Online ISSN: 2249-4626
Print ISSN: 0975-5896

Global Journal

of Science Frontier Research: B

Chemistry



Assessment of Groundwater

Synthesis of New Macrocycles

Highlights

Claisen-Schmidt Condensation

The Mechanism of Hail Formation

Discovering Thoughts, Inventing Future

VOLUME 14 ISSUE 7 VERSION 1.0

© 2001-2014 by Global Journal of Science Frontier Research , USA

Volume 14 Issue 45 was originally issued as B7

Global Journal of Science Frontier Research: B
Chemistry

Volume 14 Issue 45
Originally issued as B7

Global Journal of Science Frontier Research: B
Chemistry

Volume 14 Issue 7 (Ver. 1.0)

Open Association of Research Society

© Global Journal of Science Frontier Research. 2014.

All rights reserved.

This is a special issue published in version 1.0 of "Global Journal of Science Frontier Research." By Global Journals Inc.

All articles are open access articles distributed under "Global Journal of Science Frontier Research"

Reading License, which permits restricted use. Entire contents are copyright by of "Global Journal of Science Frontier Research" unless otherwise noted on specific articles.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without written permission.

The opinions and statements made in this book are those of the authors concerned. Ultraculture has not verified and neither confirms nor denies any of the foregoing and no warranty or fitness is implied.

Engage with the contents herein at your own risk.

The use of this journal, and the terms and conditions for our providing information, is governed by our Disclaimer, Terms and Conditions and Privacy Policy given on our website http://globaljournals.us/terms-and-condition/menu-id-1463/

By referring / using / reading / any type of association / referencing this journal, this signifies and you acknowledge that you have read them and that you accept and will be bound by the terms thereof.

All information, journals, this journal, activities undertaken, materials, services and our website, terms and conditions, privacy policy, and this journal is subject to change anytime without any prior notice.

Incorporation No.: 0423089
License No.: 42125/022010/1186
Registration No.: 430374
Import-Export Code: 1109007027
Employer Identification Number (EIN):
USA Tax ID: 98-0673427

Global Journals Inc.

*(A Delaware USA Incorporation with "Good Standing"; **Reg. Number: 0423089**)*

Sponsors: Open Association of Research Society
Open Scientific Standards

Publisher's Headquarters office

Global Journals Headquarters
301st Edgewater Place Suite, 100 Edgewater Dr.-Pl,
Wakefield MASSACHUSETTS, Pin: 01880,
United States of America
USA Toll Free: +001-888-839-7392
USA Toll Free Fax: +001-888-839-7392

Offset Typesetting

Global Journals Incorporated
2nd, Lansdowne, Lansdowne Rd., Croydon-Surrey,
Pin: CR9 2ER, United Kingdom

Packaging & Continental Dispatching

Global Journals
E-3130 Sudama Nagar, Near Gopur Square,
Indore, M.P., Pin:452009, India

Find a correspondence nodal officer near you

To find nodal officer of your country, please email us at *local@globaljournals.org*

eContacts

Press Inquiries: *press@globaljournals.org*
Investor Inquiries: *investors@globaljournals.org*
Technical Support: *technology@globaljournals.org*
Media & Releases: *media@globaljournals.org*

Pricing (Including by Air Parcel Charges):

For Authors:
22 USD (B/W) & 50 USD (Color)
Yearly Subscription (Personal & Institutional):
200 USD (B/W) & 250 USD (Color)

Integrated Editorial Board
(Computer Science, Engineering, Medical, Management, Natural Science, Social Science)

John A. Hamilton,"Drew" Jr.,
Ph.D., Professor, Management
Computer Science and Software Engineering
Director, Information Assurance Laboratory
Auburn University

Dr. Henry Hexmoor
IEEE senior member since 2004
Ph.D. Computer Science, University at Buffalo
Department of Computer Science
Southern Illinois University at Carbondale

Dr. Osman Balci, Professor
Department of Computer Science
Virginia Tech, Virginia University
Ph.D.and M.S.Syracuse University, Syracuse, New York
M.S. and B.S. Bogazici University, Istanbul, Turkey

Yogita Bajpai
M.Sc. (Computer Science), FICCT
U.S.A.Email:
yogita@computerresearch.org

Dr. T. David A. Forbes
Associate Professor and Range Nutritionist
Ph.D. Edinburgh University - Animal Nutrition
M.S. Aberdeen University - Animal Nutrition
B.A. University of Dublin- Zoology

Dr. Wenying Feng
Professor, Department of Computing & Information Systems
Department of Mathematics
Trent University, Peterborough,
ON Canada K9J 7B8

Dr. Thomas Wischgoll
Computer Science and Engineering,
Wright State University, Dayton, Ohio
B.S., M.S., Ph.D.
(University of Kaiserslautern)

Dr. Abdurrahman Arslanyilmaz
Computer Science & Information Systems Department
Youngstown State University
Ph.D., Texas A&M University
University of Missouri, Columbia
Gazi University, Turkey

