Global Journal of Science Frontier Research

dIscoverIng thoughts and InventIng future

Volume 10 Issue 2 Version 1.0

ISSN: 0975-5896

June 2010

highlights

Refraction As A Function Of Atomic Gravitation

Mathieu-type series

G- Closed Sets in a Topological Space

Fixed-Dome Biodigester

6 Advances & Discoveries of Science

ENG

Global Journal of Science Frontier Research

Global Journal of Science Frontier Research

Volume 10 Issue 2 (Ver. 1.0)

Global Academy of Research and Development

License No.: 42125/022010/1186
Registration No.: 430374
Import-Export Code: 1109007027

Reviewer, Research and Analysis Centre

Global Journals, Headquarter Office, United States

Offset Typesetting

Global Journals, City Center Office,
United States

Financial and Continental Dispatching

Global Journals, Data warehouse, India

Pricing (Including by Air Parcel Charges):

For Authors:
22 USD (B/W) & 50 USD (Color)

Yearly Subscription (Personal & Institutional):
200 USD (B/W) & 500 USD (Color)

Editorial Board Members

Dr. Bart Lambrecht
Director of Research in Accounting and FinanceProfessor of Finance
Lancaster University Management School
BA (Antwerp); MPhil, MA, PhD (Cambridge)

Dr. Carlos García Pont
Associate Professor of Marketing
IESE Business School, University of Navarra
Doctor of Philosophy (Management), Massachussetts Institute of Technology (MIT)
Master in Business Administration, IESE, University of Navarra
Degree in Industrial Engineering, Universitat Politècnica de Catalunya

Dr. Fotini Labropulu
Mathematics - Luther College
University of Regina
Ph.D., M.Sc. in Mathematics
B.A. (Honors) in Mathematics
University of Windsor

Dr. Lynn Lim
Reader in Business and Marketing
Roehampton University, London
BCom, PGDip, MBA (Distinction), PhD, FHEA

Dr. Mihaly Mezei
ASSOCIATE PROFESSOR
Department of Structural and Chemical Biology
Mount Sinai School of Medical Center
Ph.D., Etvs Lornd University
Postdoctoral Training, New York University

Dr. Söhnke M. Bartram
Department of Accounting and FinanceLancaster University Management SchoolPh.D. (WHU Koblenz)
MBA/BBA (University of Saarbrücken)

Dr. Miguel Angel Ariño
Professor of Decision Sciences
IESE Business School
Barcelona, Spain (Universidad de Navarra)
CEIBS (China Europe International Business School).
Beijing, Shanghai and Shenzhen
Ph.D. in Mathematics
University of Barcelona
BA in Mathematics (Licenciatura)
University of Barcelona

Philip G. Moscoso
Technology and Operations Management
IESE Business School, University of Navarra
Ph.D in Industrial Engineering and Management, ETH Zurich
M.Sc. in Chemical Engineering, ETH Zurich

Dr. Sanjay Dixit, M.D.
Director, EP Laboratories, Philadelphia VA Medical Center
Cardiovascular Medicine - Cardiac Arrhythmia
Univ of Penn School of Medicine

Dr. Han-Xiang Deng
MD., Ph.D
Associate Professor and Research Department
Division of Neuromuscular Medicine
Davee Department of Neurology and Clinical Neurosciences
Northwestern University Feinberg School of Medicine

Chief Author

Dr. R.K. Dixit (HON.)
M.Sc.,Ph.D.,FICCT
ChiefAuthor,India
Email: cheifauthor@globaljournals.org

Dean & Editor-in-Chief (HON.)

Vivek Dubey (HON.)
MS(IndustrialEngineering),
MS(MechanicalEngineering)
University of Wisconsin
FICCT
Editor-in-Chief, USA
editorusa@computerresearch.org

Er. Suyog Dixit
BE (HONS. in Computer Science), FICCT
SAP Certified Consultant
Technical Dean, India
Website: www.suyogdixit.com
Email:suyog@suyogdixit.com,
dean@computerresearch.org

Sangita Dixit
M.Sc., FICCT
Dean and Publisher, India
deanind@computerresearch.org

Contents of the Volume

i. Copyright Notice
ii. Editorial Board Members
iii. Chief Author and Dean
iv. Table of Contents
v. From the Chief Editor's Desk
vi. Research and Review Papers

1. Some Mathieu-type series associated with the I-function and generalized -Gauss hypergeometric function ***2-9***
2. On g- Closed Sets in a Topological Space ***10-12***
3. A Generalized Probability Distribution Pertaining To Product of Special Functions with Applications ***13-20***
4. Determination of copper (II) by simple extraction procedure prior to differential pulse polarography using 4-(2-hydroxy phenyl ethaminodiol), benzene-1,3-diol ***21-29***
5. Refraction As A Function Of Atomic Gravitation Fresh Insight Into The Natureof Space And A New Possibility In The Creation Of Metamaterials ***30-32***
6. Fixed-Dome Biodigester Construction And Determination Of Effects Of Temperature On The Performance ***33-40***

vii. Auxiliary Memberships
viii. Process of Submission of Research Paper
ix. Preferred Author Guidelines
x. Index

From the Chief Author's Desk

We see a drastic momentum everywhere in all fields now a day. Which in turns, say a lot to everyone to excel with all possible way. The need of the hour is to pick the right key at the right time with all extras. Citing the computer versions, any automobile models, infrastructures, etc. It is not the result of any preplanning but the implementations of planning.

With these, we are constantly seeking to establish more formal links with researchers, scientists, engineers, specialists, technical experts, etc., associations, or other entities, particularly those who are active in the field of research, articles, research paper, etc. by inviting them to become affiliated with the Global Journals.

This Global Journal is like a banyan tree whose branches are many and each branch acts like a strong root itself.

Intentions are very clear to do best in all possible way with all care.

Dr. R. K. Dixit
Chief Author
chiefauthor@globaljournals.org

Some Mathieu-type series associated with the I-function and generalized ω-Gauss hyper geometric function

GJSFR Classification (FOR)
230104.230109.230114

Dr. V. B. L. Chourasia[1] Ravi Shanker Dubey[2]

***Abstract*- Closed integral form expression have been established pertaining to the Mathieu-type a-series and associated alternating series whose terms involve I-function and generalized ω-Gauss hyper geometric function.**

Keywords-Dirichlet Series; I-Function; Integral representation of series; Laplace integral representation of Dirichlet series; Mathieu-type **a**-series and alternating **a**-series.

I. Introduction and Preliminaries

In a series of papers the authors, Srivastava and Tomovski considered the special Mathieu-type **a**-series and alternating Mathieu-type **a**-series, whose terms involve the well known Gauss hyper geometric function ${}_2F_1$, the generalized hyper geometric function ${}_pF_q$, the Fox-Wright ${}_1\psi_2$ function and Meiger's G-function and Fox's H-function. The results derived here concern among others closed integral form expressions for the series considered and bilateral bounding inequalities. Our aim in the present paper is to generalize the expression results for Mathieu-type **a**-series (and its alternating variants) whose terms involve I-function and generalized ω-Gauss hyper geometric function.

Saxena defined the I-function [11] as follows

$$I_{p_i,q_i:r}^{m,n}[z]=\frac{1}{2\pi i}\int_L \frac{\prod_{k=1}^{m}\Gamma(b_k-\beta_k\xi)\prod_{k=1}^{n}\Gamma(1-a_k+\alpha_k\xi)z^{\xi}\,d\xi}{\sum_{i=1}^{r}\left\{\prod_{k=m+1}^{q_i}\Gamma(1-b_{ki}+\beta_{ki}\xi)\prod_{k=n+1}^{p_i}\Gamma(a_{ki}-\alpha_{ki}\xi)\right\}}. \tag{1}$$

For conditions of convergence, asymptotic behaviour and other details, see [11].

Consider the Mathieu-type **a**-series $\tau_{\lambda,\mu}$ and its alternating variant $\tilde{\tau}_{\lambda,\mu}$ defined by

$$\tau_{\lambda,\mu}\left(I_{p_{i+1},q_i:r}^{m,n+1};c;s\right):=\sum_{j=1}^{\infty}\frac{I_{p_{i+1},q_i,r}^{m,n+1}\left(\frac{s}{c_j}\middle|\begin{matrix}(a_k,\alpha_k)_{1,n+1};(a_{ki},\alpha_{ki})_{n+2,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)}{c_j^{\lambda}(c_j+s)^{\mu}} \tag{2}$$

Author[2]-Department of mathematics
University of Rajasthan
Jaipur-302055
(E-mail:- ravishankerdubey@indiatimes.com)

$$\tilde{\tau}_{\lambda,\mu}\left(I^{m,n+1}_{p_{i+1},q_i:r};c;s\right):=\sum_{j=1}^{\infty}\frac{(-1)^{j-1}\,I^{m,n+1}_{p_{i+1},q_i:r}\left(\frac{s}{c_j}\middle|\begin{matrix}(a_k,\alpha_k)_{1,n+1};(a_{ki},\alpha_{ki})_{n+2,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)}{c_j^{\lambda}\left(c_j+s\right)^{\mu}},$$

(3)

where we make the convention that the real sequence $\mathbf{c} = \{c_n\}_{n\in N}$ increases and tends to ∞, equivalently,

$$\mathbf{c}: 0 < c_1 < c_2 < \ldots c_n \uparrow \infty. \tag{4}$$

II. Integral Representations of $\tau_{\lambda,\mu}\left(I^{m,n+1}_{p_{i+1},q_i:r};c;s\right)$ and $\tilde{\tau}_{\lambda,\mu}\left(I^{m,n+1}_{p_{i+1},q_i:r};c;s\right)$

In the course of our investigation, one of the main tool is the following result providing the Laplace transform of

$$x^{\lambda-1}\,I^{m,n}_{p_i,q_i:r}\left(wx|.\right),\ \text{for real } w$$

$$\int_0^{\infty}e^{-Ax}\,x^{\lambda-1}\,I^{m,n}_{p_i,q_i:r}\left(wx^{\rho}\middle|\begin{matrix}(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)dx$$

$$=A^{-\lambda}\,I^{m,n+1}_{p_{i+1},q_i:r}\left(\frac{w}{A^{\rho}}\middle|\begin{matrix}(1-\lambda,\rho),(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right), \tag{5}$$

where $p_i\ (i=1,2,...,r), q_i\ (i=1,2,...,r), m, n$ are integers satisfying $0 \le n \le p_i$, $0 \le m \le q_i\ (i=1,2,...,r)$; r is finite, α_j, β_j, α_{ji}, β_{ji} are real and positive and a_j, b_j, a_{ji}, b_{ji} are complex numbers; $\mathrm{Re}\left\{\lambda+\rho\frac{b_j}{\beta_j}\right\} > 0,\ j=1,2,...,m$,

The result in (5) can be establish easily.

Theorem 1: Let $\lambda > 0$, $\mu > 0$, $s > 0$, $a_{p+1} = 1-\lambda$, $\alpha_{p+1} = 1$ and let the sequence **c** satisfies (4). Then

$$\tau_{\lambda,\mu}\left(I^{m,n+1}_{p_{i+1},q_i,r};c;s\right)=\eta^{I}_{c}\left(\lambda+1,\mu\right)+\mu\,\eta^{I}_{c}\left(\lambda,\mu+1\right)$$

(6)

$$\tilde{\tau}_{\lambda,\mu}\left(I_{p_{i+1},q_i,r}^{m,n+1};c;s\right)=\tilde{\eta}_c^I(\lambda+1,\mu)+\mu\,\tilde{\eta}_c^I(\lambda,\mu+1),$$

(7)

where

$$\Im_c^I(u,v):=\int_{c_1}^{\infty}\frac{\left[c^{-1}(x)\right]}{x^u(s+x)^v}\,I_{p_{i+1},q_i:r}^{m,n+1}\left(\frac{s}{x}\middle|\begin{matrix}(u,1),(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)dx$$

(8)

$$\tilde{\Im}_c^I(u,v):=\int_{c_1}^{\infty}\frac{\sin^2\left(\frac{\pi}{2}\left[c^{-1}(x)\right]\right)}{x^u(r+x)^v}\,I_{p_{i+1},q_i:r}^{m,n+1}\left(\frac{s}{x}\middle|\begin{matrix}(u,1),(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)dx,$$

(9)

Where c: $R_+ \to R_+$ is an increasing function such that $c(x)|_{x\in N} = \mathbf{c}$, $c^{-1}(x)$ denotes the inverse of c (x), $[c^{-1}(x)]$ stands for the integer part of the quantity $c^{-1}(x)$.

Proof: On taking $z = c_n + s$ in the following known formula

$$\Gamma(\mu)z^{-\mu}=\int_0^{\infty}e^{-zt}\,t^{\mu-1}\,dt\qquad\left(\mathrm{Re}\{z\}>0,\ R\{\mu\}>0\right),$$

(10)

And on specifying $A = c_j$, $\rho = 1$, $\omega = s$ in (5) finally inserting $a_{p+1} = 1 - \lambda$, $\alpha_{p+1} = 1$, we conclude

$$\tau_{\lambda,\mu}\left(I_{p_{i+1},q_i,r}^{m,n+1};c;s\right)=\sum_{j=1}^{\infty}\frac{I_{p_{i+1},q_i:r}^{m,n+1}\left(\frac{s}{c_j}\middle|\begin{matrix}(1-\lambda,1),(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)}{c_j^{\lambda}(c_j+s)^{\mu}}$$

$$=\sum_{j=1}^{\infty}\int_0^{\infty}e^{-c_j\theta}\,\theta^{\lambda-1}\,I_{p_{i+1},q_i:r}^{m,n+1}\left(\theta s\middle|\begin{matrix}(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)ds\int_0^{\infty}\frac{t^{\mu-1}}{\Gamma\mu}e^{-(c_j+s)t}\,dt$$

$$=\frac{1}{\Gamma\mu}\int_0^{\infty}\int_0^{\infty}\left(\sum_{j=1}^{\infty}e^{-c_j(\theta+t)}\right)e^{-st}\,\theta^{\lambda-1}\,t^{\mu-1}\,I_{p_i,q_i:r}^{m,n}\left(\theta s\middle|\begin{matrix}(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)d\theta\,dt,\quad(11)$$

where $\mu > 0$.

The inside Dirichlet Series

$$D_c(\theta+t)=\sum_{j=1}^{\infty}e^{-(\theta+t)c_j} \tag{12}$$

Possesses the Laplace integral form representation [1, 2], such that we can express it as follows:

$$\begin{aligned} D_c(\theta,t) &= (\theta+t)\int_0^{\infty}e^{-(\theta+t)x}\left(\sum_{j:c_j\le x}1\right)dx \\ &= (\theta+t)\int_{c_1}^{\infty}e^{-(\theta+t)x}\left[c^{-1}(x)\right]dx \end{aligned} \tag{13}$$

with $\left[c^{-1}(x)\right]\equiv 0$ for $\left(x\in[0,c_1)\right)$.

Therefore, we conclude that

$$\tau_{\lambda,\mu}\left(I^{m,n+1}_{p_{i+1},q_i,r};c;s\right)=\frac{1}{\Gamma(\mu)}\int_0^{\infty}\int_0^{\infty}\int_{c_1}^{\infty}e^{-t(s+x)-\theta x}\,\theta^{\lambda}\,t^{\mu-1}\,I^{m,n}_{p_i,q_i:r}\left(\theta s\middle|\begin{matrix}(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)\left[c^{-1}(x)\right]d\theta\,dt\,dx \qquad (H_s)$$

$$+\frac{1}{\Gamma(\mu)}\int_0^{\infty}\int_0^{\infty}\int_{c_1}^{\infty}e^{-t(s+x)-\theta x}\,\theta^{\lambda-1}\,t^{\mu}\,I^{m,n}_{p_i,q_i:r}\left(\theta s\middle|\begin{matrix}(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)\left[c^{-1}(x)\right]d\theta\,dt\,dx. \qquad (H_t)$$

Since

$$\begin{aligned} H_s &= \frac{1}{\Gamma(\mu)}\int_{c_1}^{\infty}\left(\int_0^{\infty}e^{-\theta x}\,\theta^{\lambda}\;I^{m,n}_{p_{i+1},q_i:r}\left(\theta s\middle|\begin{matrix}(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)d\theta\right)\left(\int_0^{\infty}e^{-(x+s)t}\,t^{\mu-1}dt\right)\left[c^{-1}(x)\right]dx \\ &= \int_{c_1}^{\infty}\frac{\left[c^{-1}(x)\right]}{x^{\lambda+1}(s+x)^{\mu}}\,I^{m,n+1}_{p_{i+1},q_i:r}\left(\frac{s}{x}\middle|\begin{matrix}(-\lambda,1),(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)dx, \end{aligned}$$

introducing the auxiliary integral

$$\Im^{I}_{c}(u,v)=\int_{c_1}^{\infty}\frac{\left[c^{-1}(x)\right]}{x^{u}(s+x)^{v}}\,I^{m,n}_{p_i,q_i:r}\left(\frac{s}{x}\middle|\begin{matrix}(1-u,1)(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i}\\(b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i}\end{matrix}\right)dx$$

And

$$H_t = \frac{1}{\Gamma(\mu)} \int_{c_1}^{\infty} \left(\int_0^{\infty} e^{-\theta x}\, \theta^{\lambda-1}\; I^{m,n}_{p_{i+1},q_i:r}\left(\theta s \middle| \begin{matrix} (a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i} \\ (b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i} \end{matrix} \right) d\theta \right) \left(\int_0^{\infty} e^{-(x+s)t}\, t^{\mu} dt \right) \left[c^{-1}(x) \right] dx$$

$$= \mu \int_{c_1}^{\infty} \frac{\left[c^{-1}(x) \right]}{x^{\lambda} (s+x)^{\mu+1}}\, I^{m,n+1}_{p_{i+1},q_i:r}\left(\frac{s}{x} \middle| \begin{matrix} (-\lambda,1),(a_k,\alpha_k)_{1,n};(a_{ki},\alpha_{ki})_{n+1,p_i} \\ (b_k,\beta_k)_{1,m};(b_{ki},\beta_{ki})_{m+1,q_i} \end{matrix} \right) dx.$$

Now we can say that

$$H_s = \Im^{I}_{c}(\lambda+1,\mu) \qquad \text{and} \qquad H_t = \mu\, \Im^{I}_{c}(\lambda,\mu+1).$$

These proves the first assertion of the Theorem 1.

The derivation (7) is similar to the previous procedure; the only novelty is the new inside alternating Dirichlet series [3, section 4, p. 77], define as follows

$$\tilde{D}_c(\theta+t) = \sum_{j=1}^{\infty} (-1)^{j-1} e^{-c_j(\theta+t)}$$

$$= (\theta+t) \int_0^{\infty} e^{-(\theta+t)x} \left(\sum_{j:c_j \le x} (-1)^{j-1} \right) dx$$

$$= \frac{(\theta+t)}{2} \int_0^{\infty} e^{-(\theta+t)x} \left(1 - (-1)^{\left[c^{-1}(x) \right]} \right) dx$$

$$= (\theta+t) \int_0^{\infty} e^{-(\theta+t)x} \sin^2\left(\frac{\pi}{2} \left[c^{-1}(x) \right] \right) dx. \qquad (14)$$

This formula helps in proving the theorem.

III. Mathieu-type series with the generalized ω-Gauss hypergeometric function

Here we give the series representation of ${}^{\omega}_{e+f}R_{g+h}\left(\begin{matrix} a_1,\ldots,a_e;b_1,\ldots,b_f \\ c_1,\ldots,c_g;d_1,\ldots,d_h \end{matrix} \middle| z \right)$ which is the generalization of the ω-Gauss hyper geometric function [12, 13, 14].

$${}^{\omega}_{e+f}R_{g+h}\left(\begin{matrix} a_1,\ldots,a_e;b_1,\ldots,b_f \\ c_1,\ldots,c_g;d_1,\ldots,d_h \end{matrix} \middle| z \right) = \frac{\Gamma(d_1)\ldots\Gamma(d_h)}{\Gamma(b_1)\ldots\Gamma(b_f)} \sum_{k=0}^{\infty} \frac{(a_1)_k (a_2)_k \ldots (a_e)_k}{(c_1)_k (c_2)_k \ldots (c_g)_k} \frac{\Gamma(b_1+\omega k)\ldots\Gamma(b_g+\omega k)}{\Gamma(d_1+\omega k)\ldots\Gamma(d_h+\omega k)} \frac{z^k}{k!}, \qquad (15)$$

where a_e, b_f, c_g, d_h are complex numbers, $b_g + \omega k$ and $d_h + \omega k \neq 0, -1, -2, \ldots$ the series converges uniformly in the region $|z| < 1$, $\sum d_h - b_g > 0$.

