keywords; and
 - A list of three suggested reviewers and their e-mail addresses has been provided.
- Ensure that the anonymised manuscript **DOES NOT** contain the authors' details and contacts such as names, postal address, e-mail address, and phone number.
- Further considerations
 - Manuscript has been 'spell-checked' and 'grammar-checked'
 - References are in the correct format for this journal
 - All references mentioned in the reference list are cited in the text, and vice versa

Submission of Manuscript

Submission of manuscript is on the condition that it is an original work of the author(s) and it has neither been published previously nor currently under consideration for publication elsewhere. Authors should submit the electronic copy of their manuscript directly to the journal through the journal's website using the online submission system. Please do not submit a hard copy to the editorial office or send your manuscripts by e-mail. You may, however, report to the Editor any issues hindering you to make the online submission.

The online manuscript takes four stages to be successfully completed. In the first stage, you must check all the Submission Requirements checkboxes, and must agree to the copyright statement.

Clicking on the "Save and continue" button takes you to the "Upload Submission Files" page, where you must select an Article Component such as "Source texts" or "Article text" (any one will do). Next, you upload File 1, which is the file named **Manuscript** after which you click on the "Continue" button, next click on the Continue button again. At this point, click on "Add Another

File". On the displayed window, pick "This is not a revision of an existing file", then select Article Component, which may also be "Source texts" or "Article text" (any one will do). Upload the file named **Title_Page**, and continue, then click on the "Complete" button if you have no other document to upload again. Click on "Save and continue" to enter the article title and abstract. <u>No need to enter the subtitle</u>. To add other authors, click on the "Add contributor" button. Enter all the compulsory fields and save to add more authors or finish the submission process by clicking the "Finish Submission" button.

After the manuscript has been submitted, you will see a confirmation screen and receive an e-mail confirmation stating that your manuscript has been successfully submitted. If you do not receive this, your manuscript will not have been successfully submitted to the journal and the paper cannot progress to peer review. If this is the case your manuscript will still be sitting in the 'Incomplete' section of your 'Author Page' awaiting your attention to complete the process.

To track your submission's progress through the review and editorial process, you will need to log into the journal website, and choose your role as author. Click on the linked title to go to the submission record. There, you can see how many reviewers have completed their reviews out of a total assigned by the Editor. Authors should not panic when you see "A review is overdue". That message is not for your consumption. You may wish to call the attention of the Editor if you do not get a feedback from us after three months of submission.

Open Access Agreement

Upon acceptance of an article, authors will be requested to download from our homepage the open access agreement form, complete and sign it, and then upload it to the portal against that particular submission.

Article Publication Charge

The Nigerian Journal of Technological Development (NJTD) is an open access journal. As a result, publishing of an article in the Journal requires an Article Publication Charge (APC), which will be billed following the acceptance of the article. Aside from this, the Journal does not impose any other charge on the author, be it submission charge or colour charge.

The APC will be charged based on the corresponding author's affiliation. For the corresponding author has dual affiliations, the affiliation of where the work was carried will be used. For the corresponding authors based in Nigeria, the APC of $\mathbb{N}45,000.00$ (NGN) will be imposed while \$150.00 (USD) will be imposed on corresponding authors outside Nigeria. The publication fee is non-refundable once the article is published online. Payment can be made by International Bank wire transfer, Western Union Money Transfer, MoneyGram, Online money transfer, or Payoneer.

Х

Payment instructions will be sent to the corresponding author by the Managing Editor after the acceptance of the paper. The evidence of payment should be uploaded on the portal against the submission immediately after payment.

Subscription and Advertisement

The subscription and advertisement rates can be obtained from the Editor-in-Chief, the Managing Editor or the Business Manager. Current and past volumes of the journal are available at Room **G11**, Department of Materials and Metallurgical Engineering, Faculty of Engineering and Technology, University of Ilorin, Ilorin; at Options Bookshop, Ibadan; or Jasper Books Nig. Ltd, Ilorin.

Complimentary Copies

Since authors can always download their published papers from our website at www.njtd.com.ng, on our homepage at AJOL and in the Scopus database, we no longer send the author's complimentary copy to the authors. However, any author that so requires a print version of the journal shall pay a sum of Three Thousand Naira (N3,000:00) per copy exclusive of the delivery cost.