Dr. Xiaohong He
Professor of International Business
University of Quinnipiac
BS, Jilin Institute of Technology; MA, MS, PhD,. (University of Texas-Dallas)

Burcin Becerik-Gerber
University of Southern California
Ph.D. in Civil Engineering
DDes from Harvard University
M.S. from University of California, Berkeley & Istanbul University

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), Massachusetts 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 ReginaPh.D., M.Sc. in Mathematics
B.A. (Honors) in Mathematics
University of Windso

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 NeuroscienceNorthwestern University
Feinberg School of Medicine

Dr. Pina C. Sanelli
Associate Professor of Public Health
Weill Cornell Medical College
Associate Attending Radiologist
NewYork-Presbyterian Hospital
MRI, MRA, CT, and CTA
Neuroradiology and Diagnostic Radiology
M.D., State University of New York at Buffalo,School of Medicine and Biomedical Sciences

Dr. Roberto Sanchez
Associate Professor
Department of Structural and Chemical Biology
Mount Sinai School of Medicine
Ph.D., The Rockefeller University

Dr. Wen-Yih Sun
Professor of Earth and Atmospheric SciencesPurdue University Director
National Center for Typhoon and Flooding Research, Taiwan
University Chair Professor
Department of Atmospheric Sciences, National Central University, Chung-Li, TaiwanUniversity Chair Professor
Institute of Environmental Engineering, National Chiao Tung University, Hsin-chu, Taiwan.Ph.D., MS The University of Chicago, Geophysical Sciences
BS National Taiwan University, Atmospheric Sciences
Associate Professor of Radiology

Dr. Michael R. Rudnick
M.D., FACP
Associate Professor of Medicine
Chief, Renal Electrolyte and Hypertension Division (PMC)
Penn Medicine, University of Pennsylvania
Presbyterian Medical Center, Philadelphia
Nephrology and Internal Medicine
Certified by the American Board of Internal Medicine

Dr. Bassey Benjamin Esu
B.Sc. Marketing; MBA Marketing; Ph.D Marketing
Lecturer, Department of Marketing, University of Calabar
Tourism Consultant, Cross River State Tourism Development Department
Co-ordinator , Sustainable Tourism Initiative, Calabar, Nigeria

Dr. Aziz M. Barbar, Ph.D.
IEEE Senior Member
Chairperson, Department of Computer Science
AUST - American University of Science & Technology
Alfred Naccash Avenue – Ashrafieh

President Editor (HON.)

Dr. George Perry, (Neuroscientist)
Dean and Professor, College of Sciences
Denham Harman Research Award (American Aging Association)
ISI Highly Cited Researcher, Iberoamerican Molecular Biology Organization
AAAS Fellow, Correspondent Member of Spanish Royal Academy of Sciences
University of Texas at San Antonio
Postdoctoral Fellow (Department of Cell Biology)
Baylor College of Medicine
Houston, Texas, United States

Chief Author (HON.)

Dr. R.K. Dixit
M.Sc., Ph.D., FICCT
Chief Author, India
Email: authorind@computerresearch.org

Dean & Editor-in-Chief (HON.)

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

Sangita Dixit
M.Sc., FICCT
Dean & Chancellor (Asia Pacific)
deanind@computerresearch.org

Suyash Dixit
(B.E., Computer Science Engineering), FICCTT
President, Web Administration and
Development , CEO at IOSRD
COO at GAOR & OSS

Er. Suyog Dixit
(M. Tech), BE (HONS. in CSE), FICCT
SAP Certified Consultant
CEO at IOSRD, GAOR & OSS
Technical Dean, Global Journals Inc. (US)
Website: www.suyogdixit.com
Email:suyog@suyogdixit.com

Pritesh Rajvaidya
(MS) Computer Science Department
California State University
BE (Computer Science), FICCT
Technical Dean, USA
Email: pritesh@computerresearch.org

Luis Galárraga
J!Research Project Leader
Saarbrücken, Germany

Contents of the Issue

i. Copyright Notice
ii. Editorial Board Members
iii. Chief Author and Dean
iv. Contents of the Issue

1. Assessment of Groundwater Quality around Two Major Active Dumpsites in Lagos, Nigeria. *1-13*
2. Phytochemical and Therapeutic Studies of the Fruit Essential Oil of *Thuja orientalis* from Nigeria. *15-20*
3. The Mechanism of Hail Formation and a Method to Prevent it. *21-29*
4. *Ocimum basilicum* var. *purpureum* Floral Essential Oil: Phytochemicals, Phenolic Content, Antioxidant, Free Radical Scavenging and Antimicrobial Potentials. *31-37*
5. Synthesis of New Macrocycles of Ortho-Methoxy Salicylaldehyde using Claisen-Schmidt Condensation. *39-42*

v. Fellows and Auxiliary Memberships
vi. Process of Submission of Research Paper
vii. Preferred Author Guidelines
viii. Index

Global Journal of Science Frontier Research: B
Chemistry
Volume 14 Issue 7 Version 1.0 Year 2014
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Assessment of Groundwater Quality around Two Major Active Dumpsites in Lagos, Nigeria