Consider the Mathieu-type **a**-series $\mathfrak{U}_{\lambda,u}$ and its alternating variant $\tilde{\mathfrak{U}}_{\lambda,u}$ defined by

$$\mathfrak{U}_{\lambda,\mu}\left({}_{e+1+f}\overset{\omega}{R}_{g+h};c;r\right) := \sum_{j=1}^{\infty} \frac{{}_{e+1+f}\overset{\omega}{R}_{g+h}\left(-\frac{r}{c_j}\middle|\begin{matrix}a_{e+1};b_f\\ c_g;d_h\end{matrix}\right)}{c_j^{\lambda}\left(c_j+r\right)^{\mu}}, \tag{16}$$

and

$$\tilde{\mathfrak{U}}_{\lambda,\mu}\left({}_{e+1+f}\overset{\omega}{R}_{g+h};c;r\right) := \sum_{j=1}^{\infty} \frac{(-1)^{j-1}\,{}_{e+1+f}\overset{\omega}{R}_{g+h}\left(-\frac{r}{c_j}\middle|\begin{matrix}a_{e+1};b_f\\ c_g;d_h\end{matrix}\right)}{c_j^{\lambda}\left(c_j+r\right)^{\mu}}, \tag{17}$$

where sequence **c** is already defined

IV. Integral Representations of $\mathfrak{U}_{\lambda,u}\left({}_{e+1+f}\overset{\omega}{R}_{g+h};c;r\right)$ and $\tilde{\mathfrak{U}}_{\lambda,u}\left({}_{e+1+f}\overset{\omega}{R}_{g+h};c;r\right)$

In the course of our investigation, one of the main tool in the following result providing the Laplace transform of $x^{\lambda-1}\,{}_{e+f}\overset{\omega}{R}_{g+h}\left(wx\middle|.\right)$, that is

$$\int_0^{\infty} e^{-Ax}\,x^{\lambda-1}\,{}_{e+f}\overset{\omega}{R}_{g+h}\left(\begin{matrix}a_e;b_f\\ c_g;d_h\end{matrix}\middle|-wx\right)dx = A^{-\lambda}\,\Gamma(\lambda)\,{}_{e+1+f}\overset{\omega}{R}_{g+h}\left(\begin{matrix}\lambda,a_e;b_f\\ c_g;d_h\end{matrix}\middle|-\frac{w}{A}\right), \tag{18}$$

where $\mathrm{Re}\{A\} > 0$, $\mathrm{Re}\{\lambda\} > 0$, a_e, b_f, c_g, d_h are complex numbers, $w \in R^+$, $b_g + \omega k$ and $d_h + \omega k \neq 0, -1, -2, \ldots$ the series converges uniformly in the region $|z| < 1$ and $\sum d_h - b_g > 0$.

Theorem 2: Let $\lambda > 0$, $\mu > 0$, $r > 0$, $a_{e+1} = \lambda$ and let the sequence **c** satisfies (4). Then

$$\mathfrak{U}_{\lambda,\mu}\left({}_{e+1+f}\overset{\omega}{R}_{g+h};c;r\right) = \left(\Im_c^{\overset{\omega}{R}}(\lambda+1,\mu)+\mu\Im_c^{\overset{\omega}{R}}(\lambda,\mu+1)\right) \tag{19}$$

and

$$\tilde{\mathfrak{U}}_{\lambda,\mu}\left({}_{e+1+f}\overset{\omega}{R}_{g+h};c;r\right) = \left(\tilde{\Im}_c^{\overset{\omega}{R}}(\lambda+1,\mu)+\mu\tilde{\Im}_c^{\overset{\omega}{R}}(\lambda,\mu+1)\right), \tag{20}$$

where

$$\Im_{c}^{\omega R}(u,v) := \int_{c_1}^{\infty} \frac{\left[c^{-1}(x)\right]}{x^{u}(x+r)^{v}}\, {}_{e+1+f}\overset{\omega}{R}_{g+h}\left(\begin{matrix} a_e, u; b_f \\ c_g; d_h \end{matrix}\middle| -\frac{r}{x}\right) dx \tag{21}$$

and

$$\tilde{\Im}_{c}^{\omega R}(u,v) := \int_{c_1}^{\infty} \frac{\sin^2\left(\frac{\pi}{2}\left[c^{-1}(x)\right]\right)}{x^{u}(x+r)^{v}}\, {}_{e+1+f}\overset{\omega}{R}_{g+h}\left(\begin{matrix} a_e, u; b_f \\ c_g; d_h \end{matrix}\middle| -\frac{r}{x}\right) dx, \tag{22}$$

where $c : R_+ \to R_+$ is an increasing function.

Proof: On taking $A = c_j$, $w = r$ in (18) and inserting $a_{e+1} = \lambda$, we conclude that

$$\upsilon_{\lambda,\mu}\left({}_{e+1+f}\overset{\omega}{R}_{g+h}; c; r\right) = \sum_{j=1}^{\infty} \frac{{}_{e+1+f}\overset{\omega}{R}_{g+h}\left(-\frac{r}{c_j}\middle| \begin{matrix} \lambda, a_e; b_f \\ c_g; d_h \end{matrix}\right)}{c_j^{\lambda}(c_j+r)^{\mu}}$$

$$= \sum_{j=1}^{\infty} \frac{1}{\Gamma(\lambda)} \int_0^{\infty} e^{-c_j\theta}\, \theta^{\lambda-1}\, {}_{e+f}\overset{\omega}{R}_{g+h}\left(-r\theta\middle|_{c_g; d_h}^{a_e; b_f}\right) d\theta \int_0^{\infty} \frac{t^{\mu-1}}{\Gamma(\mu)} e^{-(c_j+r)t}\, dt$$

$$= \frac{1}{\Gamma(\lambda)\Gamma(\mu)} \int_0^{\infty}\int_0^{\infty} \left(\sum_{j=1}^{\infty} e^{-c_j(\theta+t)}\right) e^{-rt}\, \theta^{\lambda-1}\, t^{\mu-1}\, {}_{e+f}\overset{\omega}{R}_{g+h}\left(-r\theta\middle|_{C_g; d_h}^{a_e; b_f}\right) d\theta\, dt,$$

and on using the result of (13) and (14), we obtain

$$\upsilon_{\lambda,\mu}\left({}_{e+1+f}\overset{\omega}{R}_{g+h}; c; r\right) = \frac{1}{\Gamma(\lambda)\Gamma(\mu)} \int_0^{\infty}\int_0^{\infty}\int_{c_1}^{\infty} e^{-(r+x)t-\theta x}\, \theta^{\lambda}\, t^{\mu-1}\, {}_{e+f}\overset{\omega}{R}_{g+h}\left(-r\theta\middle|_{c_g; d_h}^{a_e; b_f}\right)\left[c^{-1}(x)\right] d\theta\, dt\, dx$$

$$+ \frac{1}{\Gamma(\lambda)\Gamma(\mu)} \int_0^{\infty}\int_0^{\infty}\int_{c_1}^{\infty} e^{-(r+x)t-\theta x}\, \theta^{\lambda-1}\, t^{\mu}\, {}_{e+f}\overset{\omega}{R}_{g+h}\left(-r\theta\middle|_{c_g; d_h}^{a_e; b_f}\right)\left[c^{-1}(x)\right] d\theta\, dt\, dx$$

$$= \int_{c_1}^{\infty} \frac{\left[c^{-1}(x)\right]}{x^{\lambda+1}(x+r)^{\mu}}\, {}_{e+f}\overset{\omega}{R}_{g+h}\left(\begin{matrix} a_e, \lambda+1; b_f \\ c_g; d_h \end{matrix}\middle| -\frac{r}{x}\right) dx$$

$$+ \mu \int_{c_1}^{\infty} \frac{\left[c^{-1}(x)\right]}{x^{\lambda}(x+r)^{\mu+1}}\, {}_{e+f}\overset{\omega}{R}_{g+h}\left(\begin{matrix} a_e, \lambda; b_f \\ c_g; d_h \end{matrix}\middle| -\frac{r}{x}\right) dx,$$

and finally, we get

$$\upsilon_{\lambda,\mu}\left({}_{e+1+f}\overset{\omega}{R}_{g+h}\,;c;r\right)=\Im_{c}^{\overset{\omega}{R}}\left(\lambda+1,\mu\right)+\mu\,\Im_{c}^{\overset{\omega}{R}}\left(\lambda,\mu+1\right).$$

In a similar manner, we can easily obtain

$$\tilde{\upsilon}_{\lambda,\mu}\left({}_{e+1+f}\overset{\omega}{R}_{g+h}\,;c;r\right)=\tilde{\Im}_{c}^{\overset{\omega}{R}}\left(\lambda+1,\mu\right)+\mu\,\tilde{\Im}_{c}^{\overset{\omega}{R}}\left(\lambda,\mu+1\right)$$

V. Consequences and Important Special Cases

Many well known special functions, such as erf(x), and the Bessel, Fox-Wright $\tilde{\psi}$, Whittaker, Meijer G-, and generalized hyper geometric functions ${}_pF_q$, and Jacobi polynomials and other elliptic functions are included in the class of functions which can be expressed in terms of I-function. We give below certain known results pertaining to the Theorem 1 and Theorem 2.

- For r = 1, the result given in Theorem 1 reduced to a known result recently obtained in [7].
- Taking r = 1 and $\alpha_j = \beta_j = \alpha_{ji} = \beta_{ji} = 1$, the Theorem 1 reduced to another known result established in [5].
- Taking $\omega = 0$, the Theorem 2 reduces to the known result given in [7].

VI. References

1) T. K. Pogány, Integral representations of a series which includes the Mathieu **a**-series, J. Math. Anal. Appl. 296 (2004) 309-313.
2) T. K. Pogány, Integral representation of Mathieu (**a**, λ)-series, Integral Transforms Spec. Funct. 16 (8) (2005) 685-689.
3) T. K. Pogány, H. M. Srivastava, Ž. Tomovski, Some families of Mathieu **a**-series and alternative Mathieu **a**-series, Appl. Math. Comput. 173 (1) (2006) 69-108.
4) T. K. Pogány, Ž. Tomovski, On multiple generalized Mathieu series, Integral Transforms Spec. Funct. 17 (4) (2006) 285-293.
5) T. K. Pogány, Ž. Tomovski, On Mathieu-type series which terms contain generalized hypergeometric function pFq and Meijer's G-function (submitted for publication).
6) H. M. Srivastava, Ž. Tomovski, Some problems and solutions involving Mathieu's series and its generalization, J. Inequal. Pure Appl. Math. 5 (2) (2004) 1-13. (electronic) Article 45.
7) T. K. Pogány, Integral expression for Mathieu-type series whose terms contain Fox's H-function, Applied Mathematics Letters 20 (2007) 764-769.
8) A. M. Mathai, R. K. Saxena, The H-function with Application in Statics and Other Disciplines, Wiley Eastern Ltd., New Delhi, 1978.
9) H. M. Srivastava, K. C. Gupta, S. P. Goyal, The H-functions of One and Two Variables with Applications, South Asian Publishers, New Delhi, 1982.
10) N. Laskin, Lévy flights over quantum paths, Commun. Nonlinear Sci. Numer. Simul. 12 (1) (2007) 2-18.
11) The I-Function, V. P. Saxena, Anamaya Publishers, New Delhi, 2008.
12) I. Ali, S. L. Kalla, H. G. Khajah, Integral transforms and special functions, (2001), vol. 12, No. 2, pp. 101-114.
13) N. Virchenko, S. L. Kalla, and A. Al-Zamel, Some results on a generalized hypergeometric function, Integral Transform, Spec. Funct. 12 (2001), no. 1, 89-100.
14) N. A. Virchenko, On some generalizations of the function of hypergeometric type, Fract. Calc. Appl. Anal. 2 (1999), no. 3, 233-244.

On g- Closed Sets in a Topological Space

Dedicated to Professor S. Chowdhary on his 65th birthday

M.P. Chaudhary[1] Vinesh Kumar[2, 3]

GJSFR Classification (FOR)
010106.010108.010204

The purpose of this research article is to explain the meaning of g-closed sets, which is more understandable to the readers.

I. Interior of a Set

Let *A* be a subset of a topological space X. A point $p \in A$ is called an interior point of *A*, if p belongs to an open set G contained in *A* i.e. $p \in G \subset A$.
The set of interior points of *A* is denoted by int (*A*) or A^o, which is called the interior of *A*.

II. Closure of a Set

Let *A* be a subset of a topological space X. The closure of *A* is defined as the intersection of all closed super sets of *A*.

Closure of *A* is denoted by $\bar{A}$ or A^-

III. g-Closed Set

Let (X, τ) be a topological space and *A* be its subset, then *A* is called an g-closed set if $\tau - Cl(A) \subseteq u$, whenever $A \subseteq u$ and $u \in \tau$ (i.e. u is a open set). .
Now, Let X = {a, b, c, d, e} be a non-empty set and

$$\tau = \{\phi, X, \{a, b, c\}, \{d, e, \}, \{c\}, \{d, e, c\}\}$$

is a collection of subset of X

A. Show that τ is a Topology defined on X

(i) $\phi, X \in \tau$.

(ii) $\phi \cup X = X \in \tau$

$X \cup \{a, b, c\} = X \in \tau$

$\{a,b, c\} \cup \{d, e\} = \{a, b, c, d, e\} = X \in \tau$

$\{d, e\} \cup \{c\} = \{d, e, c\} \in \tau$

$\{c\} \cup \{d, e, c\} = \{d, e, c\} \in \tau$

(iii) $\phi \cap X = \phi \in \tau$
$X \cap \{a, b, c\} = \{a, b, c\} \in \tau$
$\{a, b, c\} \cap \{d, e\} = \phi \in \tau$
$\{d, e\} \cap \{c\} = \phi \in \tau$
$\{c\} \cap \{d, e, c\} = \{c\} \in \tau$

Here all three conditions for topology is satisfied, it means that τ is a topology on X.
Now we have all possible subsets of $X = 2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$, which are given below.
ϕ, X, {a}, {b}, {c}, {d}, {e}, {a, b}, {a, c}, {c, d}, {d, e}, {a, e}, {a, c}, {a, d}, {b, d}, {b, e}, {c, e}, {a, b, c}, {a, b, d}, {a, b, e}, {a, c, d}, {a, c, e}, {b, c, d}, {b, c, e}, {c, d, e}, {d, e, a}, {d, e, b}, {a, b, c, d}, {a, b, c, e}, {b, c, d, e}, {c, e, d, a}, {d, e, a, b}

B. Verifications for g-closed sets

As given, X = {a, b, c, d, e}
And, $\tau = \{\phi, X, \{a, b, c\}, \{d, e\}, \{c\}, \{d, e, c\}\}$
Now we have also
Open sets: ϕ, X, {a, b, c}, {d, e}, {c}, {d, e, c}
Closed sets: X, ϕ, {d, e}, {a, b, c}, {a, b, d, e}, {a, b}
Now as per definition of g-closed set, here we are verifying for all (32) subsets of X;

(i) Let $A = \{a\}$, $u = \{a, b, c\}$ such that $A \subseteq u$
   a. Then $\tau - Cl(A) = \{a\}^- = \{a, b\} \subseteq u$ (i.e. g-closed set)

(ii) Let $A = \{b\}$, $u = \{a, b, c\}$ such that $A \subseteq u$
   a. Then $\tau - Cl(A) = \{b\}^- = \{a, b\} \subseteq u$ (i.e. g-closed set)

(iii) Let $A = \{c\}$, $u = \{a, b, c\}$ such that $A \subseteq u$
   a. Then $\tau - Cl(A) = \{c\}^- = \{a, b\} \subseteq u$ (i.e. g-closed set)

(iv) Let $A = \{d\}$, $u = \{d, e\}$ such that $A \subseteq u$
   a. Then $\tau - Cl(A) = \{d\}^- = \{d, e\} \subseteq u$ (i.e. g-closed set)

(v) Let $A = \{e\}$, $u = \{d, e\}$ such that $A \subseteq u$
   a. Then $\tau - Cl(A) = \{d\}^- = \{d, e\} \subseteq u$ (i.e. g-closed set)

(vi) Let $A = \{a, b\}$, $u = \{a, b, c\}$ such that $A \subseteq u$
   a. Then $\tau - Cl(A) = \{a, b\}^- = \{a, b\} \subseteq u$ (i.e. g-closed set)

(vii) Let $A = \{a, c\}$, $u = \{a, b, c\}$ such that $A \subseteq u$
   a. Then $\tau - Cl(A) = \{a, c\}^- = \{a, b, c\} \subseteq u$ (i.e. g-closed set)

(viii) Let $A = \{c, d\}$, $u = \{d, e, c\}$ such that $A \subseteq u$
   a. Then $\tau - Cl(A) = \{c, d\}^- = \{a, b\} \not\subseteq u$ (i.e. **NOT** g-closed set)

Author[1]-American Mathematical Society, Providence, USA (e-mail: mpchaudhary_2000@yahoo.co)
Author[2]-JRF (December 2009, All India Rank 67) CSIR, GOI, New Delhi, India
Author[3]-Department of Mathematics, Hindu College (University of Delhi), Delhi, India

(ix) Let $A = \{d, e\}$, $u = \{d, e, c\}$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{d, e\}^- = \{d, e\} \subseteq u$ (i.e. g-closed set)

(x) Let $A = \{a, e\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, e\}^- = \{a, b, d, e\} \subseteq u$ (i.e. g-closed set)

(xi) Let $A = \{a, c\}$, $u = \{a, b, c\}$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, c\}^- = \{a, b, c\} \subseteq u$ (i.e. g-closed set)

(xii) Let $A = \{a, d\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, d\}^- = \{a, b, d, e\} \subseteq u$ (i.e. g-closed set)

(xiii) Let $A = \{b, d\}$, $u = X$, such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{b, d\}^- = \{a, b, d, e\} \subseteq u$ (i.e. g-closed set)

(xiv) Let $A = \{b, e\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{b, e\}^- = \{a, b, d, e\} \subseteq u$ (i.e. g-closed set)

(xv) Let $A = \{c, e\}$, $u = \{d, e, c\}$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{c, e\}^- = X \not\subseteq u$ (i.e. **NOT** g-closed set)

(xvi) Let $A = \{a, b, c\}$, $u = \{a, b, c\}$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, b, c\}^- = \{a, b, c\} \subseteq u$ (i.e. g-closed set)

(xvii) Let $A = \{a, b, d\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, b, d\}^- = \{a, b, d, e\} \subseteq u$ (i.e. g-closed set)

(xviii) Let $A = \{a, b, e\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, b, e\}^- = \{a, b, d, e\} \subseteq u$ (i.e. g-closed set)

(xix) Let $A = \{a, c, d\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, c, d\}^- = X \subseteq u$ (i.e. g-closed set)

(xx) Let $A = \{a, c, e\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, c, e\}^- = X \subseteq u$ (i.e. g-closed set)

(xxi) Let $A = \{b, c, d\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{b, c, d\}^- = X \subseteq u$ (i.e. g-closed set)

(xxii) Let $A = \{b, c, e\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{b, c, e\}^- = X \subseteq u$ (i.e. g-closed set)

(xxiii) Let $A = \{c, d, e\}$, $u = \{d, e, c\}$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{c, d, e\}^- = X \not\subseteq u$ (i.e. **NOT** g-closed set)

(xxiv) Let $A = \{d, e, a\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{d, e, a\}^- = \{d, e\} \subseteq u$ (i.e. g-closed set)

(xxv) Let $A = \{d, e, b\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{d, e, b\}^- = \{a, b, d, e\} \subseteq u$ (i.e. g-closed set)

(xxvi) Let $A = \{a, b, c, d\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, b, c, d\}^- = X \subseteq u$ (i.e. g-closed set)

(xxvii) Let $A = \{a, b, c, e\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{a, b, c, e\}^- = X \subseteq u$ (i.e. g-closed set)

(xxviii) Let $A = \{b, c, d, e\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{b, c, d, e\}^- = X \subseteq u$ (i.e. g-closed set)

(xxix) Let $A = \{c, e, d, a\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{c, e, d, a\}^- = X \subseteq u$ (i.e. g-closed set)

(xxx) Let $A = \{d, e, a, b\}$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \{d, e, a, b\}^- = \{a, b, d, e\} \subseteq u$ (i.e. g-closed set)

(xxxi) Let $A = X$, $u = X$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = X^- = X \subseteq u$ (i.e. g-closed set)

(xxxii) Let $A = \phi$, $u = \phi$ such that $A \subseteq u$
a. Then $\tau - Cl(A) = \phi^- = \phi \subseteq u$ (i.e. g-closed set)

Therefore, we have 29 g-closed sets, which are the subsets of the set $X = \{a, b, c, d, e\}$.