Queries

For technical support on submissions, please send an e-mail to the Managing Editor via njtd_man_editor@unilorin.edu.ng or editor@njtd.com.ng. For questions about the editorial process especially on the status of manuscripts under review, authors may write to request for this information only when a three-month period from submission has elapsed.

Peer Review Process

NJTD operates a double anonymised peer review process. All submissions will be initially assessed by the Editor for suitability for the journal. Papers deemed technically suitable are then subjected to plagiarism check. If the similarity index is higher than 25%, such article is rejected at that stage and the corresponding author is communicated. Articles that pass this stage will be allocated to a Section Editor, who assigns a minimum of three reviewers to evaluate the scientific quality of the manuscript. However, the Editor is responsible for the final decision regarding acceptance or rejection of articles, and this decision is final.

Authors are encouraged to download the article processing flowchart from our homepage. The document summarises the peer review process used by NJTD. Authors should note that this process may last up to three months on the average.

TABLE OF CONTENTS

Volume 20, Number 2, June 2023

Comparative Analysis of Bamboo-based (Bambusa vulgaris) Activated Carbon produced through Trioxonitrate (V) Acid and Potassium Hydroxide. C.O. Akinbile, E. M. Epebinu, O.O. Olanrewaju, A.T. Abolude <u>http://dx.doi.org/10.4314/njtd.v20i1.1155</u> 1-10

Experimental Investigation for Fault Diagnosis of a Single Stage Worm Gearbox Using Response Surface Methodology. R. R. Barshikar, P. R. Baviskar <u>http://dx.doi.org/10.4314/njtd.v20i1.1259</u> 11-22

Characteristics of Soils for Civil Engineering Foundations in Part of North Central Nigeria, Using Electrical Resistivity Method. O. S. Ayanninuola, U. D. Msughter, C. O. Ofoegbu, E. D. Uko http://dx.doi.org/10.4314/njtd.v20i1.1261 23-34

Forced convection heat transfer in micro heat sinks with square and circular configuration. N. Y. Godi, L. B. Zhengwuvi, M. O. Petinrin http://dx.doi.org/10.4314/njtd.v20i1.1272 35-42

Physico-chemical and bacteriological assessments of shallow well water samples during the dry and rainy seasons. O. O. Ayeni, S. O. Oyegoke, O. I. Ndububa, A. E. Adetoro <u>http://dx.doi.org/10.4314/njtd.v20i1.1291</u> 43-52

Electrolytic Co-deposition of Zn-ZnO and Zn-ZnO-CaCO₃ Composite Substrates on Low-Carbon Steel. R. N. Nnaji, M. A. Bodude, D. E. Esezobor <u>http://dx.doi.org/10.4314/njtd.v20i1.1314</u> 53-61

Hydro-geochemical characterization and Groundwater modelling of the subsurface around Ughelli West Engineered Dumpsite in the Western Niger Delta, Nigeria. K. E. Aweto, O. Ohwohere-Asuma, G. Ovwamuedo, P. C. Atiti <u>http://dx.doi.org/10.4314/njtd.v20i1.1393</u> 62-72

Lean Concept to Reduce Waste of Process Time in the Plastic Injection Industry in Indonesia. C. Jaqin, H. Kurnia, H. H. Purba, T. D. Molle, S. Aisyah <u>http://dx.doi.org/10.4314/njtd.v20i1.1396</u> 73-82 Modelling Flood Hazards Impacted by Ungauged River in Urbanised Area Using HEC-RAS and GIS. Abdulganiyu Yusuf, Romoke Ojo, Mohammed O. Idrees, Abdul-Lateef Balogun, Isa B. Salami, and Ojogbane S. Sani <u>http://dx.doi.org/10.4314/njtd.v20i1.1405</u> 83-92

Optimisation of Synthesis Parameters for Co-Mo/MgO Catalyst Yield in MWCNTsProduction. A. S. Buhari, A. S. Abdulrahman, S. A. Lawal, A. S. Abdulkareem, R. A.Muriana, O. T. Jimoh, H. K. Ibrahimhttp://dx.doi.org/10.4314/njtd.v20i1.140993-102

Crab (Brachyura) shell Acid and Alkali Treatments: Influence on Thermal and Structural Properties of Isolated Acetamide-Rich Natural Polymer. O.P Gbenebor, C.C Odili, G.I. Lawal, S.O. Adeosun http://dx.doi.org/10.4314/njtd.v20i1.1411 103-113