By Adeyi, A. A. & Majolagbe, A. O.
Lagos State University, Nigeria

Abstract- This paper presents the results of physico-chemical parameter data and water quality index used to assess the groundwater quality around Olusosun and Solus dumpsites in Lagos southwest, Nigeria. Twenty (20) water samples each were collected in wells and boreholes around these two dumpsites, once in two months consecutively for two years. The parameters determined include pH, acidity, alkalinity, conductivity (EC), total dissolved solids (TDS), total hardness (TH), Cl-, SO42-, NO3- and PO43- and heavy metals: Pb, Ni, Cd, Zn, Cu, Fe, Mg, Ca, Na and K using standard analytical methods. Descriptive statistics and correlation coefficient were carried out on the data generated. There is strong correlation at $p < 0.05$ in some of the parameters such as TDS versus EC ($r = 0.95$), TDS versus TS ($r = 0.90$), TH versus acidity ($r = 0.73$) in Olusosun while TDS versus EC ($r = 0.93$), TDS versus acidity ($r = 0.82$), TH versus alkalinity ($r = 0.77$) in Solus, suggesting common source. However, very weak chemical associations ($r < 0.30$) were observed in majority of the quality parameters particularly anions and trace metals, indicating multiple anthropogenic sources.

Keywords: *physico-chemical, water quality index, correlation coeficiency, dumpsites, water quality parameters.*

GJSFR-B Classification : *FOR Code: 260501*



Strictly as per the compliance and regulations of :

© 2014. Adeyi, A. A. & Majolagbe, A. O. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Assessment of Groundwater Quality around Two Major Active Dumpsites in Lagos, Nigeria

Adeyi, A. A. [α] & Majolagbe, A. O.[σ]

Abstract- This paper presents the results of physico-chemical parameter data and water quality index used to assess the groundwater quality around Olusosun and Solus dumpsites in Lagos southwest, Nigeria. Twenty (20) water samples each were collected in wells and boreholes around these two dumpsites, once in two months consecutively for two years. The parameters determined include pH, acidity, alkalinity, conductivity (EC), total dissolved solids (TDS), total hardness (TH), Cl-, $SO4^{2-}$, NO_{3-} and PO_4^{3-} and heavy metals: Pb, Ni, Cd, Zn, Cu, Fe, Mg, Ca, Na and K using standard analytical methods. Descriptive statistics and correlation coefficient were carried out on the data generated. There is strong correlation at $p < 0.05$ in some of the parameters such as TDS versus EC ($r = 0.95$), TDS versus TS ($r = 0.90$), TH versus acidity ($r = 0.73$) in Olusosun while TDS versus EC ($r = 0.93$), TDS versus acidity ($r = 0.82$), TH versus alkalinity ($r = 0.77$) in Solus, suggesting common source. However, very weak chemical associations ($r < 0.30$) were observed in majority of the quality parameters particularly anions and trace metals, indicating multiple anthropogenic sources. Water quality index (WQI) reveal minimal contamination on the groundwater, delineates Solus groundwater as excellent – good – poor and Olusosun groundwater as good – poor – very poor. However, the nitrate level in almost all the groundwater collected around the Olusosun dumpsite reveal is worrisome and portends a great health risk. Therefore, concerted efforts must be put in place to address the situation and ensure sustainable environment.

Keywords: physico-chemical, water quality index, correlation coeficiency, dumpsites, water quality parameters

I. Introduction

Groundwater remains a major source of water supply for drinking, recreation, agricultural and industrial purposes in most part of Nigeria. Lagos state provides about 220 million liters of water daily for domestic and industrial purposes for about 37 % of its population 1. About 8.3 million residents in Lagos (62.6% of the population) and some industries have no access to pipe borne water, thus depend solely on groundwater through privately dug bore holes and shallow wells. This trend could be as a result of either lack of improper planning by government for new residential areas that are emerging in the state, inadequate and erratic water supply by the government water works and or the population - water facility ratio, which is on the high side. Therefore, the ever increasing population will continue to rely on groundwater as a main source of water supply. However, the quality of groundwater assessed by the citizens is doubtful because groundwater resources particularly in Lagos state are under varying degree of threats 2. These threats include various sources of pollution, such as industrial effluents discharges, municipal solid wastes (MSW), residential effluents discharges, agricultural chemicals and fertilizers applied on farms, oil spills and leakages, as well as salt water intrusion and urban surface runoff [3,4].