IV. Conclusion

Here we find 29 g-closed sets out of 32 subsets of $X = \{a, b, c, d, e\}$ with $\tau = \{\phi, X \{a, b, c\}, \{d, e\}, \{c\}, \{d, e, c\}\}$ as given below

ϕ, X, {a}, {b}, {c}, {d}, {e}, {a, b}, {a, c}, {d, e}, {a, e}, {a, c}, {a, d}, {b, d}, {b, e}, {a, b, c}, {a, b, d}, {a, b, e}, {a, c, d}, {a, c, e}, {b, c, d}, {b, c, e}, {d, e, a}, {d, e, b}, {a, b, c, d}, {a, b, c, e}, {b, c, d, e}, {c, e, d, a}, {d, e, a, b}
Total : 29

Also following 3 subsets of X are NOT g-closed sets as given below:

{c, d}, {c, e}, {c, d, e}
Total : 03

V. References

Levine, N. : Semi open sets and semi continuity in topological spaces. Amer. Math. Monthly, 70., 1963., 36-41.

Abd El- Monsef, M.E., El-Deeb, S.N. & Mahmoud, R.A. : β-open sets and β-continuous Mappings. Bull. Fac. Sci. Assiut Univ., 12(1)., 1983., 77-90.

Andrijevic, D. : Semi-preopen sets. Mat. Vesnik, 38., 1986., 24-32.

Levine, N. : Generalized closed sets in topology. Rend. Circ. Mat. Palermo, 19(2)., 1970., 89-96.

Bhattacharyya, P. & Lahiri, B.K. : Semi generalized closed sets in topology. Indian J. Math., 29., 1987., 375-382.

Biswas, N. : Characterization of semicontinuous mappings. Atti. Accad. Naz. Lience. Rend. Cl. Sci. Fis. Mat. Nat. (8)., 48., 1970., 399-402.

Jankovic, D.S. & Reilly, I.L. : On semi-separation properties. Indian J. Pure & Appl. Math., 16(9)., 1985., 957-964.

A Generalized Probability Distribution Pertaining To Product of Special Functions with Applications

Dr. V.B.L. Chaurasia[1], Jagdev Singh[2]

GJSFR Classification (FOR) 230109.230201.230204

***Abstract*-The aim of the present paper is to study a generalized probability distribution involving M-series and H-function. Here, we first obtain the distribution function for the probability density function and then apply the technique of convolution to obtain the distribution of sum of two independent random variables with p.d.f. involving the generalized hyper geometric function. The results obtained here are unified in nature and capable of yielding a very large number of corresponding results (new and known) involving simpler special functions and polynomials as special cases of our results.**

Keywords- Probability density function, distribution function, H-function, M-series.

I. Introduction

In this paper we consider a general class of statistical probability distribution, having the probability density function

$$f(x)= \frac{x^{\lambda-1}}{C(1+\beta x)^{\mu}} {}_r\overset{\alpha}{M}_s\left[\frac{\omega x^{\gamma}}{(1+\beta x)^{\eta}}\right]$$

$$\times H_{p,q}^{m,n}\left[\frac{zx^{\rho}}{(1+\beta x)^{\sigma}}\middle| \begin{matrix}(a_j,A_j)_{1,p}\\(b_j,B_j)_{1,q}\end{matrix}\right], \quad \ldots(1)$$

for $0 < x < \infty$ and $f(x) = 0$ for other values of x and the constant C is given by

$$C=\beta^{-\lambda}\sum_{k=0}^{\infty}\frac{(u_1)_k\ldots(u_r)_k}{(v_1)_k\ldots(v_s)_k}\frac{w^k}{\Gamma(\alpha k+1)}\beta^{-\gamma k}$$

$$\times H_{p+2,q+1}^{m,n+2}\left[\frac{z}{\beta^{\rho}}\middle| \begin{matrix}(1-\lambda-\gamma k,\rho),(1-\mu-\eta k+\lambda+\gamma k,\sigma-\rho),(a_j,A_j)_{1,p}\\(b_j,B_j)_{1,q},(1-\mu-\eta k,\sigma)\end{matrix}\right]. \quad (2)$$

Author[1]-Department of Mathematics, University of Rajasthan, Jaipur-302055, Rajasthan, India
Author[2]-Department of Mathematics, Jagannath University, Village- Rampura, Tehsil- Chaksu, Jaipur-303901, Rajasthan, India
E-mail: jagdevsinghrathore@gmail.com

The M-series introduced by Sharma (2008) is defined as

$${}_r\overset{\alpha}{M}_s(u_1,\ldots,u_r;v_1,\ldots,v_s,w)=\sum_{k=0}^{\infty}\frac{(u_1)_k\ldots(u_r)_k}{(v_1)_k\ldots(v_s)_k}\frac{w^k}{\Gamma(\alpha k+1)}. \quad \ldots(3)$$

For convergence conditions and other details of M-series, see Sharma (2008).

The H-function introduced by Fox (1961) is defined as

$$H_{p,q}^{m,n}\left[z\middle| \begin{matrix}(a,A)_{1,p}\\(b,B)_{1,q}\end{matrix}\right]=$$

$$\frac{1}{2\pi i}\int_{-i\infty}^{+i\infty}\frac{\prod_{j=1}^{m}\Gamma(b_j-B_j\xi)\prod_{j=1}^{n}\Gamma(1-a_j+A_j\xi)}{\prod_{j=m+1}^{q}\Gamma(1-b_j+B_j\xi)\prod_{j=n+1}^{p}\Gamma(a_j-A_j\xi)}z^{\xi}\,d\xi. \quad \ldots \quad (4)$$

For convergence conditions and other details of H-function see Fox (1961).

The following conditions are assumed to be satisfied

(i) $\mu > \lambda+\gamma k>0,\ \beta>0, \sigma\geq\rho>0,$

(ii) $\lambda+\gamma k+\rho\min_{i\leq j\leq m}\left(\frac{b_j}{B_j}\right)>0,$

(iii) $(\lambda+\gamma k-\mu-\eta k)+(\rho-\sigma)\min_{i\leq j\leq n}\left(\frac{a_j-1}{A_j}\right)<0,$

(iv) $\Delta=\sum_{j=1}^{m}B_j-\sum_{j=m+1}^{q}B_j+\sum_{j=1}^{n}A_j-\sum_{j=n+1}^{p}A_j>0,$

(v) $r\leq s,\ |w|<1.$

(vi) The parameters involved in (1) are real and so restricted that f(x) remains positive for $0 < x < \infty$. …(5)

The p.d.f. f(x) given by (1) is generalization of the generalized F-distribution defined by Malik (1967). It is also shown that the p.d.f. defined by Mathai and Saxena (1971) is particular case of the p.d.f. f(x) given by (1).

II. The Distribution Function

The distribution function F(x) for p.d.f. f(x) is given by

$$F(x) = \int_0^{\infty} f(t)\, dt \qquad \ldots(6)$$

Now, substituting the value of f(t) from (1), expressing the M-series in series form and the H-function in the form given by (4), interchanging the order of summation and integration and putting $y = \beta t/(1+\beta t)$ in the resulting integral, we get

$$F(x) = \frac{1}{C\beta^{\lambda}} \sum_{k=0}^{\infty} \frac{(u_1)_k \ldots (u_r)_k}{(v_1)_k \ldots (v_s)_k} \frac{w^k}{\Gamma(\alpha k+1)}$$

$$\times \frac{1}{\beta^{\gamma k}} \frac{1}{2\pi i} \int_{-i\infty}^{+i\infty} \left(\frac{z}{\beta^{\rho}} \right)^{\xi} \phi(\xi)\, d\xi$$

$$\times \int_0^{\frac{\beta}{1+\beta x}} y^{\lambda+\gamma k+\rho\xi-1} (1-y)^{\mu+\eta k+(\sigma-\rho)\xi-\lambda-\gamma k-1}\, dy$$

, … (7)

where C is given by (2) and

$$\phi(\xi) = \frac{\prod_{j=1}^{m} \Gamma(b_j - B_j\xi) \prod_{j=1}^{n} \Gamma(1-a_j+A_j\xi)}{\prod_{j=m+1}^{q} \Gamma(1-b_j+B_j\xi) \prod_{j=n+1}^{p} \Gamma(a_j-A_j\xi)}$$

. … 8)

Further, writing the incomplete beta function occurring in (7) in terms of Gauss hyper geometric function using a result (Erdélyi et al. (1954, p.87)), applying Euler's transformation formula (Erdélyi et al. (1954, p.64, eq.(23))) and expressing the result thus obtained in terms of H-function of two variables with the help of (Srivastava, Gupta and Goyal (1982, p.84, eq.(6.2.1))), we arrive at the following result after a little simplification

$$F(x) = \frac{x^{\lambda}}{C(1+\beta x)^{\mu}} \sum_{k=0}^{\infty} \frac{(u_1)_k \ldots (u_r)_k}{(v_1)_k \ldots (v_s)_k} \frac{w^k}{\Gamma(\alpha k+1)} \frac{x^{\gamma k}}{(1+\beta x)^{\eta k}}$$

$$\times H_{1,1;p+1,q+1:1,1}^{0,1;m,n+1:1,1}\left[\frac{zx^{\rho}}{(1+\beta x)^{\sigma}}\,\middle|\,\begin{matrix}(1-\mu-\eta k:\sigma,1):(1-\lambda-\gamma k,\rho),(a_j,A_j)_{1,p};(0,1)\\ (-\lambda-\gamma k:\rho,1):(b_j,B_j)_{1,q},(1-\mu-\eta k,\sigma);(0,1)\end{matrix}\right] \quad \ldots (9)$$

III. Particular cases

(1) If we set k = 0, ρ = σ and β = 0, we get the result obtained by Mathai and Saxena (1971, p.201, eq. (132)) and also by Srivastava and Singhal (1972, p.6, eq. (14)) after a little simplification.

(2)On taking k = 0, ρ = σ = 1, z = – β in (1) and reducing the Fox's H-function to generalized hypergeometric function ${}_pF_q$ with the help of known result (Srivastava and Daoust (1982, p.18, eq.(2.6.3))) the p.d.f. (1) reduces to the following form

$$f(x) = \begin{cases} \dfrac{x^{\lambda-1}}{C_1(1+\beta x)^{\mu}}\,{}_pF_q\left[(a_p);(b_q);\dfrac{\beta x}{1+\beta x}\right] \\ 0, \quad \text{otherwise} \end{cases} \quad \ldots (10)$$

where

$$C_1 = B[\lambda,\mu-\lambda]\beta^{-\lambda}\,{}_{p+1}F_{q+1}[\lambda,(a_p);\mu,(b_q);1] \quad \ldots (11)$$

and the corresponding distribution function as obtained from (9) is given by

$$F(x) = \frac{x^{\lambda}}{C_1\lambda(1+\beta x)^{\lambda}}\,F_{1:q;0}^{1:p;1}\left[\begin{matrix}\lambda:a_1,\ldots,a_p;\lambda-\mu;\dfrac{\beta x}{1+\beta x}\\ 1+\lambda:b_1,\ldots b_q;--;\dfrac{\beta x}{1+\beta x}\end{matrix}\right], \quad \ldots (12)$$

provided that | βx | < 1 and the conditions easily obtainable from those stated in (5) are satisfied.

(3) On taking α = 1 in (1), the M-series reduces to generalized hypergeometric function ${}_rF_s$ (Sharma (2008, p.189,eq. (5))),we get

$$f(x) = \begin{cases} \dfrac{x^{\lambda-1}}{C_2(1+\beta x)^{\mu}}\,{}_rF_s\left[\dfrac{w\,x^{\gamma}}{(1+\beta x)^{\eta}}\right] \\ \quad \times H_{p,q}^{m,n}\left[\dfrac{zx^{\rho}}{(1+\beta x)^{\sigma}}\,\middle|\,\begin{matrix}(a_j,A_j)_{1,p}\\ (b_j,B_j)_{1,q}\end{matrix}\right], \; x > 0 \\ 0, \quad \text{otherwise} \end{cases} \quad \ldots (13)$$

where

$$C_2 = \beta^{-\lambda} \sum_{k=0}^{\infty} \frac{(u_1)_k \ldots (u_r)_k}{(v_1)_k \ldots (v_s)_k} \frac{w^k}{k!} \beta^{-\gamma k}$$

$$\times H_{p+2,q+1}^{m,n+2}\left[\frac{z}{\beta^{\rho}} \middle| \begin{matrix} (1-\lambda-\gamma k,\rho),(1-\mu-\eta k+\lambda+\gamma k,\sigma-\rho),(a_j,A_j)_{1,p} \\ (b_j,B_j)_{1,q},(1-\mu-\eta k,\sigma) \end{matrix} \right]$$

, …(14)

and the corresponding distribution function as obtained from (9).

$$F(x) = \frac{x^{\lambda}}{C_2(1+\beta x)^{\mu}} \sum_{k=0}^{\infty} \frac{(u_1)_k \ldots (u_r)_k}{(v_1)_k \ldots (v_s)_k} \frac{w^k}{k!} \frac{x^{\gamma k}}{(1+\beta x)^{\eta k}}$$

$$\times H_{1,1;p+1,q+1:1,1}^{0,1;m,n+1:1,1}\left[\begin{matrix} \frac{zx^{\rho}}{(1+\beta x)^{\sigma}} \\ \frac{-\beta x}{1+\beta x} \end{matrix} \middle| \begin{matrix} (1-\mu-\eta k:\sigma,1):(1-\lambda-\gamma k,\rho),(a_j,A_j)_{1,p};(0,1) \\ (-\lambda-\gamma k:\rho,1):(b_j,B_j)_{1,q},(1-\mu-\eta k,\sigma);(0,1) \end{matrix} \right].$$

…(15)

(4) If we set r = s = 0 in (1), the M-series reduces to Mittag-Leffler function (Sharma (2008, p.188,eq.(4))), we get

$$f(x) = \begin{cases} \frac{x^{\lambda-1}}{C_3 (1+\beta x)^{\mu}} E_{\alpha}\left[\frac{w x^{\gamma}}{(1+\beta x)^{\eta}} \right] \\ \quad \times H_{p,q}^{m,n}\left[\frac{zx^{\rho}}{(1+\beta x)^{\sigma}} \middle| \begin{matrix} (a_j,A_j)_{1,p} \\ (b_j,B_j)_{1,q} \end{matrix} \right], x > 0 \\ 0, \text{ otherwise} \end{cases}$$

…(16)

where

$$C_3 = \beta^{-\lambda} \sum_{k=0}^{\infty} \frac{w^k}{\Gamma(\alpha k+1)} \beta^{-\gamma k}$$

$$\times H^{m,n+2}_{p+2,q+1}\left[\frac{z}{\beta^{\rho}}\,\middle|\,\begin{matrix}(1-\lambda-\gamma k,\rho),(1-\mu-\eta k+\lambda+\gamma k,\sigma-\rho),(a_j,A_j)_{1,p}\\(b_j,B_j)_{1,q},(1-\mu-\eta k,\sigma)\end{matrix}\right]$$

, …(17)

and the corresponding distribution function is given by

$$F(x) = \frac{x^{\lambda}}{C_3(1+\beta x)^{\mu}}\sum_{k=0}^{\infty}\frac{w^k}{\Gamma(\alpha k+1)}\frac{x^{\gamma k}}{(1+\beta x)^{\eta k}}$$

$$\times H^{0,1;m,n+1\ :1,1}_{1,1;p+1,q+1:1,1}\left[\frac{zx^{\rho}}{(1+\beta x)^{\sigma}},\frac{-\beta x}{1+\beta x}\,\middle|\,\begin{matrix}(1-\mu-\eta k:\sigma,1):(1-\lambda-\gamma k,\rho),(a_j,A_j)_{1,p};(0,1)\\(-\lambda-\gamma k:\rho,1):(b_j,B_j)_{1,q},(1-\mu-\eta k,\sigma);(0,1)\end{matrix}\right].$$

…(18)

IV. The Distribution of the Sum of Two Independent Random Variables

In this section, we shall obtain the distribution of the sum of two independent random variables with the p.d.f. as given by (10). By convolution formula, the distribution function G(y) of $Y = X_1 + X_2$ is given by

$$G(y) = \int_0^y F_1(y-x_2)\,f_2(x_2)\,dx_2 ,$$

… (19)

where $F_2(x_2)$ is the p.d.f. of the variable X_2 and $F_1(y-x_2)$ is the distribution function of the variate X_1. The result can be expressed in the form of following theorem:

Theorem 1. Let X_i (i = 1,2) be two independent random variables with p.d.f. defined by

$$f_i(x_i) = \begin{cases}\dfrac{x_i^{\lambda_i-1}}{L_i\,(1+\beta_i x_i)^{\mu_i}}\;{}_{p_i}F_{q_i}\left[(a^{(i)}_{p_i});(b^{(i)}_{q_i});\dfrac{\beta_i x_i}{1+\beta_i x_i}\right], & x>0\\ 0, & \text{otherwise}\end{cases}$$

(20)

Where for i = 1,2.

$$L_i = B[\lambda_i,\mu_i-\lambda_i]\beta_i^{-\lambda_i}\;{}_{p_i+1}F_{q_i+1}\left[\lambda_i,(a^{(i)}_{p_i});u_i(p^{(i)}_{q_i});1\right]$$

, (21)

and the following conditions are assumed to be satisfied, for i = 1,2

(i) $\mu_i > \lambda_i > 0,\ \beta_i > 0$,

(ii) $p_i \le q_i$ or $p_i = q_i + 1$ and

$$(\mu_i-\lambda_i)+\sum_{j=1}^{q_i}(b^{(i)}_j)-\sum_{j=1}^{p_i}(a^{(i)}_j)>0,$$

(iii) the parameters involved in (20) are so restricted that $f_i(x_i)$ remain positive for $0 < x_i < \infty$. Then the p.d.f. g(y) of $Y = X_1 + X_2$ is given by

$$g(y) = \frac{y^{\lambda_1+\lambda_2-1}}{L_1 L_2} B(\lambda_1,\lambda_2)\, F^{4:p_1;1;p_2:0;0}_{1:q_1;0;q_2+1;0;0}$$

$$\left[\begin{matrix}\beta_1 y\\ \beta_1 y\\ \beta_2 y\\ -\beta_2 y\\ -\beta_1 y\end{matrix}\middle|\begin{matrix}(\lambda_1;1,1,0,0,1), & (\lambda_2;0,0,1,1,0), (\mu_2,0,0,1,1,0),\\ & \\ & \\ & \\ (\lambda_1+\lambda_2,1,1,1,1,1), & ------\ , \ -------,\end{matrix}\right.$$

$$\left.\begin{matrix}(1+\lambda_1;1,1,0,0,1), ((a^{(1)}_{p_1}),1), (\lambda_1-\mu_1,1), ((a^{(2)}_{p_2}),1), -- & ,-- \\ & \\ -------- , ((b^{(1)}_{q_1}),1), - & -, ((b^{(2)}_{q_2}),1), (\mu_2,1), -- , --\end{matrix}\right],$$

…(22)

$|\beta_i y| < 1 \quad (i = 1,2)$.

Proof. On substituting the values of $F_1(y-x_2)$ and $f_2(x_2)$ as obtained from the equations (18) and (20) respectively in equation (19), we get

$$G(y) = \frac{1}{\lambda_1 L_1 L_2}\int_0^y \frac{(y-x_2)^{\lambda_1}\, x_2^{\lambda_2-1}}{(1+\beta_1(y-x_2))^{\lambda_1}(1+\beta_2 x_2)^{\mu_2}}$$

.

$$F^{1:p_1;1}_{1:q_1;0}\left[\begin{matrix}\lambda_1:a^{(1)}_1,\ldots,a^{(1)}_{p_1};\lambda_1-\mu_1;\frac{\beta_1(y-x_2)}{1+\beta_1(y-x_2)}\\ 1+\lambda_1:b^{(1)}_1,\ldots,b^{(1)}_{q_1};-\ ;\frac{\beta_1(y-x_2)}{1+\beta_1(y-x_2)}\end{matrix}\right] {}_{p_2}F_{q_2}\left[(a^{(2)}_{p_2});(b^{(2)}_{q_2});\frac{\beta_2 x_2}{1+\beta_2 x_2}\right] dx_2$$

…(23)

Now, expressing the generalized Kampé de Fériet function and the generalized hypergeometric function in series form using the results (Bryson (1974, p.27, eq. (28) and p.19, eq. (23)and interchanging the order of integration and summations, then substituting $x_2 = yz$ in the resulting integral, and after a little simplification, we get

$$G(y) = \frac{y^{\lambda_1+\lambda_2}}{\lambda_1 L_1 L_2} \sum_{r_1,r_2,r=0}^{\infty}$$

$$\times \frac{(\lambda_1)_{r_1+r_2} \prod_{j=1}^{p_1} (a_j^{(1)})_{r_1} (\lambda_1 - \mu_1)_{r_2} \prod_{j=1}^{p_2} (a_j^{(2)})_r \beta_1^{r_1+r_2} \beta_2^{r_1+r_2+r}}{r_1! r_2! r! (1+\lambda_1)_{r_1+r_2} \prod_{j=1}^{q_1} (b_j^{(1)})_{r_1} \prod_{j=1}^{q_2} (b_j^{(2)})_r}$$

$$\times \int_0^1 z^{\lambda_2+r-1} (1-z)^{\lambda_1+r_1+r_2} [1+\beta_1 y(1-z)]^{-(\lambda_1+r_1+r_2)} (1+\beta_2 yz)^{-(\mu_2+r)} \, dz$$

…(24)

Further, writing the integral occurring in right hand side of (24) in terms of Appell's function F_3 using a result (Srivastava and Karlsson (1985, p.279,eq. (18))), expressing the Appell's function F_3 in series form (Exton (1976, p.24, eq.(1.4.3))) and after a little simplification, the distribution function G(y) can be expressed in terms of generalized Lauricella function (Srivastava and Daoust (1969, p.454))) as follows

$$G(y) = \frac{B(\lambda_1, \lambda_2)\, y^{\lambda_1+\lambda_2}}{L_1 L_2 (\lambda_1+\lambda_2)} F^{4:p_1;1;p_2:0;0}_{1:q_1;0;q_2+1;0;0}$$

$$\left[\begin{matrix} \beta_1 y \\ \beta_1 y \\ \beta_2 y \\ -\beta_2 y \\ -\beta_1 y \end{matrix} \middle| \begin{matrix} (\lambda_1;1,1,0,0,1), & (\lambda_2;0,0,1,1,0), (\mu_2,0,0,1,1,0), \\ & \\ & \\ & \\ (1+\lambda_1+\lambda_2,1,1,1,1,1), & ----, \; -------, \end{matrix}\right.$$

$$\left.\begin{matrix} (1+\lambda_1;1,1,0,0,1), ((a_{p_1}^{(1)}),1), (\lambda_1-\mu_1,1), ((a_{p_2}^{(2)}),1), & --, \; -- \\ & \\ -------, ((b_{q_1}^{(1)}),1), \; ---, \; ((b_{q_2}^{(2)}),1), (\mu_2,1), & --, \; -- \end{matrix}\right].$$

…(25)

Since G(y) is the distribution function of the random variable Y, so the p.d.f. g(y) of random variable Y is obtained by differentiating the expression G(y) with respect to y and we get the desired result (22).

The result obtained here is quite general in nature and is capable of yielding a large number of corresponding results merely by specializing the parameters involved in it. To illustrate we give the following known special case of our result.

If we take the variables X_1 and X_2 have generalized F-distribution obtained by Malik (1967) then the density function of random variable Y can be easily obtained from equation (22). Further on integrating the result thus obtained from 0 to y with respect to y, we get the distribution function for the random variable Y, which is recently obtained by Dyer (1982, p.185, eq.(8.7)) in a slightly different form.

V. References

1) Bryson, M.C. (1974). Heavy-failed distributions, Properties and tests. Techno metrics, 16, 61-67.

2) Dyer, D. (1982). The convolution of generalized F-distributions. J. Amer. Statist. Assoc., 77 (377), 184-189.

3) Erdélyi, A. (1953). Higher Transcendental Functions. Vol.I, McGraw-Hill, New York, Toronto and London.

4) Exton, H. (1976). Multiple Hyper geometric Functions and applications. Ellis Harwood Ltd., Chichester; Halsted Press (John Wiley and Sons), New York-London-Sydney-Toronto.

5) Fox, C. (1961). The G and H-functions as symmetrical Fourier kernels. Trans.Am. Math. Soc., 98, 395-429.

6) Johnson, N.L., & Kotz, S. (1970). Distributions in Statistics: Continuous Univariate Distributions. Vol. I, New York, John Wiley.

7) Malik, H.J. (1967). Exact distribution of the quotient of independent generalized gamma variable. Canadian Mathematical Bulletin, 10, 463-465.

8) Mathai, A.M., & Saxena, R.K. (1971). A generalized probability distribution. Univ. Nat. Tucuman Rev. Ser. (A) 21, 193-202.

9) Saran, S. (1954). Hypergeometric Functions of Three Variables. Ganita, 5, 77-91.

10) Sharma, M. (2008). Fractional integration and fractional differentiation of the M-series. Fractional calculus and applied analysis, Vol.11, 187-191.

11) Springer, M.D. (1979). The Algebra of Random Variables, New York, John Wiley.

12) Srivastava, H.M., & Daoust, M.C. (1969). Certain generalized Neumann expansions associated with the Kampe de Feriet function. Nederl. Akad. Wetensch. Proc. Ser.A, 72, Indag. Math., 31, pp.449-457.

13) Srivastava, H.M., Gupta, K.C., & Goyal, S.P. (1982). The H-Functions of One and Two Variables with Applications. South Asian Publishers, New Delhi and Madras.

14) Srivastava, H.M., & Karlsson, P.W. (1985). Multiple Gaussian Hypergeometric Series. Ellis Horwood Limited,

15) John Wiley and Sons, New York, Chichester, Brisbane and Toronto.

16) Srivastava, H.M., & Singhal, J.P. (1972). On a class of generalized hypergeometrc distributions. Jñānābha, Sec.A, 2, 1-9.

Determination of copper (II) by simple extraction procedure prior to differential pulse polarography using 4-(2-hydroxy phenylethaminodiol) benzene-1,3-diol

GJSFR Classification (FOR)
250102, 250203, 250402

Dr. D.Rekha[1] N.Y.Sreedhar[2] P.Reddy prasad[3]

***Abstract*-Outline of the present paper proposes the determination of copper in biological samples, plants and pharmaceutical preparations using a newly synthesized analytical reagent 4-(2-hydroxy phenyl ethaminodiol), benzene-1,3-diol (4-2-HPEDB-1,3,D) to form a complex at pH 4.0 (acitate Buffer), which is extracted in to chloroform and the electrochemical behavior of chloroform extract was studied by differential pulse paleography under the optimum conditions. The linearity was maintained at the concentration range of 0.05 to 200µg/mL at pH 4.0 with correlation factor of 0.9997. The influence of sample matrix was investigated thoroughly which made the method more sensitive and selective. The present method was successfully applied for the determination of copper in biological samples, plants and pharmaceutical preparations and the results obtained from the proposed method show good agreement with reported method which is exist in literature. The precision, accuracy and validity of the method was checked by the investigating the Standard Reference Material (SRM) which is distributed by the National Institute of Standard and Technology (NIST).**

Keywords- Copper, Differential pulse polarogrphy, (4-2-HPEDB-1,3,D), biological samples, Plant material and pharmaceutical preparations.

I. INTRODUCTION

Generally copper is widely distributed in environment, food material and animal origins and more over it is exist in +2 oxidation state in several compounds. It plays important role in carbohydrates and lipid metabolism, due to this reason it is fact that many of the higher plants and animal life needs the trace amounts of copper as nutrient to survive. Copper has both essential and toxic element to human beings, however the high dosage of copper moderately causes toxicity and it will be responsible for the pointer to various diseases. For example the willson's disease arising in human beings by intake of high concentration of copper. Copper enters in to the humans, plants and animal bodies are mainly through food, air, water, rain, snow, irrigation water and fertilizers etc.

The other application of copper is used as thermal conductors, electrical conductors, building material and an important constituent of various metal alloys, in addition to that copper has 29 distinct isotopes ranging from the atomic mass number from 52 to 80. Among this ^{63}Cu, and ^{65}Cu are stable and naturally occurring isotopes of copper remaining are radioactive isotopes. It also functions as a co-factor in various enzymes and in copper based pigments. In view of that it is necessary to monitoring the copper in different field areas. Several analytical reagents have been synthesized for the determination of copper in various samples which is shown in Table 1.

In early days various analytical methods are reported for the monitoring of copper like Spectrophotometry [1-6], Voltammetry [7] Atomic absorption spectrometry [8-10], Inductively coupled plasma atomic emission spectrometry [11-14] and Inductively coupled plasma mass spectrometry [15]. The above said methods have suffers some disadvantages like time consuming, and it require more sophisticated laboratory conditions, well expensive instrumentation.

The aim of the present work is to determined the copper in various samples at low concentration levels using differential pulse polarographic technique is to over come the drawbacks in the above said methods usually having insufficient for very low concentration level determination in samples.

Therefore authors proposed a novel, simple, selective, sensitive and new analytical method, differential pulse polarography for the determination of copper and it is a alternative method for the determination of copper in biological samples, plant and pharmaceutical preparations with newly synthesized analytical reagent which is very low expensive and synthesized at ordinary laboratory conditions.

II. Experimental

A. Apparatus

An Elico CL-362 model polarographic system is used for DPP measurements and Elico Li-129 Model glass-calomel combined electrode was employed for measuring pH values. Ag/AgCl (salt KCl) was used as a reference electrode which provide a reversible half reaction with nernstian behavior be constant over time and easy to assemble and maintain and a platinum wire as an auxiliary electrode which displays negative potential range.

Author[1,2&3]-Department of chemistry, S.V.University, Tirupati 517502 A.P, India
(Email[1]-dasarirkh@gmail.com)
(Email[2]-sreedhar_ny@reddif mail.com)

B. Reagents

All reagents used were of analytical reagent grade. Double distilled water was used throughout the experiment. A stock solution of copper (II) was prepared by dissolving appropriate amount of copper sulphate in double distilled water in volumetric flask. Working standard solution was freshly prepared by diluting the stock solution with double distilled water. 0.1 M concentration of 4-2-HPEDB-1,3,D was prepared by dissolving 2.48 g of 4-2-HPEDB-1,3,D in 100 mL of methanol

C. Synthesis of 4-2-hydroxy phenyl ethaminodiol

benzene-1,3-diol

(4-2-HPEDB-1,3,D)

Equimolar ratio of 2,4-dihydroxy acetophenone and 2-aminophenol in methanol mixture was refluxed for 3-4 hours and the contents were cooled at room temperature, it gives orange-red color precipitate. The precipitate was filtered and washed with methanol to pure Schiff base. (M.P-115 ^{0}C, yield 97%) as shown in Scheme I.

I.R –(KBr), 1601.8cm$^-$(C=N), 3304.0 cm$^-$ (N-H), Free (OH) 3375.3 cm$^-$ 1465.9 cm$^-$(O-H) and the spectrum was shown in Figure 1.

D. Recommended analytical Procedure for the determination of metal ions

An aliquot of working standard solution containing 1-100 µL of metal ion is taken in to 25 mL volumetric flask. To this 5 mL of acetate buffer solution (pH 4.5), 2mL of reagent solution were added. The mixture was shaken with 5.0 mL portion of chloroform for 30s and allowed to stand for 5-10 min. The organic phases curve collected and tranfered in to polarographic cell and diluted with 9 mL of supporting electrolyte and then deoxygenated with nitrogen gas for ten min. After recoding polarogram small increment (0.2mL) of standard solution is added to the cell treated for 1min, and polarogram is again recorded under similar conditions. In the same manner, 10 polarograms are recorded for 10 additions.. In the present study the best precision was obtained at pH 4.0 with a drop time 2 sec, pulse amplitude of 50 mV and an applied potential of -420.0 mV. The relative standard deviation and correlation coefficients were found to be 5.45% and 0.9997 respectively for 5 replicants.

E. Analysis of pharmaceutical preparations

A tablet or an appropriate aliquate of each (Supradyn and Multivitamin Iron Mineral tablets.) were grounded well and added 2-3 mL of nitric acid for dissolution and transfer in to a 100 mL calibrated flask, diluted to the mark with distilled water and mixed well and analyzed for copper by the above said general procedure. The results were given in the Table 2.

F. Analysis of biological samples

The hair samples were washed with acetone 2-3 times in a beaker with continuous stirring. Then they were dried in an electric oven at 70° C for 4 h. Two grams of the sample was weighed and taken in a beaker. To this a (1:1) mixture of nitric acid and perchloric acid was added, and the mixture was heated on a hot plate. The solution was evaporated to near dryness. The ash was taken up with 5 mL of HCl (1+9) and evaporated to dryness. The residue was taken up in 2 mL conc. HCI, filtered and made up to 25 mL with water. Suitable volumes of these solutions are taken for the determination of copper as described in above said procedure and the results were shown in Table 2.

G .Analysis of plant material

The cabbage and banana samples (5 g each) were placed in a 250 mL beaker, and a solution of concentrated H_2SO_4 / HNO_3 1:1 (v/v) (10 mL) was added. This mixture was heated until the solution is clear. The solution was filtered off and concentrated to 5 mL then cooled and diluted to 50 mL with deionised double-distilled water then the general procedure was applied to 1 mL of this solution and results obtained were shown in Table 2.

The accuracy and precision of the present method was validated by taking the Standard Reference Material SRM-1573a of tomato leaves, which is distributed by National Institute of Standard and Technology. Inter calibration was performed by using tomato leaves-SRM 1573a and it's certified value is 4.7 ppm. The analytical results obtained from the present method (4.68±0.05) shows the good agreement with certified value (4.7 ppm) of the tomato leaves.

III. Result and Discussion

DIFFERENTIAL PULSE POLAROGRAPHIC STUDIES

A. Effect of pH

The effect of pH on the peak potential E_p and current intensity i_p, using differential pulse polarography was examined for [Cu-(4-2-HPEDB-1,3,D)]. The pH was varied in the whole pH range 2.5 to 10.5 for [Cu-(4-2-HPEDB-1,3,D)] complex. It can be observed from Figure 2, - 460.0 mV that the maximum peak current obtained with pH 4.0. When the pH has been increased from 2.5 to 10.5 the peak potentials have been shifted towards more negative values, indicating proton participation in the reduction process and the results were shown in Figure 3.

B. Effect of Pulse amplitude and Scan Rate

The influence of the pulse amplitude was investigated. The results suggested that DPP peak current reached the maximum value when the pulse amplitude was 50 mV. As for the scan rate; the current response with increasing the scan rate of 12 mVs^{-1} gave the maximum response. Accordingly, the optimum conditions for recording a maximum developed and sharper DPP peak for 0.05 mM [Cu-(4-2-HPEDB-1,3,D)] are scan rate : 12 mVs^{-1} and pulse amplitude : 50 mV.

Other experimental parameters such as temperature and ionic strength were optimized. The stripping peak currents were not modified when the temperature varied between 20-50°C. The value chosen was 25°C.

C. Effect of Solvent

The extraction of [Cu-(4-2-HPEDB-1,3,D)] complex was carried out with different organic solvents like dimethyl formaldehyde, CCl_4, Cyclohexane, chloroform, xylene,

tolunene, n-butanol, 1-pentanol, 1-amyl alcohol and nitrobenzene. Among these solvents the extraction of [Cu-(4-2-HPEDB-1,3,D)] complex efficiency more in chloroform when compare to other organic solvents. Therefore chloroform is chosen as solvent for extraction of [Cu-(4-2-HPEDB-1,3,D)] complex for further studies.

D.Calibration

The detection limit and the relative standard deviation obtained as 0.45 µg/mL, 5.45% respectively. The linearity is maintained in the concentration range of Cu 0.05 to 200µg/mL with correlation coefficient of 0.9997 and calibration curve is prepared according to the general procedure under the optimized conditions as shown in Figure 4.

The Method of Quantification (MOQ) value was calculated based on calibration curve of analytical procedure. The MOQ values found to be 6.920 µg/mL for copper determination.

E. .Stoichiometry of the complex

The composition of the complex was found to be 1:1 = Cu^{2+}: 4-2-HPEDB-1,3,D . The Stoichiometry of the complex was verified by Mole ratio method and Job's continuous variation method and their data was shown in Figure 5 and 6.

F. Effect of Foreign ions

The effect of interfering ions on the determination of copper in biological samples, Plant material and pharmaceutical preparations was investigated and the results were shown in Table 3 which is individually added to the copper having appropriate concentration and the general procedure was applied. The tolerable limits of various foreign ions are masked using suitable masking agents and recovery ranges (<2%) are shown in Table 3.The results are almost quantitative in the presence of interfering ions to evaluate the feasibility and sensitivity of the present method.

IV. Conclusion

The present method was successfully applied for the determination of copper in biological samples, plant material and pharmaceutical preparations. The Differential pulse polarographic method, after chloroform extraction procedure, for the assay of the copper determination using newly synthesized analytical reagent was reported and the results were compared with reference method with good agreement. The method has added advantages over reported methods i.e.

1. The organic reagent was less expensive, economical and it was synthesised at ordinary laboratory atmospheric conditions.
2. The organic reagent synthesised for the present work is very distinct in terms of selectivity, sensitivity towards metal ions.
3. The risk of contamination is very low and foreign ions do not interfere in the present method during the analysis of copper.
4. Electrodes used in the present work for the analysis of metal in samples is very sensitive and selective.
5. Statistical analysis and eliminating of time taking process, lengthy extraction steps makes the methods more sensitive and selective one for the determination of copper in biological samples, Plant material and pharmaceutical preparations.
6. The validity of proposed method was checked by standard reference material (SRM) tomato leaves 1573a which is given by National Institute of Standard and Technology which show the method have more accuracy and precision.

V. References

1) K.Thipyapong , C Suksai., Bull Korean chem. Soc, 24 (12), 2003,1767.
2) B.K.Reddy, J.R.Kumar, K.J.Reddy, L.S.Sarma and A.V.Reddy, Anal. Sci., 19,2003, 423
3) M.Endo, ABE S.Suzukik, Analytica Chemica Acta , 364, 1998, 13.
4) L.Hejazi, D.E.Mohammadi, Y.Richard, G.Brereton, Talanta, 62, 2004,185.
5) A.P.Argekar, A.K.Shett, Anal Sci.,12, 1996, 255.
6) X.Jianjun, W.wanzhi, H.Yanbo, T.Han , Ling , Anal.Sci., 20(7), 2004,1037.
7) A.Moghmi, Chinese journal of chemistry, 25(11), 2007,1663.
8) S.Tautkus, R.Kazlauskas, A.Kareiva, Chemija., 14, 2004, 49.
9) A.P.Jadid, H.Eskandari., E.Journal of Chemistry, 5(4), 2008, 878.
10) R.Ganjali m., M.R.Pourjavid ,H.Babaei l, Quim.Nova., 27(2), 2004, 213. .
11) Y.Gub, B.Din , Y.Liu , X.Chang, S.Meng , Talanta., 62, 2004,209.
12) Y.Liu, P.Liang ,L.Guo, Talanta., 68, 2005, 25.
13) A.Ramesh ,K.Ramamohan k, K.Seshaiah , N.D.Jaya kumar, Anal lett, 34, 2001, 219.
14) J.W.Mclaren , K.E.Jarinis, A.L.Gray , R.S.Houk , (Eds) Hand book of indusctively coupled plasma-mass spectroscopy blackie ans son ltd, glasgow., 226, 1992.
15) A.Bhalotra, B.Krishan prui, Journal of AOAC, 84(1), 2001,47.
16) V.S.Ijeri, A.K.Srivastav, Fresenius' Journal of Analytical Chemistry, 367(4), 2000, 373.
17) H.R.Shahbaazi , A.Safavi ,N.Maleki., The Malaysian Journal of Anal.Sci, 12(2), 2008, 384.
18) A.Mohadesi , Salmanipoura., Ziaes., A.Mohammadi, Pourhatamib,M.Ali taherc, J.braz. chem. soc., 19(5), 2008, 956.
19) C.Agra-Gutiérrez , J.L.Hardcastle,J.C.Ball , R.G.Compton, Analyst, 24, 1999, 1053.
20) .