Landfills have been identified as one of the major threats to groundwater resources [5,6,7]. The volume of wastes generated in Lagos is increasing with time and is presently at about 1000 tons per day apart from the medical wastes which is given separate and special treatment [8]. The quantity and quality of municipal solid waste (MSW) depends upon various factors such as population, life style, food habit, standard of living, industrial and commercial activities in the area9, cultural and tradition of inhabitants, as well as climate[6]. Of the 2.3 million tons of waste generated annually in Lagos since 2008, only about 50% are accounted for by Lagos State Waste Management Authority (LAWMA). The remaining is disposed illegally and haphazardly without regards for environmental consequences. In most open dumpsites across the cities, wastes collected are burnt in the open and ashes abandoned at the site .The practice of burning wastes, destroy the organic component, oxidize metals, thereby enriching the ashes left behind with metal[7]. Wastes in landfills or open dumps are subjected to either groundwater underflow interaction or infiltration from precipitation. The dumped solid wastes gradually release its initial interstitial water (leachate) and some of its decomposition by-products get into water moving through the waste deposit. This leachate accumulates at the bottom of the wastes and percolates through the soil[5] migrate downward and contaminate the groundwater. The leachate sometimes contains mainly organic carbon largely in the form of fulvic acids. It usually contains toxic substances, especially, when wastes are of industrial origin[4]. Such contamination of groundwater resource poses a substantial risk to local resource user and to the natural environment. Each year, about two million people die as a result of poor sanitation and contaminated water, of which ninety percent (90%) are children 10. Various

Author α: Department of Chemistry, University of Ibadan, Ibadan, Nigeria.
Author σ: Department of Chemistry, Lagos State University, P.M.B. 1087, Apapa, Lagos, Nigeria. e -mail: abdulmajss@gmail.com

© 2014 Global Journals Inc. (US)

studies on the impact of landfill on groundwater quality have been reported using different approaches11,12. These approaches include experimental determination (i.e. physicochemical assessment), estimation through mathematical modeling[13.14,] geophysical method[15,16,17] and the use of water quality indices [18].

Physicochemical assessment of water quality has been extensively used to evaluate the quality status of both surface and groundwater and to suggest possible usage of such water [19,2,20],. A major advantage of physicochemical assessment method of evaluating the quality of water bodies is that the water samples(s) are directly analyzed, thereby generating data that show the true quality or the actual values of the water quality parameters. A large data is usually the results which indicate comprehensive quality assessment. The largeness of the data also helps in revealing possible various trends and patterns that are inherent in the data obtained [21].

Water quality index (WQI) takes the complex scientific information of water quality variables and synthesizes them into a single number, thereby, also reducing the dimensionality of the water data. Various models used in calculating WQI include weighted arithmetic mean, weighted geometric mean, un-weighted harmonic square mean, use of fuzzy logic model and baseline comparative model22. By comparing the mean values of these parameters in the water samples with the maximum permissible limits by various known regulatory bodies such as World Health Organization (WHO), United State Environmental Protection Agency (USEPA) etc., it becomes possible to declare a water body contaminated, polluted or either safe or not for human consumption.

This study therefore, aimed at presenting the use of water quality index and physicochemical assessment of quality of groundwater around two major active refuse dumpsites in Lagos state, thereby evaluating the impact of these dumpsites on the quality of groundwater. The data generated will assist regulatory agencies in formulating policies to ensure sustainable environment and a baseline for further studies.

II. Material and Methods

a) *Description of the study areas*

The study area consists of Olusosun and Solus refuse dumpsites and their environ.

i. *Olusosun refuse dumpsite*

It is a controlled dumpsite located at Ojota, Lagos within longitude 03.372 E to 03.374 E and latitude 06.588 N to 06.595 N. It is the largest government owned dump facility in Nigeria. It is about 18 meters deep and covers close to 42 hectares of land. Olusosun refuse dump was established in 1988 with a life span of 35 years. The dump is surrounded by Oregun industrial layout, Olusosun residential compound, Shangisah residential areas and commercial neighborhood (Fig.1.0). It receives an average of 1.2 million tons of assorted wastes annually and is presently serving as a pilot project for biogas production in Nigeria.

ii. *Solus refuse dumpsite*

The Solus dumpsite is situated between longitude 03.255 E to 03.253 E and latitude 06.569 N to 06.574 N in Igando area of Lagos State. It started operations in 1996. It is of 9 m depth and covers about 3 hectares. Solus refuse dump receives 4000 tons of waste per day and has reached over 70% of its full capacity [23]. The dump is entirely surrounded by residential area (Fig. 2.0). An abattoir and a small fast shrinking Oba stream is located about 2.5 km westward of the dumpsite.

b) *Sampling*

Groundwater samples were collected from twenty (20) locations around each dumpsite determination for physico – chemical parameters and trace metal analyses. Sampling was done once in two months, for two years (January, 2009 -December, 2010). The samples collected around Olusosun dumpsite are represented as OSW 1 – OSW 20, while that of Solus are represented as SWS 1 – SWS 20. The samples were preserved accordingly based on standard methods (APHA/AWWA, 2005). Two samples (1.5 L and 0.75 L for physico –chemical parameters and trace metals respectively) were taken from each location. The 0.75 L water samples were preserved by acidifying with 1.5 ml of concentrated HNO_3 (Analar grade) per liter of water sample. Blank samples were collected (using double distilled water) and treated in the same way as the other water samples 24. The samples were stored in an ice box, transported to the laboratory where they were refrigerated until analysis using standard methods.