C.Renata ,B.Cordeiro1 ,A.L.Brandes Marques, L.E.P.Marques,W.S.Cardoso, J.Zhang , Int. J. Electrochem. Sci., 1, 2006, 343

Table 1. Comparison of the reagents for the determination of copper with other electro analytical techniques

S. No	Reagents	Electro analytical technique	Concentration	Samples	Refer ence
1.	Mercapto acid	Voltammetry	8×10^{-7} to 1×10^{-5} mol/L	Real environmental samples	[7]
2.	1-(2-thiazolylazo)- 2-naphthol.	Differential pulse polarography	0.18–13.5 and 0.30-17.3	Various samples	[16]
3.	crown ethers	Voltammetry	Up to 100 ppb	Alcoholic beverages	[17]
4.	SSA	Adsorptive stripping voltammetry	3 – 23 µg L^{-1}	Crude oil, crude oil tank button sludge	[18]
5.	Nitroso-R dopant anion	Anodic stripping voltammetry	1.2 to 243.9 ng mL^{-1}	Water and human hair samples	[19]
6.	-	Anodic stripping voltammetry	100 to 300 mg	Beer	[20]
7.	Alizarin red S (ARS)	Catalytic-Adsorptive Stripping Voltammetriy	1.7×10^{-3} mol/L	Real samples	[21]
8..	4-2-HPEDB-1,3,D	Extractive differential pulse polarography	0.05 to 200 µg/mL	Biological samples, pharmaceutical and plant material	Present method

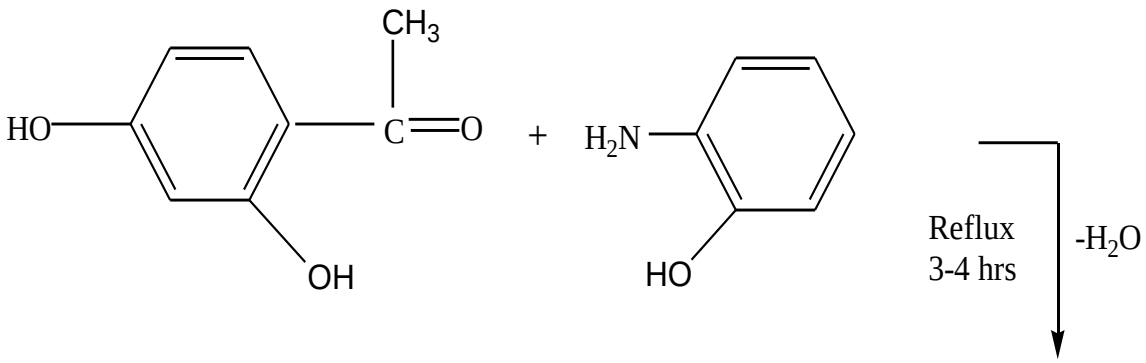
Table 2. Determination of copper in Biological samples, pharmaceutical preparation and plant material

S.NO	Samples	Present method	Reported method [6]	R.S.D
1.	Pharmaceutical preparations			
	Supradyn Certified value(0.86)	0.86.5	0.86	0.35
	Multivitamin Iron minerals Certified value(0.25)	0.27	0.26	0.16
2.	Human hair			
	A	46.52	45.11	0.04
	B	69.12	68.98	0.04
	C	63.99	61.81	0.02
3.	Plant material			
	Cabbage	38.75	37.66	0.11
	Banana	16.05	14.11	0.57

Table 3. Effect of Foreign ions in the determination of Copper

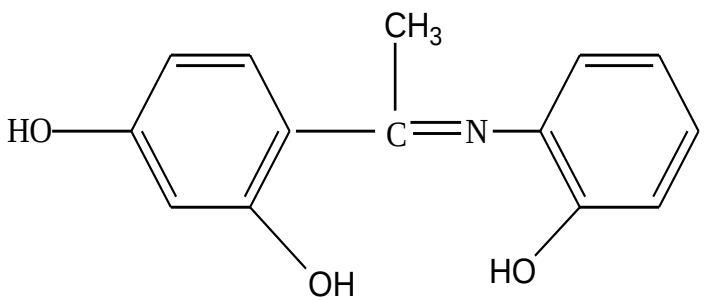
S.No	Ions	Concentration µg/mL[a]
1	SCN^{-}, $C_2O_4^{2-}$,Cd^{2+}, Mg^{2+}, Cr^{3+},	300
2.	Zn^{2+}, Tartarate ion	100
3	Al^{3+}, Fe^{3+}, CN^{-}	50
4	Co^{2+}, Ni^{2+}, NO_3^{-}, Pb^{3+}	10

[a] *It can be masked by using 2mL of 2% sulphuric acid.*



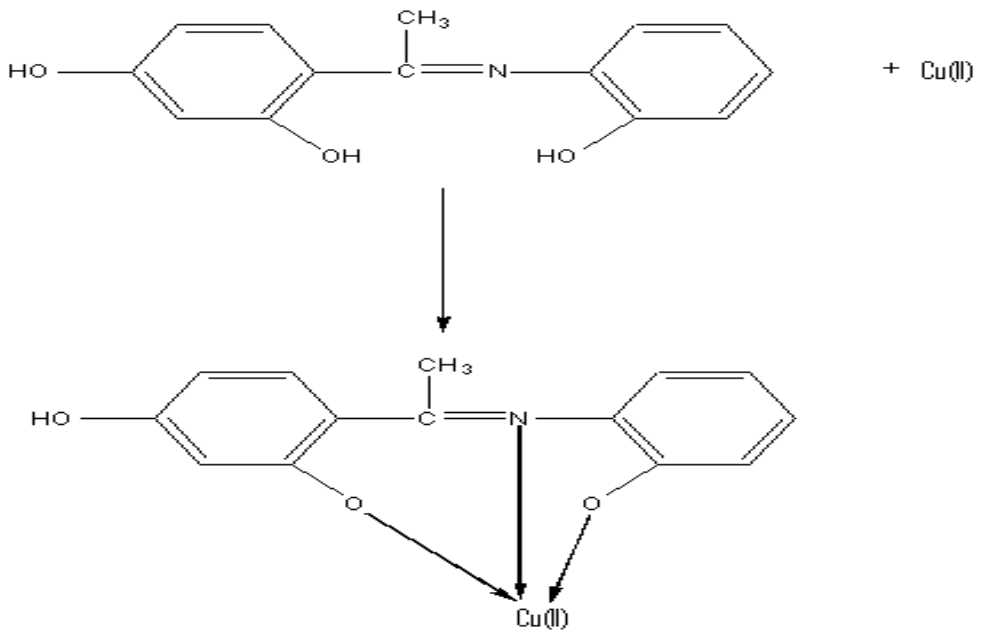
2,4-dihydroxy acetophenone

2-amino phenol



4-(2-hydroxy phenyl ethaminodiol), benzene-1.3-diol

Synthesis of 4-(2-hydroxy phenyl ethaminodiol) benzene-1.3-diol (4-2-HPEDB-1,3,D)



Complexation of 4-2-HPEDB-1,3,D with Cu

Scheme I. Synthesis and complexation of 4-2-HPEDB-1, 3,D with Cu

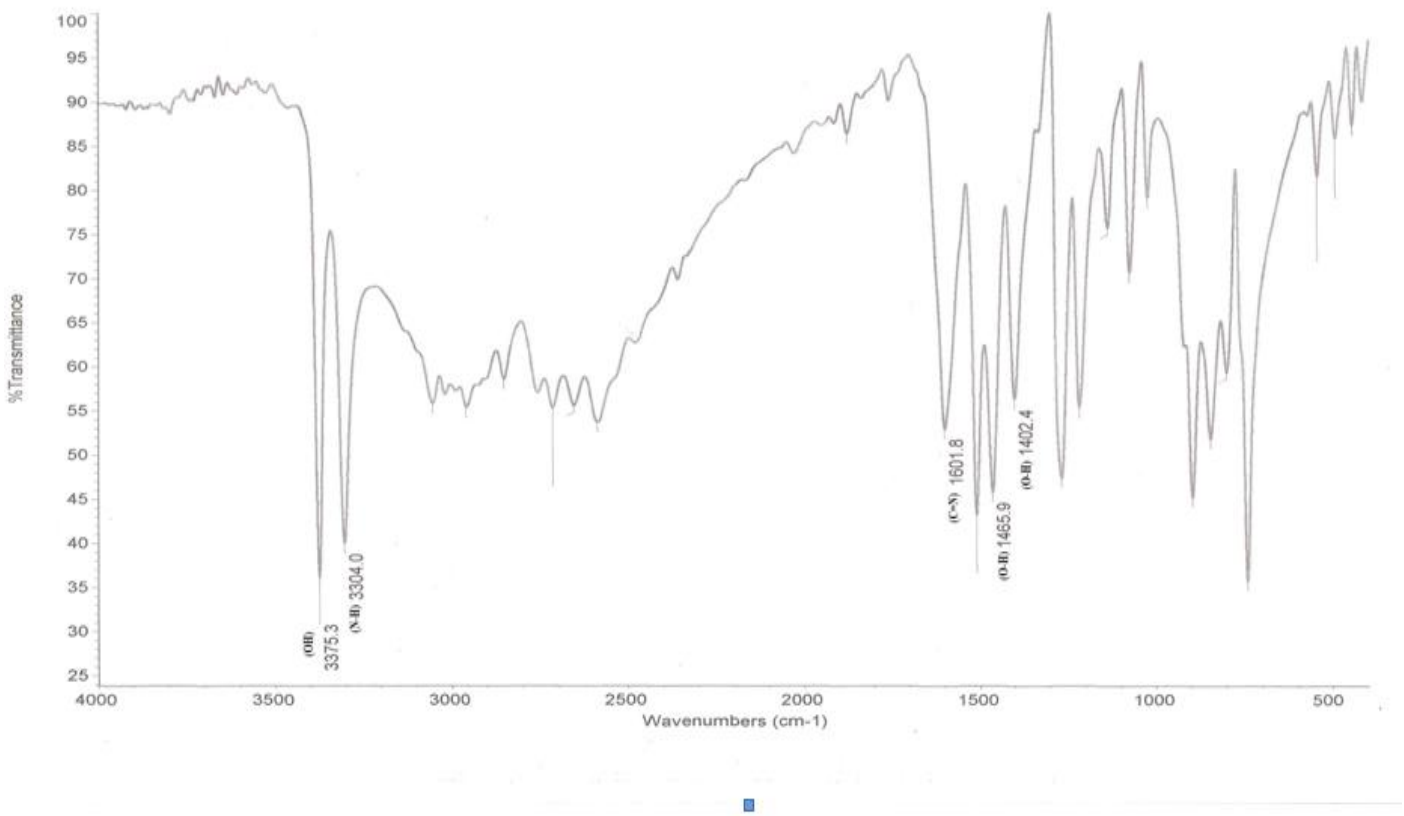


Fig 1. I.R spectrum for 4-(2-hydroxy phenyl ethaminodiol) benzene-1.3-diol (4-2- HPEDB-1,3,D)

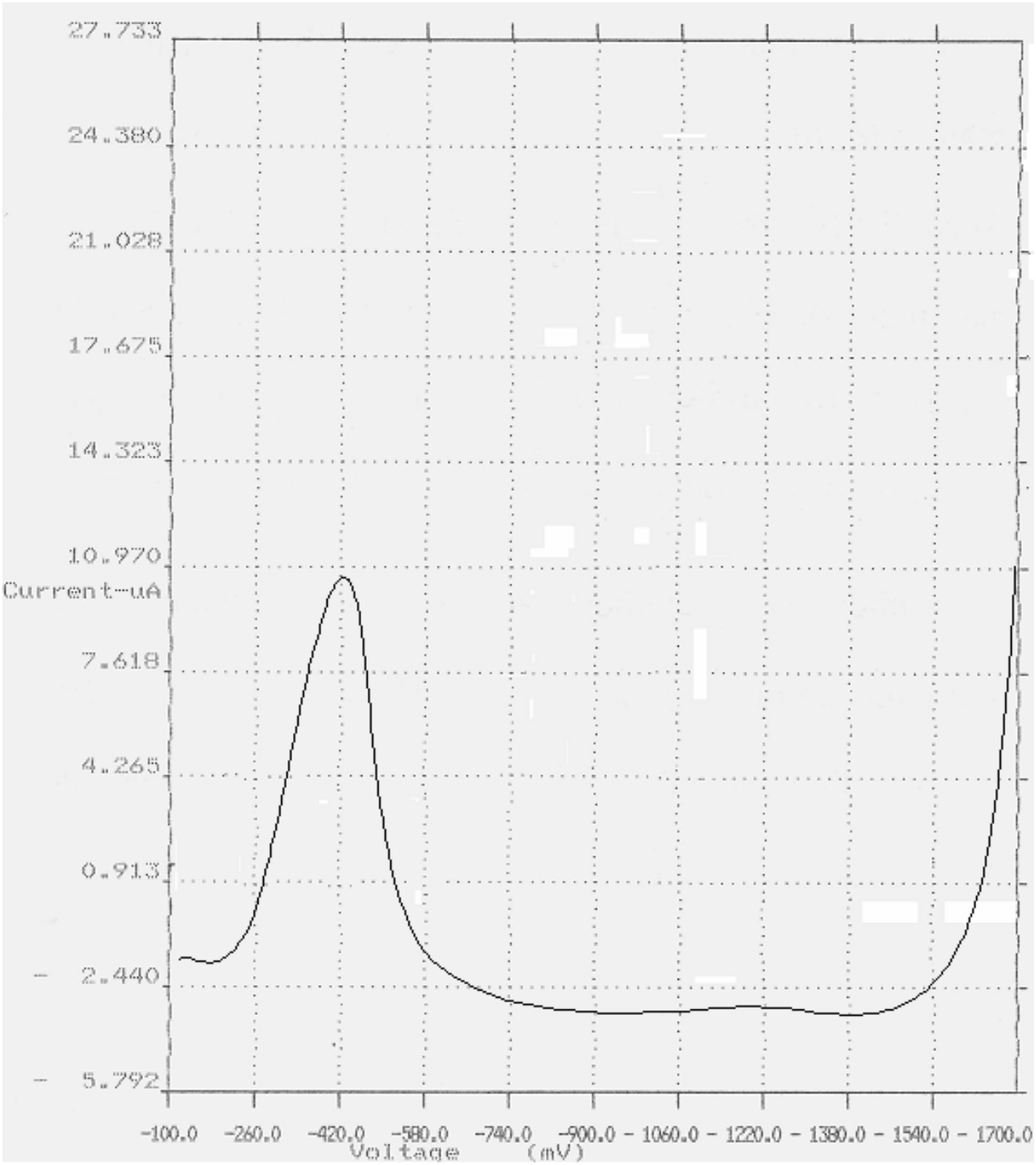


Fig 2. Differential pulse polarogram of Cu (II). Peak at - 420.0 mV at pH 4.0; Cu-(4-2-HPEDB-1,3,D) concentration :1% of 1 ml Scan rate : 12 mVs^{-1} pulse amplitude :50 mV

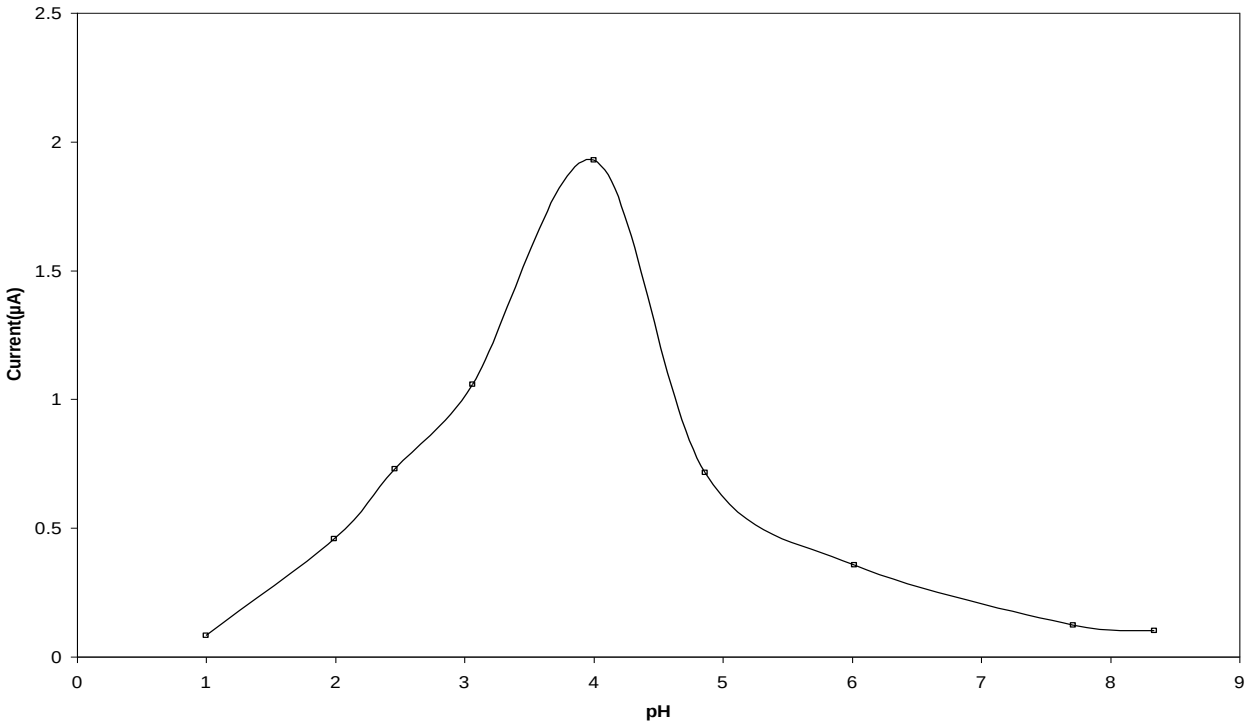


Fig 3. Effect of pH on determination of Cu (II)

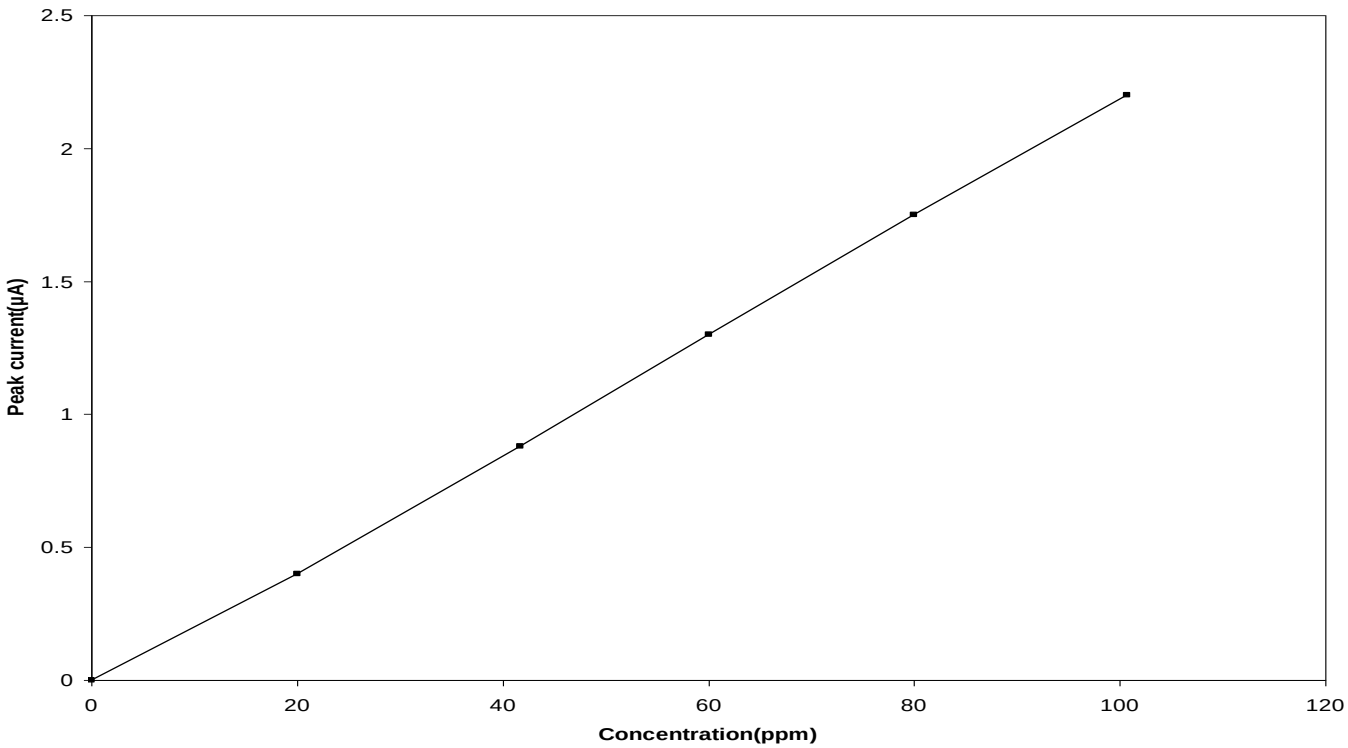


Fig 4. Calibration curve for Cu(II)

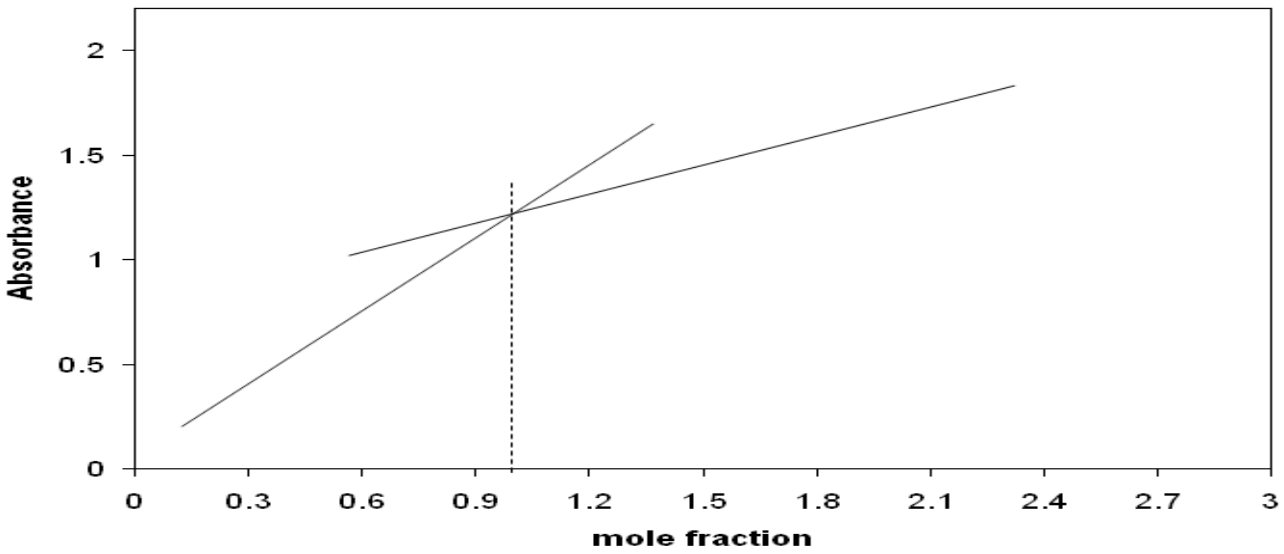


Fig.5. Mole ratio method for the Cu(II) - 4-2-HPEDB-1,3,D

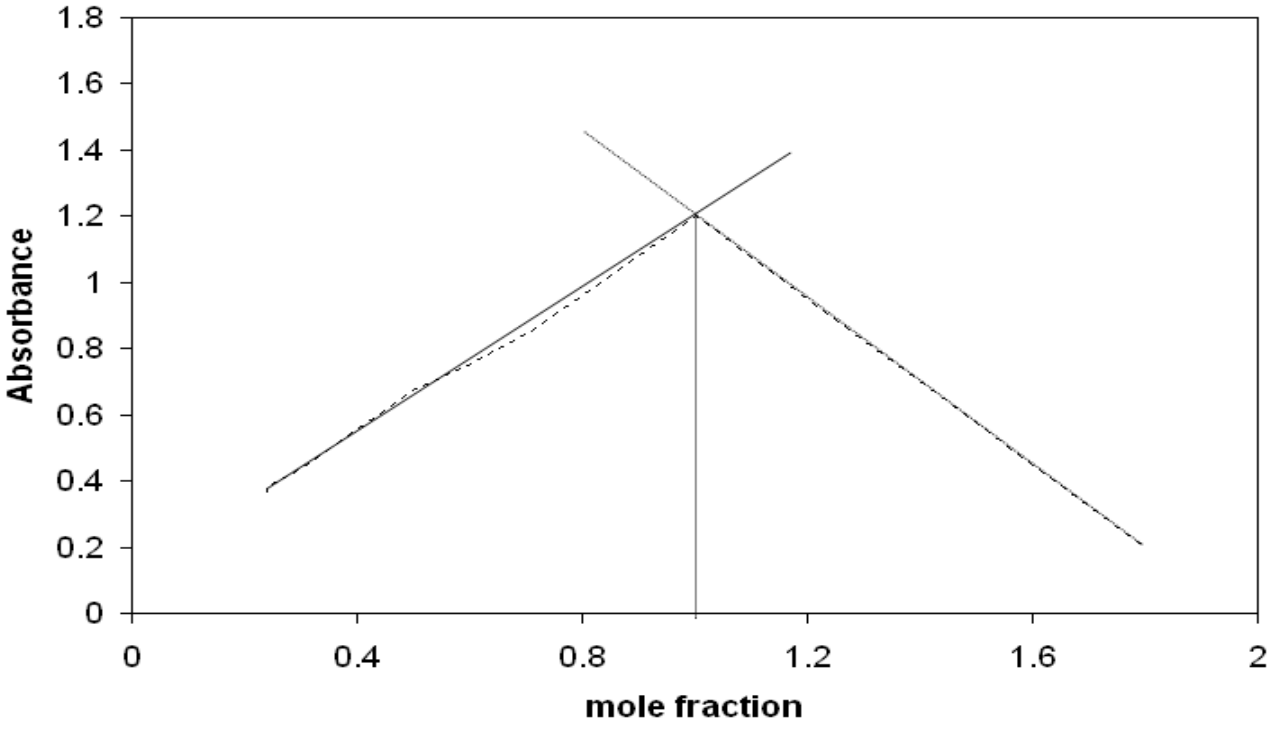


Fig.6. Job continuous variation method for the Cu(II) - 4-2-HPEDB-1,3,D

Refraction as A Function of Atomic Gravitation Fresh Insight into the Nature of Space and A New Possibility In The Creation Of Metamaterials

Dr. Henry H.M. Mwangasha
Mwangasha@gmail.com

GJSFR Classification (FOR)
240301.240203.240504

Abstract- **The paper states and illustrates what it claims as a new discovery, namely, that the refractive index of a material is directly proportional to the material's atomic gravitation. Then there follows three revolutionary implications of this discovery: Refraction is explained as a simple relativistic phenomenon; space (the fabric of the universe) is now seen to consist of the gravitational and the electromagnetic fields moving at c relative to each other, i.e., these fields are not in space, they are space; and, finally, atomic gravitation (rather than relative permittivity and relative permeability) is offered as the guiding principle in the construction of meta materials of different refractive indices.**

I. INRODUCTION

Having discovered a direct proportionality between the refraction of electromagnetic waves through a medium and the gravitational field of the medium's atoms, I now present not only this discovery but also my own humble interpretation of it in the context of the theory of general relativity and the creation of meta materials in the rapidly expanding realm of nanotechnology

II. DISCOVERED

For a given wavelength, the refractive index of a medium, n, is directly proportional to the gravitational field at r where r is the radius of the representative particle of the medium's constituent building blocks. Thus n = kGm/r2 where k is about 1.25 x 1016;G = universal gravitational constant; m and r are the mass and radius of the representative particle.

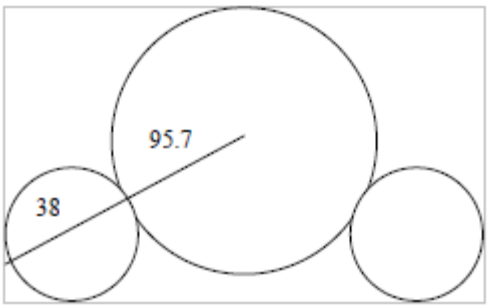
III. ILLUSTRATION

A. Water

Disregarding, for simplicity, the continual combining and separating of water molecules due to intermolecular hydrogen bonding, we may take the water molecules the representative particle of the medium.

Now in the water molecule we find: H-O bond length = 95.7pm.,H – O – H angle is !04.5° [1]; the covalent radii of O and H are, respectively, 73pmand 38 pm [2]; and the atomic weights of O and H are, respectively, 16 and 1 [3].

We can therefore regard the water molecule as a sphere of r = 95.7 + 38 = 133.7pm. (see diagram below where we take the nucleus of oxygen as a good approximation to the molecular center of mass)



So n =

kGm/r_2 = (1.25 x 10_{16} x 6.67 x 10_{-11} x 18 x 1.66 x 10_{-27}) / (1.337_2 x 10_4 x 10_{-24})

= 1.39. This is quite close to the expected 1.33 [4] considering the simplifications above.

B. Sodium Chloride (table salt)

In this crystal the radii of Na and Cl ions are respectively, 98 pm and 181 pm [2]; atomic weights of Na and Cl are respectively 23 and 35.5 pm [3]; further, each Na ion is surroun dedby six Cl ions (as each Cl ion is neighbored by six Na ions) [5].So we may take, as our representative particle of this medium, the Na ion with its coordinate six Cl ions. This particle with its center in the Na nucleus extends through a radius r = 98 +181 + 181 = 460 pm.

So, n = (1.25 x 10_{16} x 6.67 x 10_{-11} x (6 x 35.5 + 23) x 1.66 x 10_{-27}) / (4.6_2 x 10_4 x 10_{-24})= 1.54. This is the value expected! [4].

C. Diamond

Diamond affords such a close packing of carbon atoms that, for a firstapproximation, we can take the single carbon atom as our representative particle. Given thecovalent radius of carbon as 77 pm [2] and its atomic weight as 12 [3], we have:

n = (1.25 x 10_{16} x 6.67 x 10_{-11} x 12 x 1.66 x 10_{-27}) / (7.7_2 x 10_2 x 10_{-24})n = 2.80 - which, for a first approximation, is reasonably close to the expected value of 2.42 [4].

For a more accurate value, let us observe the following: Each carbon atom in diamond is the centre of a tetrahedron whose vertices are four carbon atoms covalently bonded to the central one with a bond length of 154 pm [6]; the atom at each vertex is also the centre of a tetrahedron. In this way

these tetrahedral units join up into a huge diamond crystal. Now itso happens that the representative particle for diamond is a tetrahedron with its first generation tetrahedra , i.e., a tetrahedron whose four vertices are centres of four more tetrahedra.Therefore this unit has (1+4x5) atoms and a radius of 154+154+77=385 pm. This gives us :n=(1.25x1016x6.67x10-11 x21x12x1.66x10-27)÷(3852 x10-24)=2.35 . The expected value is 2.42 [6].

D. Carbon disulphid

The data for this molecule is as follows : carbon-sulphur bond length = 155 pm [7]; covalentradii of carbon and sulphur are, respectively, 77pm and 102 pm[2]; atomic weights forcarbon and sulpher are 12 and 32 [3].

We can therefore consider this molecule as a sphere of r = 155 + 102 = 257 pm. This givesus n = 1.25 ×1016×6.67×10-11 ×76×1.66×10-27÷(2.572×104×10-24) = 1.60 .The expected value is 1.62 [4].

Of course another way of illustrating all this is to plot a graph of n against Gm/r2for a chosen number of substances; however, the above presentation was deliberately chosen to demonstrate the procedure of identifying the representative particle in a medium. What we must emphasize, in addition to these few examples, is that the chemistry as well asthe atomic, molecular or ionic geometry resulting from this chemistry must be given particular attention before we can discern the representative particle and its gravitation. When dealing with ionic compounds, for instance, we must realize that pure ionic bonds donot exist [8] and that the degree of covalency in the compound under investigation may warrant consideration; and when we come to examining the refractive index of metals in thislight we have to take into account the peculiarities of metallic bonding as we try to establish the appropriate representative particle of the medium. Especially in connection with atomicradii, consideration must be given to the environment of an atom or molecule: for example, due to large intermolecular spaces in air, the atoms in its molecules will tend to assume the irrespective van der waals radius values.

IV. Interpretation of $n = kGm/r^2$

A. Explaining refraction

This has been the subject of heated scientific and philosophical debate from ancient times down to this day. Reviewing the debate – before offering another problematic explanation –an expert in this field commented "Every explanation of refraction has some problems that have not yet been overcome" [9].

To claim, as we do by the above equation, that the refraction of electromagnetic waves through different materials is the function of gravitation is to remind us of the general relativity theorists who employ the idea of gravity causing space time-curvature to explain thebending of stellar light by massive bodies .We interpret the equation as claiming that refraction is an entirely relativistic phenomenon.

However, we shall not use this idea of gravitational space-time curvature; we only need oneaxiom of relativity , namely, that gravity causes *time dilation* and *length contraction*. Since agravitational field dilates time while contracting length, it is easy to see why an observer will find the speed of light in glass to be less than the speed of light in air:If light travels at 3 x 10^8 metres in 1 second in air, this distance of 3 x 10^8 metres undergoes gravitational contraction in glass to a lower value (due to the gravitational field set up byglass atoms). This value turns out to be 3 x 10^8 metres divided by n, where n is the refractive8index of glass. Since this 1 second is measured in air outside the glass slab the speed is found to be (3 x 10^8 metres divided by n) per second. Of course if the 1 second is measured insidethe glass slab where there is gravitational dilation (time ticks slower) the speed of light wouldbe found to be c (or 3 x 10^8 m/s). Let us explain how: When 1 second elapses outside theglass slab, it is still (1 divided by n) seconds in the glass slab. So the speed of light for anobserver in the glass slab (were this possible) is

(3 x 10^8 / n) / (1/n) = 3 x 10^8 metres per second.

B. Fresh insight into the inside of atoms and molecules

The equation $n = kGm/r^2$ suggests that for the phenomenon of refraction, the only regionthat matters is the circumference of the representative particle. In the case of diamond, forexample, electromagnetic radiation appears to suffer refraction only as it crosses the circumference of the carbon atom.What happens to the radiation as it traverses regions of greater gravity at points between the nucleus and the circumference? The only way to explain this is to postulate regions in atoms and molecules where the gravitational field = 0 so that n = 0 so that radiation in these regions travels at infinite velocity. Infinite speed of electromagnetic radiation means that, in such regions, a photon simply finds itself everywhere *in no time*; for a photon, in other words, the whole of such aregion is simply a point!Now a photon is an electromagnetic field and an electromagnetic field is nothing butan electric field in motion. It therefore seems plausible to conclude that, for a photon, anelectric field (in which it finds itself) is a single point. So the region in the atom where this9 happens (where n = 0 and gravity = 0) must be the electric field between the positivelycharged nucleus and the negatively charged electrons at the circumference.

So when a photon arrives at a point on the circumference of the representative particle itinstantaneously finds itself on the opposite side of the circumference. (Remember that theatomic sphere or its outermost shell is a fuzzy band of electrons. A medium consisting of many atoms will offers many such bands to cross; these all add up to one medium of that particular refractive index- like many very thin glass slabs held tightly together).

C. Where to find "gravitons"

As said above, for a photon the electric field is simply one point and that, strictly speaking, the photon cannot be said to propagate 'through' an electromagnetic field. It is only in agravitational field where (according to an observer outside

this field) the photons move with a speed governed by v= c/n where n = k E. (E being the gravitational field forming themedium)Similarly, we now postulate, a graviton can only be observed propagating through anelectromagnetic field, not through a gravitational field. Experiments with gravitons, so far, have not been as successful as expected and we think this failure is to be attributed to the fact thatscientists have been trying to see the propagation of these particles at the wrong place, namely, in a gravitational field.The emerging picture of the interaction between the two fields is this: either we have photons flying through the gravitational field at c or gravitons flying through theelectromagnetic field at c: where the gravitational field is zero the electromagnetic field reduces to a point as far as photons are concerned; but for gravitons the point is a universe inwhich they are flying at c. Where the electromagnetic field is zero the gravitational field10reduces to a point as far as gravitons are concerned; but for photons this point is a universe in which they fly at c.

D. A new view of the 'fabric of the universe'

The equation n = k Gm/r2 allows us to speak about electromagnetic radiation propagating *not through space-time* but through a gravitational field; in deed the equation goes further to suggest that apart from gravitation, electromagnetic radiation cannot propagate (i.e. movefrom one point to another). We are therefore led to think of the gravitational field (with thee lector magnetic field in motion relative to it) not as an entity in space but as space itself! This means that if we were to wipe out these two fields –e.g. by 'freezing" all mass and charge into a singularity we would be left not with a singularity in space but a singularity surrounded bya realm _ perhaps that much coveted spirit world _ of spacelessness (and timelessness, seebelow)Scientists believe there are four fields in the universe: the gravitational, the electromagnetic,the strong and the weak force. But already some have suggested that the weak field isultimately electromagnetic [10]. Physicists need the strong force to explain how the particlesin the nucleus can hold together against the repulsion due to the positive charge of the protons. If we now propose, for instance, that the positive charge resides on the outside ofthe nucleic 'shell' then we do not need a force any stronger than gravitation to hold theparticles together in the nucleus.This view of space as fields together with all that we have said above must compel us to replace the space-time curvature metaphor with space density in explaining relativistic phenomena.

For we realize that time is not a dimension of space but a mere consequence of the fact that these fields are in finite relative motion. We may try to demonstrate this by observing the following:

11Every object in the universe can and must move only at c relative to light or any other electromagnetic field. If nature had set these two fields to move at infinite velocity relative to each other then every motion would be instantaneous and time _ as well as space_ as weknow it would be nonexistent; and if the fields were fixedly stationary relative to each otherno material object would move and we would be visited with omnitemporality where one second would be an eternity. In other words, what time is depends on the relative motion of thesefields.The concept space density is already in use whenever we speak of one medium as being optically denser than another; and naturally therefore the refractive index of a medium, n , is the measure of this density.n=kGm/r2 and the creation of metamaterials.Technology, in the construction of negative index metamaterials, has been guided by an equation which gives n in terms of relative permittivity and relative permeability [11]. Thechallenge has been to get that material whose permittivity and permeability are simultaneously negative. This has proved very difficult demanding complex and tediousmethods of construction.

Realizing that n=kGm/r2 (which means that permittivity and permeability are ultimatelydependent on atomic gravity) should significantly reduce the problem of design and construction.

V. Reference

1) http://www.chem1.com/acad/sci/aboutwater.html
2) http://en.wikipedia.org/wiki/Atomic_radii_of_the_elements_(data_page)
3) http://chemistry.about.com/od/elementfacts/a/atomicweights.htm
4) http://en.wikipedia.org/wiki/List_of_refractive_indices#List
   http://www.avogadro.co.uk/structure/chemstruc/ionic/g-ionic.htm
5) http://www.citycollegiate.com/carbonsiliconIXa.htm
6) http://commons.wikimedia.org/wiki/File:Carbon-disulfide-2D-dimensions.png
7) http://en.wikipedia.org/wiki/Ionic_bond
8) http://en.wikisource.org/wiki/Accord_between_different_laws_of_Nature_that_seemed_incompatible
9) http://en.wikipedia.org/wiki/Metamaterial#Electromagnetic_metamaterials

Fixed-Dome Biodigester Construction and Determination of Effects of Temperature on the Performance

GJSFR Classification (FOR)
240202,240503,249901

Dr. Ugwoke D .U[1] and Ekpe E.O[2]

Abstract **- Construction of a 0.459m3 fixed-dome galvanized biodigester with objectives to determine the effects of temperature o n its performance at 100 days retention period was carried out at Abakaliki area of high moisture content cow dung wastes at 1:2 ration. The measurements of the ambient and slurry temperatures and the biogas volumes using mercury- in -glass thermometer (-10.0OC – 100.0OC) and downwards displacement techniques of water in a 25-litre calibrated white jerry can respectively were conducted at 9.30 am, 12.00noon and 2.30pm and corresponding mean values computed for each day. Results showed 25.0OC -41.0OC (ie 25.0OC – 38.5OC ambient and 29.0OC – 41.0OC slurry temperatures) range which agree with earlier results. Two ranges of temperature fluctuations exited in the slurry range. The mild case between 1st and 57th day gave rise to early enhanced quantity and quality biogas production while the later range gave rise to reduced the volume of biogas. The highly fluctuated ambient temperature favoured the activation of the microorganisms for better performance of the digester. The value produced is quite impressive and this is as a result of the favourable micro-organisms activities within the temperature range in the leakage and corrosion free biodigester.**

Keywords: mesophiles, slurry, digestion, cubic and regression.