c) *Sample chemical analyses*

The pH, electrical conductivity (EC) and temperature of the groundwater samples were determined on sites. Temperature was measured using thermometer, while EC and pH were measured using conductivity meter (Mettler Toledo) and pH meter (pHep HANNA HI 98107) respectively. Alkalinity and acidity were determined titrimetrically [25], total hardness by complexomertry[25], Total suspended solids (TSS), dissolved solids (TDS) and total solids (TS) by gravimetry[25,26] chloride by silver nitrate method[25], sulphate by turbidimetric method [25], phosphate by colorimetric and nitrate by phenol disulphonic acid method [27,28]. Determination of cations Na+, and K+ and trace metals were done with flame photometer and Flame Atomic Absorption Spectrophotometry (Buck scientific 210V model) respectively after acid digestion

© 2014 Global Journals Inc. (US)

of the samples [29]. Each sample was analyzed in duplicate, so as to ascertain the validity of the method.

d) Statistical Analysis

Descriptive analyses of data generated were carried out using Graph Pad Prism (version 5.00). Correlations coefficiency was performed in a pair wise fashion employing Pearson correlation coefficent.

e) Water Quality Index

Three steps are followed as described by Srinivas and Nageswararao 18, to calculate Water Quality Index (WQI). In the first step each of the parameters has been assigned a weight (w_i) according to its relative importance in the overall quality of the water for drinking purpose. A maximum weight of 5 has been assigned to nitrate due to its major importance in water quality assessment. In the second step, the relative weight is calculated from the following equation

$$W_i =$$

where W_i is the relative weight, w_i is the weight of each parameter and n is the number of parameters. Calculated W_i values of the parameter are given in Table 1.0. In the third step, a quality rating scale (q_i) for each parameter is assigned by dividing its concentration of each water sample by its respective standard according to the WHO guidelines and the result multiplied by 100. $q_i = (C_i - C_{io} / S_i - C_{io}) \times 100$ where Ci is the concentration of each chemical parameter in each water sample in mg/L, Cio is the ideal value of the parameter in pure water and Si is the Indian drinking water standard for each chemical parameter in mg/L according to the guidelines of the WHO. For pH, C_{io} is 7 and $q_i = (C_i - 7)/(S_i - 7) \times 100$. For the remaining parameters the ideal value is 0.

Table 1.0 : Relative Weight of the Chemical Parameters

Chemical parameters	WHO standards	Weight	Relative weight (Wi)
pH	6.5 – 8.5	4	0.1818
Total hardness	300	2	0.0909
Ca	75	2	0.0909
Mg	30		0.0909
Cl	250	3	0.1363
Total dissolved solids	500	4	0.1818
Nitrate	10	5	0.2272

To calculate the WQI, the sub index (SI) is first determined for each parameter, which is used to determine the WQI using the following equations.

$$SI_i = W_i \times q_i,$$

$$W_i =$$

Where SI_i is the sub index of the i^{th} parameter. The calculated WQI values are classified into four types as shown in Table 2.0.

Table 2.0 : Water Quality Classification based on WQI value

WQI	Water quality
< 50	Excellent
50 – 100	Good
100 – 200	Poor
200 – 300	Very poor

III. Results and Discussion

a) Physicochemical Properties Groundwater

The results of physico-chemical analysis and trace metal load of water samples around the two major active controlled dumpsites in Lagos (Olusosun and Solus) are presented in Tables 3.0and 4.0 respectively. The correlation coeficiency between various physicochemical variables are presented in Tables 5.0 and 6.0 for Olusosun and Solus groundwater respectively. The mean and range of pH values for the Olusosun and Solus groundwater were 5.23 ± 0.97 (3.10-7.10) and 5.71 ± 0.75 (4.40-6.90), respectively. All the mean values were in the acidic range and lower than the allowable limits of 6.5 – 8.5 WHO (2006) and Nigerian Standard for Drinking Water Quality [30]. The acidic nature of Lagos water is probably as a result of high volume of CO_2 in atmosphere, an indication of high level of population and industrialisation. Longe et al.[4] however pointed out that acidic status of Lagos groundwater is also a charateristic of coastal water, whose pH is primarily controlled by its hydrological settings. 15% and 20% of Olusosun and Solus water samples collected have the mean value within the WHO

© 2014 Global Journals Inc. (US)

allowable range. The neutral average pH value observed in samples OWS11and OWS12 could be as a result of the proximity of the location of the wells to a big canal that bound Ketu market, hence infiltration of waste water to the neighbouring water,which results in the pH obtained might be responsible for this. The pH of water controls its solubilty and the rate of reaction of the metal species that is invovlved in corrosion recaction [31].

The temprature of groundwater around Olususun ranges from 24.8 °C and 27.4 °C with mean value of 25.6 ± 0.7 °C, while the mean for Solus was 25.9 ± 0.5 °C and range from 24.9 to 26.9 °C.