I. Introduction

Energy as capacity for doing work has been an essential input to all aspect of human Endeavour and needs no surface. Energy radiated to the earth is far more that we can ever use. The use of solar energy is expanding generally and particularly in biomass energy form which is one type of renewable energy and a good alternative to the just depleting and polluting energy source.

distortion in its chain – supply at any point in time because it will cause a serious economic and social hardship Okeke, (2004) and Garba, (1996). All energy sources emanated from the sun – a giants star that radiates energy in all directions with only a small portion reaching the earth's The anaerobic production of biofuel known as biogas from a biodigester which captures the methane which would have gone into the atmosphere and would have added to global warning met with diverse technologies in the modern time.

The process of this methane production passes through four biological and chemical processes of hydrolysis, acidogenesis, acetogenesis and methanogenesis, represented in figure 1.0 below

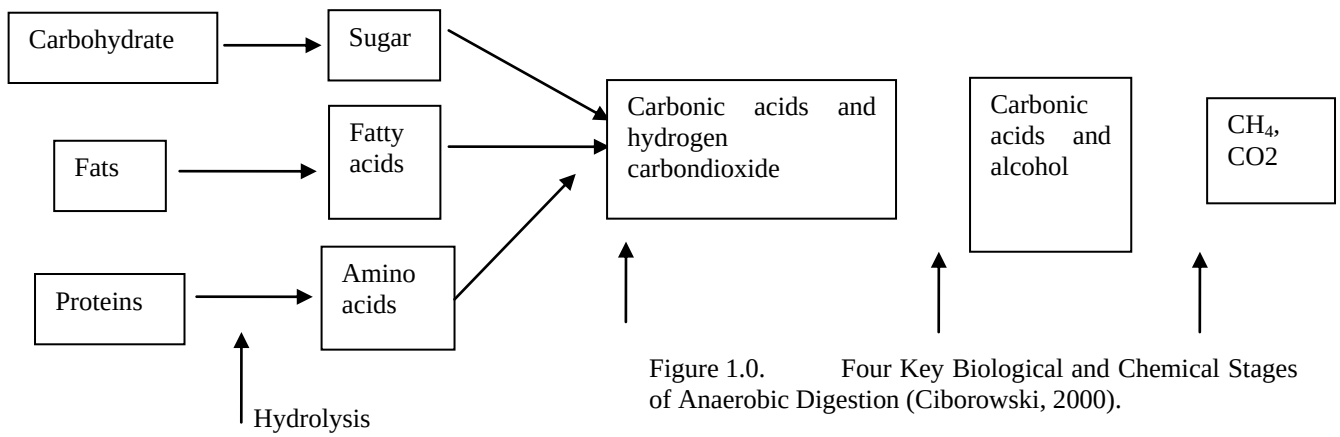


Figure 1.0. Four Key Biological and Chemical Stages of Anaerobic Digestion (Ciborowski, 2000).

Several factors affect these technologies in respect to the production of biogas-(Porkhared, et. al. 1991). These factors include pH- values of the slurry, the nature and type of feed stocks, the C/N ratio, loading rate, the size of the digester and more importantly the temperature of the digester which exists as ambient and slurry temperatures (Dioha el. al.2003).

By the time the radiation reaches the earth, most of the ultraviolet components have been filtered out remaining virtually the visible region with a small portion covering the

Author[1]-Department of Physics, Enugu State College of Education (Technical), Enugu.
(E-mail: Ugwokedennis at yahoo.com)
Author2-Department of Industrial Physics, Ebonyi State University, Abakaliki.

short infrared region. It is this small portion that is converted to heat energy quantified in terms of temperature. Other factors such as the distance of the sun from the earth, length of day, latitude and longitude of the location on the earth, affect the intensities of solar radiations on the earth's surface (Okpani and Nnabuchi, 2008). Also air – mass which is the radiative length of the direct beam path through the atmosphere affects solar radiation (Tomas, 2000).

Therefore temperature as a function of solar radiations affected the content of our digesters. Three zones of this temperature are identified with biogas production through anaerobic degradation of organic materials. These are mesophillic, thermophillic and psycrophillic zones which exist within the wider temperature range corresponding to three different sets of bacteria. They are mesophiles; those that operate best ac 20.0 ^{0}C – 40.0 ^{0}C, the thermophiles; which operate at 40.0 ^{0}C – 60.0 ^{0}C and the psycrophiles that operates at 4.0 ^{0}C – 15. 0 ^{0}C. Marchaim in 1992 identified that the optimum biogas generation existed at the mesophillic zone of ambient temperature while the methanogenic bacteria are inactive in extreme low zone of psycrophillic zone and high temperature zone of thermophillic zone. Experiences in China, Anonymous reported in 1992, indicated that a rapid change of more than 5^{0}C will slow down biogas production noticeably. This implies that biogas yield is greatly affected by seasons since ambient and fermentative temperature values are influenced by the earth temperature which is related to the atmosphere.

Song et. al. (2004) maintained also that mesophillic digestion takes place optimally at 20.0 ^{0}C -45.0 ^{0}C and 50.0 ^{0}C -52. 0^{0}C for thermophillic digestion. Other investigation reports by Itodo et .al. (1995), Ezeonu et. al. (2005), Nwokoye at. al. (2008), Dioha et. al. (2003) and Dioha et. al. (2006) indicated mesophillic temperature ranges of 20.0^{o}C- 40.0^{0}C, 28.0^{0}C – 35.0^{0}C and 35.00C – 50.00C, 30.00C – 40.00C and 20.00C – 45.00C for cow dung respectively.

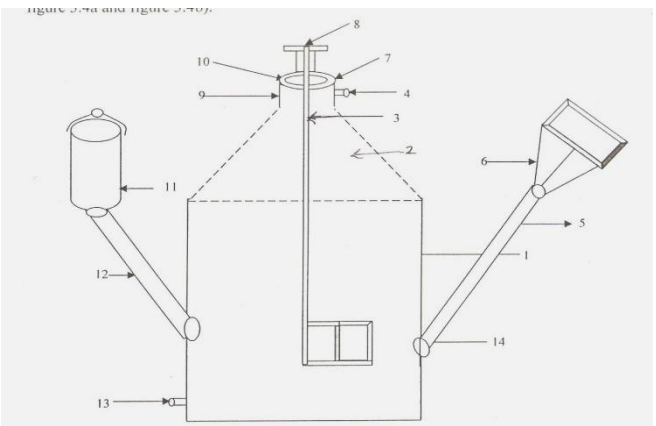
It means that all technologies involving anaerobic digestion in order to produce biogas in the past and at present must be within the above ranges. In Nigeria and overseas the existing biogas plants are made of concrete, cement, bricks, plastics and metals. In some cases, though locally, we have digesters fixed with separate or integral gasholders with attended difficulties in costs and operations. .Nigeria is rich in manpower and material resources such as quality iron and steels which are potential materials for the construction of improved biodigester (ie galvanized fixed – dome biodigester) with outweighed advantages over the floating types. Also cow dung are readily available in Nigeria.

Therefore, the researcher wishes to re-examine the effect of temperature on the performance of a constructed galvanized fixed – dome biodigester using cow dung from a high moisture content areas of the country – Abakaliki, within a reasonable length of time ie. 8th April, 2009 -17th July, 2009.

II. Materials and Method

The materials used for the construction include: galvanized iron sheets, sockets, bearings, air value, shaft to stir, bolts and nut; 18mm gauge of galvanized iron plate for cover plate, washers, flat iron bar for stirrer blade, 16mm gauge galvanized iron sheets to form the inlet and outlet pipes, 25-litre calibrated white jerry can and hoses. The researcher adopted a three stage approach of making a detailed master plan of the dimensions of the parts, the construction details and evaluation of the digester using cow dung. Some standard parts such as the bearings, the iron sheet, oil seal, nipple and sockets, bolts and nuts, hoses and black paints were purchased from material markets using the dimensions specified. Some other parts such as top plate for cover, stirring handle, Paddle (blade), tank with inlet and outlet pips were welded according while shaft, locknuts, etc were machined to fit in using lather machine in the engineering workshop of National Centre for Energy, Research and Development, NCERD, University of Nigeria Nsukka.

The constructed digester consists of the cylindrical compartment, and a hemispherical dome with small cylindrical neck and a metal cover, the inlet and outlet pipes and gas pipes to utility. The capacity is 0.45900 m^3 and thickness of 1.5mm to withstand pressure of the gas produced (see figure 2.0 below).



Part no = part name: 1 = Fermentation unit, 2 = gas storage unit, 3 = stirrer shaft, 4 = gas outlet pipe, 5 = slurry inlet pipe, 6 = funnel-like mouth, 7 = bolts hole, 8 = stirrer handle, 9 = short metal eck, 10 = metal reim/ring, 11 = cylindrical outlet mouth, 12 = slurry pipe, 13 = Nipple and socket, 14 = shaft blade.

Figure 2.0: Schematic Diagram of the bilodigester

After positioning the biodigester in a shade and intercepting sun light free environment, it was tested for leakage and was batch fed with fresh cow dung (slurry) collected from Abakaliki Abatoir after sorting to remove non-degradable materials such as stone, cellophane, feather, bones, pebels etc.

The slurry was obtained by using 1:2 radio of the waste: water. The weighting was carried out by using the "five goat

model" Z051299 weighing balance graduated in imperial and metric scales of 0-110 lb and 0-50.0kg respectively after correcting the zero errors. Then the Slurry was thoroughly mixed and introduced into the digester while it was open. The mass ratio of 90:180) totaling 270kg and equivalent to one-third of the entire volume was used and the container tightly covered with rubber seals, iron plate cover, bolts and nuts, and air value.

Starting from the next day, the measurements and readings of the ambient and slurry temperatures, and biogas volumes were carried out at 9.30am, 12.00noon and 2.30pm with stirring to break the scum formed on the surface of the slurry and redistribute the temperatures evenly within the contents. The mean values for the ambient temperature, slurry temperature and biogas volumes were computed for each day after the respective last measurements and readings.

The slurry and ambient temperatures were monitored daily using a mercury – in – glass thermometer graduated in Celsius scale. The range of the scale of the instrument is – 10.0OC – 110.00C. After positioning the digester in convenient place, the ambient and the slurry temperatures were measured after proper stirring of the slurry giving rise to slurry turbling in the cylinderical outlet top showing that these temperatures are the replica of the temperatures inside the biodigester. The volume of the biogas produced was determined by subsequent downward displacements of water in the 25 – litre calibrated jerry can until the biogas produced was exhausted and the total volume taken (see figure 3.0 and table 1. 0).

Table 1.0: Values of Ambient and Slurry Temperature (^{0}C), Biogas Volume (l) and Retention Time (days).

S/N	DATE	RETN. TIME (Days)	Ambient Temp (^{0}C)	Slurry TEMP. (^{O}c)	VOL. (litres)	CUM. GAS VOLUME (litres)
	8/4/09	Charging the Biodigester				
1	9/4/09	1	33.0	37.0	13.0	13.0
2	10/4/09	2	34.0	39.0	15.5	28.5
3	11/4/09	3	34.5	36.0	52.5	81.0
4	12/4/09	4	36.0	37.0	49.0	120.0
5	13/4/09	5	34.0	38.0	40.0	170.0
6	14/4/09	6	36.0	37.0	47.0	217.0
7	15/4/09	7	34.0	37.0	41.0	258.0
8	16/4/09	8	35.0	36.5	46.0	304.0
9	17/4/09	9	34.0	36.0	46.5	350.0
10	18/4/09	10	29.0	34.0	36.5	387.0
11	19/4/09	11	35.9	36.0	36.5	423.5
12	20/4/09	12	32.0	35.0	45.5	469.0
13	21/4/09	13	32.5	38.0	34.0	503.0
14	22/4/09	14	35.0	36.0	46.5	549.5
15	23/4/09	15	33.0	37.0	46.0	595.5
16	24/4/09	16	32.0	36.0	46.5	642.0
17	25/4/09	17	35.0	39.0	45.5	687.5
18	26/4/09	18	29.5	36.0	35.5	723.0
19	27/4/09	19	36.0	37.0	31.5	754.5
20	28/4/09	20	30.0	35.0	46.0	800.5
21	29/4/09	21	31.0	37.5	14.0	814.5
22	30/4/09	22	39.0	39.5	18.0	832.5
23	01/5/09	23	26.0	39.0	11.0	843.5
24	02/5/09	24	37.0	35.5	14.5	868.0
25	03/5/09	25	27.0	37.0	32.0	900.0
26	04/5/09	26	37.5	38.0	28.0	928.0
27	05/5/09	27	31.0	41.0	28.5	956.5
28	06/5/09	28	28.5	40.0	24.0	980.5
29	07/5/09	29	30.0	41.0	35.5	1026.0
30	08/5/09	30	32.0	40.0	29.0	1055.0
31	09/5/09	31	33.5	38.0	39.5	1094.5
32	10/5/09	32	34.5	37.0	28.0	1122.5
33	11/5/09	33	32.0	38.0	31.0	1153.5
34	12/5/09	34	38.0	40.5	29.0	1182.5
35	13/5/09	35	32.0	40.0	32.0	1215.0
36	14/5/09	36	33.5	38.0	26.0	1241.0
37	15/5/09	37	33.0	39.0	25.0	1266.0
38	16/5//09	38	35.0	37.0	27.0	1293.0
39	17/5/09	39	27.0	35.5	26.0	1318.0
40	18/5/09	40	31.5	38.0	35.0	1353.0
41	19/5/09	41	35.0	39.0	27.0	1380.0
42	20/5/09	42	32.0	38.0	29.5	1410.0
43	21/5/09	43	30.0	37.0	35.5	1445.5
44	22/5/09	44	38.0	40.5	25.5	1471.0
45	23/5/09	45	32.0	37.0	25.0	1496.0
46	24/5/09	46	38.0	41.0	24.5	1520.5
47	25/5/09	47	38.5	39.0	24.5	1545.0
48	26/5/09	48	34.0	38.0	26.5	1571.0
49	27/5/09	49	33.0	40.0	27.0	1598.5
50	28/5/09	50	36.0	39.0	22.5	1621.0
51	29/5/09	51	36.5	41.0	23.5	1644.5

52	30/5/09	52	35.0	39.0	17.5	1662.0
53	31//5/09	53	32.0	37.0	19.5	1681.5
54	01/6/09	54	32.0	38.0	17.0	1698.5
55	02/6/09	55	32.0	38.0	29.5	1728.0
56	03/6/09	56	33.0	40.0	32.0	1760.0
57	04/6/09	57	30.0	37.0	13.0	1773.0
58	05/6/09	58	37.0	39.5	16.0	1789.0
59	06/6/09	59	37.0	38.5	17.0	1806.0
60	07/6/09	60	27.0	31.5	23.0	1829.0
61	08/6/09	61	34.0	39.0	19.5	1848.5
62	09/6/09	62	35.0	38.0	15.5	1864.0
63	10/6/09	63	33	37	23.5	1887.5
64	11/6/09	64	29	32	17	1904.5
65	12/6/09	65	33	37	14	1918.5
66	13/6/09	66	35	39	12	1930.5
67	14/6/09	67	32	37	12.5	1943.0
68	15/6/09	68	31	35	11	1954.0
69	16/6/09	69	31	34	16.0	1970.6
70	17/6/09	70	30	33.5	14	1984.6
71	18/6/09	71	32	35.5	16	2000.6
72	19/6/09	72	33	38	13	2013.6
73	20/6/09	73	34.5	39.5	12	2025.6
74	21/6/09	74	35	39	10	2035.6
75	22/6/09	75	38	41	11	2046.6
76	23/6/09	76	35.5	37	11.5	2058.1
77	24/6/09	77	33	35	11.5	2269.6
78	25/6/09	78	34	38	12	2081.6
79	26/6/09	79	32	36	17	2098.6
80	27/6/09	80	32	37	16.5	2115.1
81	28/6/09	81	34	38	15.5	2130.6
82	29/6/09	82	32.5	38	13	2143.6
83	30/6/09	83	31	36	11.5	2155.0
84	01/7/09	84	33	36	16	2171.0
85	02/7/09	85	34	38	11	2182.0
86	03/7/09	86	30	35	14	2196.0
87	04/7/09	87	33	36	11	2207.0
88	05/7/09	88	34	40	5.5	2212.5
89	06/7/09	89	30	35	3.5	2216.0
90	07/7/09	90	31	36	4.5	2220.5
91	08/7/09	91	30	36	10.5	2241.0
92	09/7/09	92	31	40	4.0	2245.0
93	10/7/09	93	28	32	4.5	2250.0
94	11/7/09	94	25.6	29	3.0	2253.5
95	12/7/09	95	33	40	5.5	2259.0
96	13/7/09	96	32	38	5.0	2264.0
97	14/7/09	97	33.5	39	4.2	2268.2
98	15/7/09	98	32.5	37.0	4.0	2272.2
99	16/7/09	99	30.5	39.0	3.5	2275.7
100	17/7/09	100	30.0	38.0	3.1	2278.8

III. Results and Discussion

Observed in figures 4.0 and 5.0 are the consistent fluctuations of the ambient and slurry temperatures with retention time. These give rise to 25.0^0C- 38.50^0C ambient temperature and 29.0^0C – 41.0^0 slurry temperature ranges all within the 25.0^0C-41.0^0mesophillic temperature range only.

The novel cubic regression approximation profile of biogas volumes with the same retention time, figure 6.0, gave the minimum and maximum biogas volumes of 13.08 liters on the 99th day -37.67 liters on the 4th day. The stable flammability started on the 4th day.

The consistent fluctuations of temperature were more within the ambient range than in slurry range. This feature might be due to the the lower absorption of heat by more compressed

particles of the slurry unlike in the air. Within the slurry temperature range mild fluctuations exist between the 1st day to the 57th day. After 57th day the fluctuations were high. Within the low fluctuation range the micro-organisms in the slurry were stabilized and active. This leads to high productions of biogas. The maximum value of biogas produced was on the 4th day which is within the period of moderate sustainance of the stability of the organisms. As from 57th day of the retention time of intense absorption of heat by the organisms, the stability was disruptal and as such biogas production decreased. This condition became more pronounced due to insufficient nutrients in the medium.

Figure 7.0 showed the normal cumulative biogas volume of 2198.0 litres within 100 days. This shows that 25.0^0C – 41.0^0C mesophillic temperature range has mean favourable effects on the development, growth and stability of the medium micro organisms.

The maintenance of the organisms with the observed mesophillic temperature range tallies consistently with the results of investigations of earlier researchers such as Itodo, et. al. (2005) 20.0^0- 40.0^0C, Nwokoye, et. al. (2008) 28.0^0C – 35.0^0C, Dioha, et. al. (2003) 30.0^0C – 40.0^0C and Dioha, et al. (2006) 20.0^0 – 45.0^0C.

It implies that above 41.0^0C and below 25.0^0 the biogas productions will be drastically reduced due to micro organisms inability to survive in the environment.

IV. Conclusion

In this work, the novel cubic regression approximation of biogas volumes, cumulative biogas volumes, ambient and slurry temperatures plots with the same retention period indicate that optimum biogas production existed within 25.0^0 C-41.0 ^{0}C mesophillic temperature range which is ideal compared with earlier and similar investigation results of Itodo et. al. (2005), Nwokoye et. al (2008) and Dioha et. al (2006).