Temperature, if high can cause legionellosis, schistomiasis and other related health conditions whose causative organism thrives more in warm water and in the presence of nutrients. Temperature can affects the amount of dissolved oxygen of water.It also control fluoride content which causes dental coloration in childeren and skeletal damage[32]. The mean and range of total alkalinity value were 144 ± 91 (26.2 to 373) and 123 ± 106 (12.3 to 396) mg/L for water around Olususun and Solus dumpsites respectively. Generally, most groundwater tends to be high in alkalinity and Oxygen rich except in high populated and industrialized areas. The larger percentage of the water samples collected around both Olususun and Solus dumpsite had values lower than 100 mg/L. However, going by Ragunath classification of groundwater based on alkalinity [33], only 10% and 25% of the groundwater samples around Olususun and Solus respectively can be said to be good for drinking purpose. Phenolphthalein alkalinity was zero in all water samples analyzed; therefore all alkalinity values were due only to bicarbonate.

The electrical conductivity (EC) is a quality parameter that describes the ability of water to allow passage of conducting electrons. It is an indication of dissolved inorganic in groundwater [34]. The importance of EC of water is its measure of salinity, which greatly affects the taste consequently; it has a significant impact on the users' acceptance of the water as potable [35]. Water around Olususun dumpsite gave 0.9 mS /cm as the mean value of electrical conductivity. Highest conductivity value were observed from wells OWS5 and OWS6 that were closer (4 m) to the dumpsite. For Solus groundwater sample, values reported were lower, than that of Olususun groundwater samples. This may be probably because of age of the Olususun dumpsite, the geological formations of Olususun area and the depth of wells found around Solus dumpsite. The direction of groundwater flow may also not be unconnected with this finding. About 5% and 10% of water sample collected around Solus in rain and dry season respectively show conductivity values higher than WHO maximum limit of 1.4 mS/cm for drinking water, while all the water collected around Olususun dumpsite, have conductivity values within the acceptable limit. The EC value in Olususun water maintains strong correlation with TDS at $p < 0.05$ ($r = 0.98$), TS ($r = 0.54$) and TSS ($r = 0.90$) (Table 8.0) while strong correlation was observed also between EC and TDS ($r = 0.94$) as well as TS ($r = 0.85$) in water collected around Solus dumpsite.

The average values of total dissolved solids observed in groundwater around Olususun was almost twice of the value in water around Solus dumpsite. The mean and range of values of TDS for water collected around Olususun and Solus were 412 ± 179 (122.0 - 849.0) mg/L and 393 ± 186 (112.0 -1294) mg/L respectively. The TDS of all water collected from Olususun are within fresh water range and lower than the WHO a permissible limit of 1000 mg/L for drinking water. However, 5% of water around Solus had TDS within brackish water range. Total dissolved solid is a measure of amount of dissolved minerals that influences the usability of water. These mineral including inorganic salts (Ca, Mg, K, Na, HCO_3- and SO_4^{2}-) and small amount of organic matter, some of which are dangerous, if ingested at high concentration. TDS varies considerably in different geological regions owing to differences in the solubility of minerals. The palatability of water with TDS value less than 500 mg/L is generally considered good36, while water with TDS value above 1000 mg/L is objectionable to consumer because taste of such water is affected. The TDS in this study correlated with electrical conductivity ($r = 0.93$) and total solids ($r = 0.90$) in Solus groundwater while in Olususun groundwater, TDS correlate strongly with electrical conductivity ($r = 0.98$), total solids ($r = 0.90$) and TSS($r = 0.55$) indicating a common source of the contaminant, while weak association were observed TDS/Cl, TDS/Alkalinity, TDS/Acidity and TDS/ pH.

The mean values of total hardness observed in Solus are almost twice of the TH values in water collected around Olususun. Hardness is an important operational water quality parameter; it defines the suitability of usage of water. Hardness can be caused by Ca and or Mg, these usually prevents formation of lather thereby consuming more soap. Olususun and Solus groundwater have mean and range of TH value 45.6 ± 36 (4.30 - 125) mg/L and 74.0 ± 61 (14.5 - 210) mg/L respectively. These values are higher than the result of similar study in Lagos 37 with 61.3 mg/L. TH as water quality parameter helps in control of corrosion.

Depending on the interaction with other factors such as pH and alkalinity, water with hardness value above 200 mg/L may carry scale of deposition in treatment work. A number of ecological studies have shown a great significant inverse relationship between hardness of drinking water and cardiovascular diseases.

This indicates that, soft water affect the functional behavior of human system. Hardness values in water around Olususun dumpsite(Table 5.0) reveal strong correlation with acidity ($r = 0.73$) and moderate correlation with total suspended solids ($r = 0.52$), while

© 2014 Global Journals Inc. (US)

it maintains weak correlations with conductivity (r = 0.26), total solid (r = 0.45), alkalinity (r = 0.38), and sulphate (r = 0.23), while water collected around Solus reveal strong correlation between total hardness and acidity (r = 0.81) and alkalinity (r = 0.77) as well as weak associations with pH, nitrate and sulphate as shown in Table 6.0.

The chloride values from Solus groundwater were twice higher than the corresponding chloride values in Olusosun groundwater. This could indicate that bulk of the solid waste received at Solus dumpsite are non industrial, as chloride is major anion from food waste. The mean and range of chloride value in water around Solus and Olusosun dumpsites 146 ± 112 (17.3- 354.0) and 68.2 ± 32 (19.9 – 184) mg/L. The highest chloride values were in wells SWS1, SWS2, SWS 3, SWS 10 and SWS 11, possibly due to their close proximity to the refuse dumpsite. 20% of water collected around Solus dumpsite showed concentration higher than the 250 mg/L permissible chloride limits for drinking water. This may be a pointer to chronic chloride toxicity from Solus groundwater. The values recorded in this study are lower than that reported by Laluraj 38 but higher than Niger delta study19 and Lagos groundwater study by Ikem [37].

The sources of salt water in these areas may be diversified. Tindal et al.39 suggested that it may be due to the retention of ions from salt trapped at the time of deposition, from solution of minerals and constituents or by infiltration of clay and recharge atmospheric precipitation containing ions. Chloride was observed to maintain weak correlations in Olusosun groundwater samples (Table 5.0) with nitrate, sulphate, acidity, alkalinity, EC and TDS with coefficient values ranging from 0.01 to 0.39, and a negative correlation with phosphate. However, in Solus groundwater (Table 6.0), chloride had weak correlation with sulphate, acidity, alkalinity and total hardness and negative correlations with phosphate, nitrate, EC and TDS.

The mean and range of sulphate value in groundwater collected around Olusosun and Solus were 22.4 ± 17 (9.27 - 69.5) mg/L and 12.9 ± 6.4 (3.24 - 25.3) mg/L respectively. Sulphate concentrations in groundwater collected around both dumpsites were generally lower than 250 mg/L limit stipulated by World Health Organization for drinking water. The level of SO_4= in groundwater under investigation could be traced to geological nature of the soil because interlocation of clays, sands and silt could encourage dissolution of sulphite such as pyrite from inter stratified matters percolating water to produce SO_4^{2-} water35. Vehicle emission can also contribute to the SO_4^{2-} concentration in an environment. High level of SO_4^{2-} can cause laxative effect to unaccustomed consumers 31.Excessive intake of SO_4^{2-} can lead to diarrhea, hydration and intestinal irritation, though no health based guideline has been fixed for SO_4^{2-}. Sulphate water collected around Solus dumpsite maintained weak correlation with pH, alkalinity, acidity, total hardness, TDS, TSS, conductivity and all the other anions with coefficient values (r) ranging from 0.004 to 0.48.This shows that the quality parameters are of different sources. However, in groundwater collected around Olusosun dumpsite sulphate maintained negative correlation with EC, TDS and TS, an indication that the higher the sulphate concentration ,the lower the quality parameters mentioned above. A weak chemical association was also observed for SO_4^{2-} versus pH, SO_4^{2-} versus acidity, and $SO_4$2- versus TSS indicating common origin of the paired parameters.

© 2014 Global Journals Inc. (US)