High ambient temperature variations with the retention time imply direct activation of the particles in the system. Although, we have harsh slurry temperature variations as from 57th day of the period, the fair temperature variations within the temperature range (ie from the 1st day to the 57th day) provided the favourable mean development, growth and stability of the micro-organisms which lead to enhanced biogas production at early stage.

The temperature variations within and outside the digester generally maintain the mean favourable development, growth and stability of the organisms from high moisture areas of the country, which favours biogas production.

Cow dungs are vital raw materials for very early and enhanced biogas productions since the performance of the 0.4590 m3 capacity galvanized fixed-dome biodigester is quite impressive.

Therefore, the researcher recommends the biodigesters, though in much improved forms, and cow dungs, as potential digester and raw material respectively, for more enhanced biogas production both in quantity and quality.

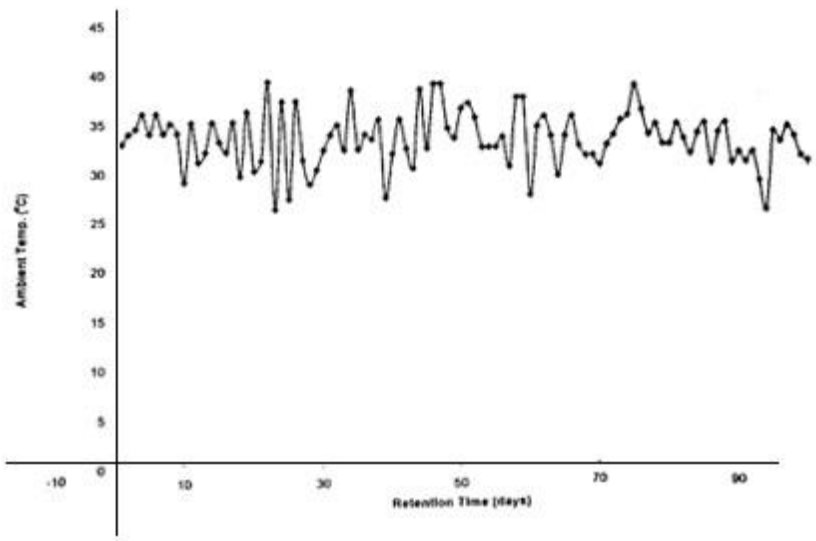
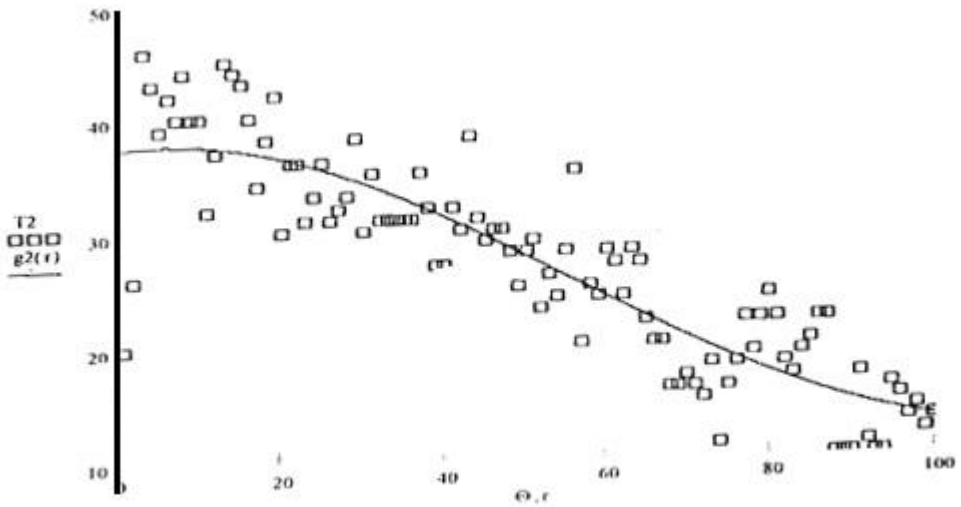


Figure 5.0: Graph of Slurry Temperature (^{0}C) Against Retention time (days)



Maxm value = 37.62 at t = 3.6
Minm value = 13.084 at t= 99.925
$V(t) = 37.446+0.091t - 8.12x10^{-3}t^2+ 4.773x\ 10^{-3}t^3$

Figure 6.0. Graph of cubic Regression Approximation of Biogas Volume (l) Against Retention time (days)

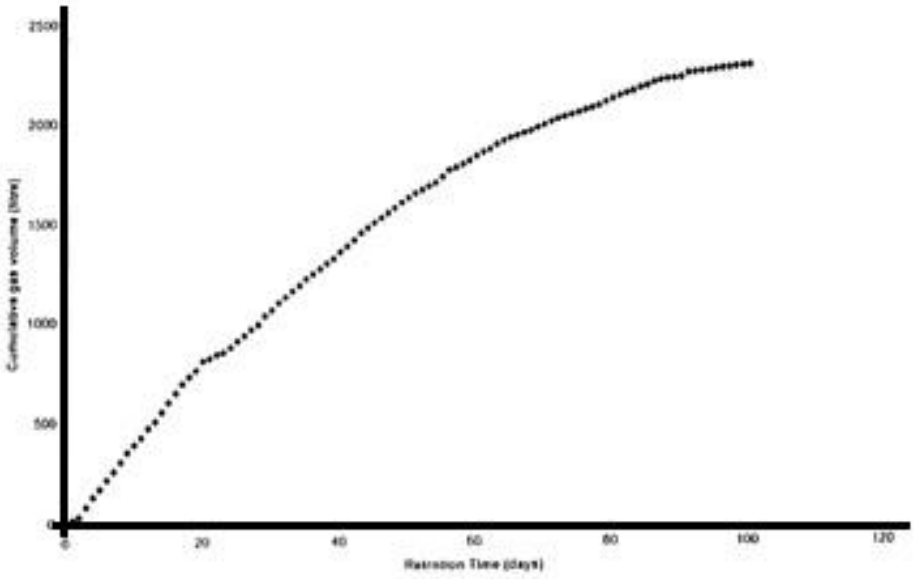


Figure 7.0. Plot of Cumulative Biogas Volume (l) versus Retention time (days).

V. Acknowledgement

The researcher thanks Dr. Ezema, F.I, Mrs. Urama J.O, Dr. Eze J.I, Mr. Obi Innocent, Mr. Ogbonna C.D, Mrs. Ugwoke Caroline and Prof. Oparaku, O.U - Director NCERD, University of Nigeria Nsukka, Enugu state, for their kindness, encouragements, sacrifices, candid advice and facilities made available to me during the period of this work.

VI. References

1) Anonymous (1992). Biogas Technology in China. Chengdu Biogas Research

2) Institute of the Ministry of Agriculture.

3) Ciborowski, P. (2000). Anarobic Digestion, Minnesota Pollution ControlAgency, Air Innovation Conference, www.epa gov. retrieved 19.08.07.

4) Dioha, I.J., Gulma, M.A. And Nabade .K. (2003).
5) A Modified. 10m3 fixed – Dome Community Biogas Plant. Nigerian Journal of Solar Energy, Volume 14, P. 126- 134.

6) Dioha, I.J., Eboatu, A.N., Sambo, A.S., Birinkebbi, A.M., Tung, .S. and Okoye, P.A.C., (2006). Investigation of the Effects of Temperature on Biogas Production from Poutry Dropping and Neem Tree Leaves. Nigerian Journal of Solar Energy, Volume 16, P. 19- 20.

7) Ezeonu, S.O., Dioha, I. J and Ezoatu, A.N. (2005). Daily Biogas from Different Wastes and Identification of Methanogenic Bacteria Involved. Nigerian Journal of Solar Energy, Volume 15, P.80 – 84.

8) Garba, B. (1996). Mechanism and Biochemistry ofMethanogenesis in Biogas – genesis in Biogas Production. Nigerian Journal of Renewable Energy, Volume 7, number 1and 2, P. 12 -16 .

9) Itodo, I.N., Onuh, C.E. and Ogar, B.B. (1995). Effects of Various Total Solids Concentration of Cattle Waste on Biogas Filed. Nigerian Journal of Renewable Energy, Volume 13, P. 36 – 39

10) Marchaim, N. (1992). Biogas Processes for Sustainable

11) Development. FAO Agricultural Services Bullerin 95

12) Nwokoye, A.O.C, Okeke, C.E. and Ogbuagu, F.O. (2008). The Studies of Some Biogas Production Operating Parameters from Cow Dung Using a Model Type Biodidigester, Nigerian Journal of Solar Energy, Volume 19, Number 1, P.131-135.

13) Okeke, C.E (2004).The Sensitization Seminar on Energy

14) Efficiency in the Industry, Workshop on Energy CostSaving Measures in Nigerian Industries.

15) Porkhared, R.K. and Yadua, R.P. (1991). Applications of Biogas Technology in Nepal: Problems and Prospects. M.I.T series No. 11, 1C1MOD, P.5-7.

16) Song, Y.C., Kwon, S. J. and Woo, J.H. (2004).Mesophillic and Thermophillic Temperature Co-phase Anaerobic Digestion Compared with Single Phase.

17) Tomas, M.V. (Editor), (2000). Solar Electricity. John Wiley and Sons Limited, Newyork.

Global Journals Guidelines Handbook 2010

www.GlobalJournals.org

FELLOW OF INTERNATIONAL CONGRESS OF SCIENCE FRONTIER RESEARCH (FICSFR)

- 'FICSFR' title will be awarded to the person/institution after approval of Editor-in-Chief and Editorial Board. The title 'FICSFR' can be added to name in the following manner:
  e.g. Dr. Andrew Knoll, Ph.D., FICSFR
- FICSFR can submit two papers every year for publication without any charges. The paper will be sent to two peer reviewers. The paper will be published after the acceptance of peer reviewers and Editorial Board.
- Free unlimited Web-space will be allotted to 'FICSFR 'along with sub Domain to contribute and partake in our activities.
- A professional email address will be allotted free with unlimited email space.
- FICSFR will be authorized to receive e-Journals-GJFS for the Lifetime.
- FICSFR will be exempted from the registration fees of Seminar/Symposium/Conference/Workshop conducted internationally of GJFS (FREE of Charge).
- FICSFR will be an Honorable Guest of any gathering held.

ASSOCIATE OF INTERNATIONAL CONGRESS OF SCIENCE FRONTIER RESEARCH (AICSFR)

- AICSFR title will be awarded to the person/institution after approval of Editor-in-Chef and Editorial Board. The title 'AICSFR' can be added to name in the following manner:
  eg. Dr. Thomas Knoll, Ph.D., AICSFR
- AICSFR can submit one paper every year for publication without any charges. The paper will be sent to two peer reviewers. The paper will be published after the acceptance of peer reviewers and Editorial Board.
- Free 2GB Web-space will be allotted to 'AICSFR' along with sub Domain to contribute and participate in our activities.
- A professional email address will be allotted with free 1GB email space.
- AICSFR will be authorized to receive e-Journal GJFS for lifetime.

ANNUAL MEMBER

- Annual Member will be authorized to receive e-Journal GJFS for one year (Journal subscription for one year).
- The member will be allotted free 1 GB Web-space along with sub Domain to contribute and participate in our activities.
- A professional email address will be allotted free 500 MB email space.

PAPER PUBLICATION

- The members can publish paper once. The paper will be sent to two-peer reviewer. The paper will be published after the acceptance of peer reviewers and Editorial Board.

Process of submission of Research Paper

The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide. The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission .Online Submission: There are three ways to submit your paper:

(A) (I) Register yourself using top right corner of Home page then Login from same place twice. If you are already registered, then login using your username and password.

(II) Choose corresponding Journal from "Research Journals" Menu.

(III) Click 'Submit Manuscript'. Fill required information and Upload the paper.

(B) If you are using Internet Explorer (Although Mozilla Firefox is preferred), then Direct Submission through Homepage is also available.

(C) If these two are not convenient, and then email the paper directly to dean@globaljournals.org as an attachment.

Offline Submission: Author can send the typed form of paper by Post. However, online submission should be preferred.

Preferred Author Guidelines

MANUSCRIPT STYLE INSTRUCTION (Must be strictly followed)

Page Size: 8.27" X 11'"

- Left Margin: 0.65
- Right Margin: 0.65
- Top Margin: 0.75
- Bottom Margin: 0.75
- Font type of all text should be Times New Roman.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, "Abstract" word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be two lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

You can use your own standard format also.

Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

1. GENERAL

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

Scope

The Global Journals welcome the submission of original paper, review paper, survey article relevant to the all the streams of Philosophy and knowledge. The Global Journals is parental platform for Global Journal of Computer Science and Technology, Researches in Engineering, Medical Research, Science Frontier Research, Human Social Science, Management, and Business organization. The choice of

specific field can be done otherwise as following in Abstracting and Indexing Page on this Website. As the all Global Journals are being abstracted and indexed (in process) by most of the reputed organizations. Topics of only narrow interest will not be accepted unless they have wider potential or consequences.

2. ETHICAL GUIDELINES

Authors should follow the ethical guidelines as mentioned below for publication of research paper and research activities.

Papers are accepted on strict understanding that the material in whole or in part has not been, nor is being, considered for publication elsewhere. If the paper once accepted by Global Journals and Editorial Board, will become the *copyright of the Global Journals.*

Authorship: The authors and coauthors should have active contribution to conception design, analysis and interpretation of findings. They should critically review the contents and drafting of the paper. All should approve the final version of the paper before submission

The Global Journals follows the definition of authorship set up by the Global Academy of Research and Development. According to the Global Academy of R&D authorship, criteria must be based on:

1) Substantial contributions to conception and acquisition of data, analysis and interpretation of the findings.

2) Drafting the paper and revising it critically regarding important academic content.

3) Final approval of the version of the paper to be published.

All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

Acknowledgements: Contributors to the research other than authors credited should be mentioned under acknowledgement. The specifications of the source of funding for the research if appropriate can be included. Suppliers of resources may be mentioned along with address.

Appeal of Decision: The Editorial Board's decision on publication of the paper is final and cannot be appealed elsewhere.

Permissions: It is the author's responsibility to have prior permission if all or parts of earlier published illustrations are used in this paper.

Please mention proper reference and appropriate acknowledgements wherever expected.

If all or parts of previously published illustrations are used, permission must be taken from the copyright holder concerned. It is the author's responsibility to take these in writing.

Approval for reproduction/modification of any information (including figures and tables) published elsewhere must be obtained by the authors/copyright holders before submission of the manuscript. Contributors (Authors) are responsible for any copyright fee involved.

3. SUBMISSION OF MANUSCRIPTS

Manuscripts should be uploaded via this online submission page. The online submission is most efficient method for submission of papers, as it enables rapid distribution of manuscripts and consequently speeds up the review procedure. It also enables authors to know the status of their own manuscripts by emailing us. Complete instructions for submitting a paper is available below.

Manuscript submission is a systematic procedure and little preparation is required beyond having all parts of your manuscript in a given format and a computer with an Internet connection and a Web browser. Full help and instructions are provided on-screen. As an author, you will be prompted for login and manuscript details as Field of Paper and then to upload your manuscript file(s) according to the instructions.

To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads: Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

5. STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also. Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers*:* These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)*Title* should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, *"Abstract"* (less than 150 words) containing the major results and conclusions.

(c) Up to *ten keywords*, that precisely identifies the paper's subject, purpose, and focus.

(d) An *Introduction*, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; *conclusions* should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals, ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods*:* Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: *Please make these as concise as possible.*

References

References follow the *Harvard scheme* of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

Color Charges: It is the rule of the Global Journals for authors to pay the full cost for the reproduction of their color artwork. Hence, please note that, if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a color work agreement form before your paper can be published.

Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.

6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals.

6.1 Proof Corrections

The corresponding author will receive an e-mail alert containing a link to a website or will be attached. A working e-mail address must therefore be provided for the related author.

Acrobat Reader will be required in order to read this file. This software can be downloaded

(Free of charge) from the following website:

www.adobe.com/products/acrobat/readstep2.html. This will facilitate the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof.

Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

As changes to proofs are costly, we inquire that you only correct typesetting errors. All illustrations are retained by the publisher. Please note that the authors are responsible for all statements made in their work, including changes made by the copy editor.

6.2 Early View of Global Journals (Publication Prior to Print)

The Global Journals are enclosed by our publishing's Early View service. Early View articles are complete full-text articles sent in advance of their publication. Early View articles are absolute and final. They have been completely reviewed, revised and edited for publication, and the authors' final corrections have been incorporated. Because they are in final form, no changes can be made after sending them. The nature of Early View articles means that they do not yet have volume, issue or page numbers, so Early View articles cannot be cited in the conventional way.

6.3 Author Services

Online production tracking is available for your article through Author Services. Author Services enables authors to track their article - once it has been accepted - through the production process to publication online and in print. Authors can check the status of their articles online and choose to receive automated e-mails at key stages of production. The authors will receive an e-mail with a unique link that enables them to register and have their article automatically added to the system. Please ensure that a complete e-mail address is provided when submitting the manuscript.

6.4 Author Material Archive Policy

Please note that if not specifically requested, publisher will dispose off hardcopy & electronic information submitted, after the two months of publication. If you require the return of any information submitted, please inform the Editorial Board or dean as soon as possible.

6.5 Offprint and Extra Copies

A PDF offprint of the online-published article will be provided free of charge to the related author, and may be distributed according to the Publisher's terms and conditions. Additional paper offprint may be ordered by emailing us at: editor@globaljournals.org .

Informal Tips for writing a Science Frontier Research Paper to increase readability and citation

Before start writing a good quality Science Frontier Research Paper, let us first understand what is Science Frontier Research Paper? So, Frontier Research Paper is the paper which is written by professionals or scientists who are associated to Physics, Mathematics, Chemistry, Zoology, Botany, Bio-tech, Geology, Military Science, Environment and all Interdisciplinary & Frontier Subjects etc., or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

Techniques for writing a good quality Applied Science Research Paper:

1. Choosing the topic- In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Frontier Science. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: At a first glance, this point looks obvious but it is first recommendation that to write a quality research paper of any area, first draft your paper in Microsoft Word. By using MS Word, you can easily catch your grammatical mistakes and spelling errors.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to

not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. **Pick a good study spot:** To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. **Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.
- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.

- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.

You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The

purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described.
Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

Administration Rules Listed Before Submitting Your Research Paper to Global Journals

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals:

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.
- Do not give permission to anyone else to "PROOFREAD" your manuscript.

Written Material: You may discuss with your guides and key sources.

- Do not copy or imitate anyone else paper. (Various Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper *(Compilation)* by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

Index

A

alternating · 2, 6, 7
associated · 3, 2, 20, X
atmosphere · 33, 34

C

carbohydrates · 21
concentration · 21, 22, 23, 27, VII
Copper enters · 21

D

Determination · 3, 21, 24, 33
Determination Of Effects · 3, 33
Differential · 21, 22, 23, 27
Dirichlet · 2, 5, 6
distribution function · 13, 14, 15, 16, 17, 19, 20
Distributions · 20

E

efficiency · 23
electromagnetic · 30, 31, 32

F

Function Of Atomic · 3, 30

G

general · 13, 20, 22, 23, 30, 31, III, XIII
generalized · 3, 2, 9, 12, 13, 14, 15, 18, 19, 20
Generalized · 3, 12, 13

H

H-function, M-series · 13
hypergeometric · 3, 2, 6, 9, 13, 14, 15, 18

I

integrating · 20
investigation · 3, 7, 31, 34, 38, VI

L

longitude · 34

M

measurements · 21, 33, 35, VII, XII
mesophiles · 33, 34
Metamaterials · 3, 30

N

negative · 21, 22, 32

P

parameters · 14, 17, 20, 22
Performance · 3, 33
persistent · VII
pharmaceutical · 21, 22, 23, 24
photonsimply · 31
polarography · 3, 21, 22
polynomials · 9, 13
Possibility · 3, 30
Probability · 3, 13
Process · 3, III
production · 33, 34, 38, IX

R

refraction · 30, 31
Refraction · 3, 30
representation · 2, 5, 6, 9
representative · 30, 31

S

Search · VII
special · 2, 9, 13, 20

T

Temperature · 3, 33, 36, 39, 40
thatscientists · 32
thisdiscovery · 30
topological · 10, 12

U

understandable · 10

V

volumetric · 22

W

Whittaker · 9

save our planet

Global Journal of Science Frontier Research

Visit us on the Web at www.GlobalJournals.org | www.ComputerResearch.org
or email us at helpdesk@globaljournals.org

ISSN 9755896