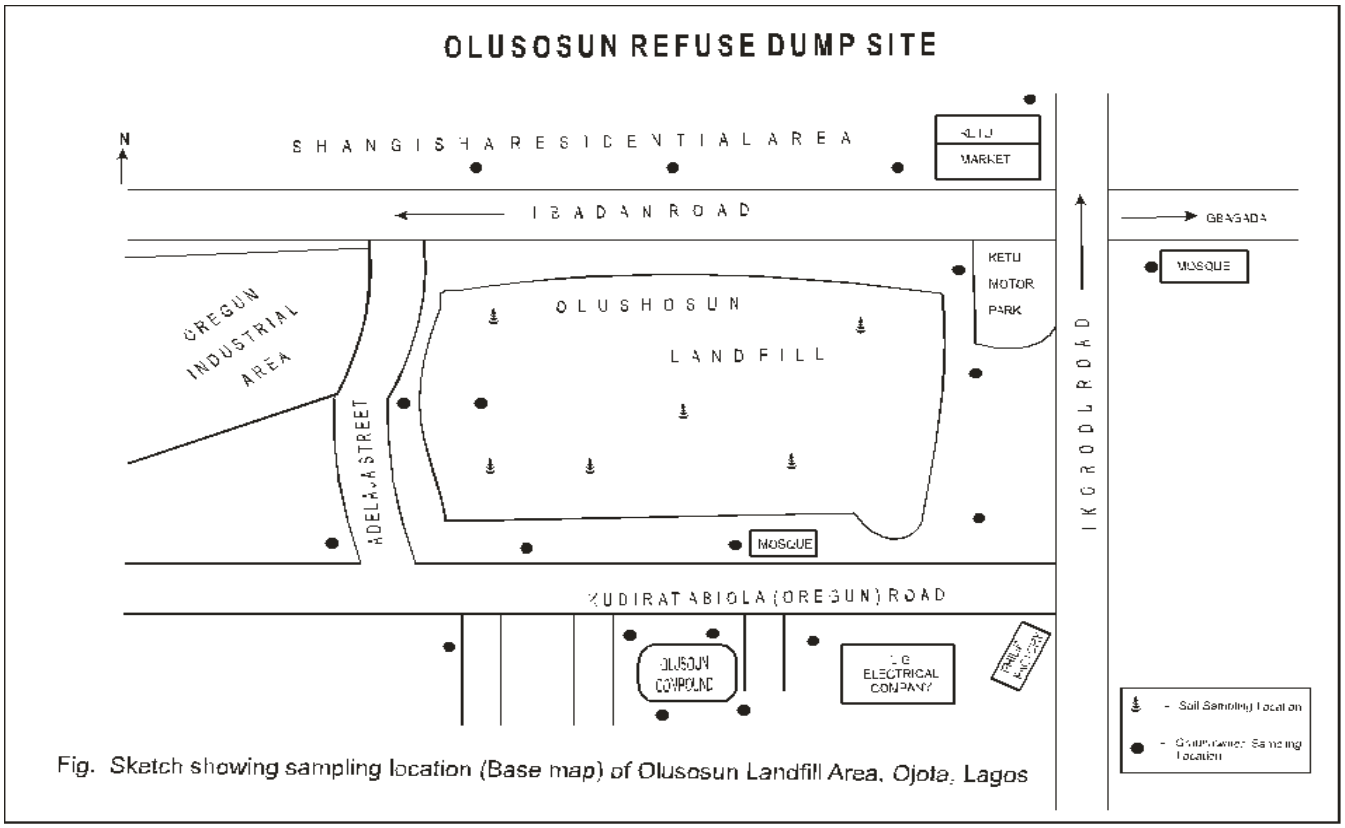


Fig. Sketch showing sampling location (Base map) of Olusosun Landfill Area, Ojota, Lagos

Fig. 1.0 : Sampling locations of Olusosun dumpsite area, Ojota, Lagos

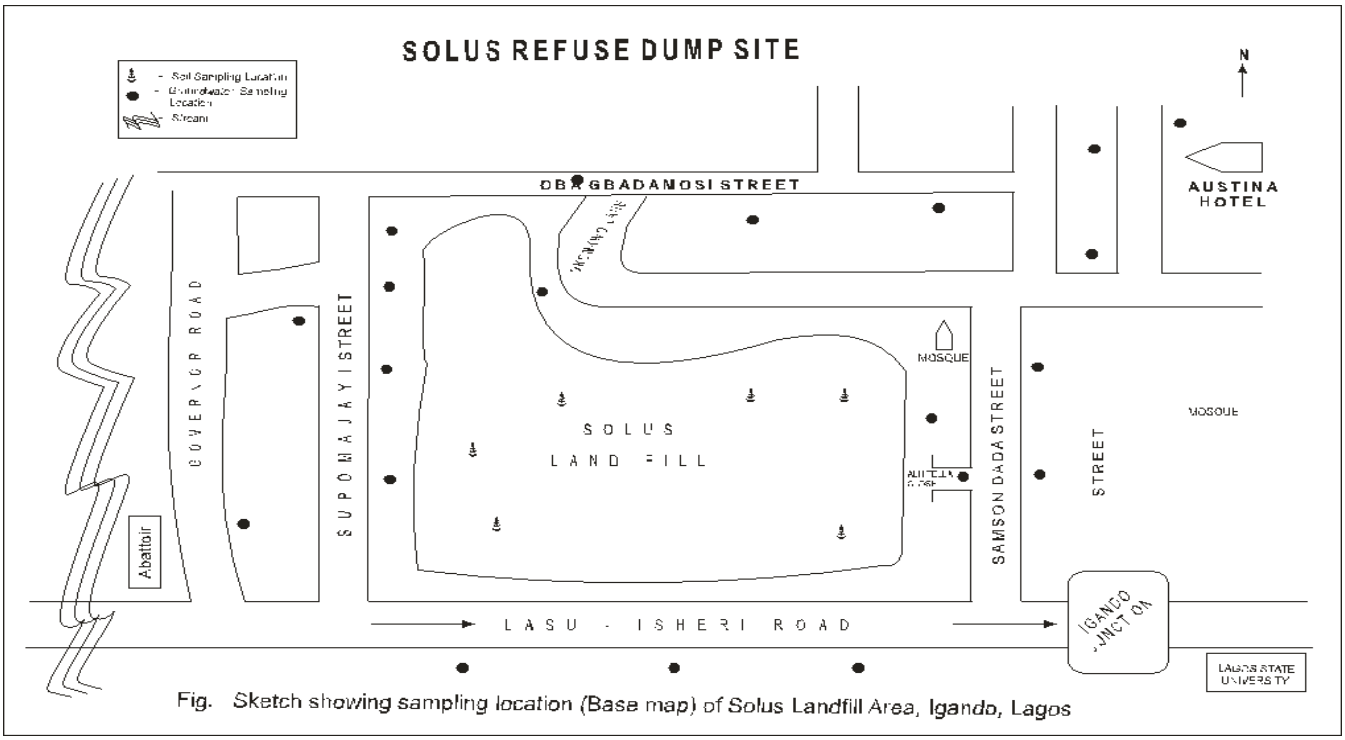


Fig. Sketch showing sampling location (Base map) of Solus Landfill Area, Igando, Lagos

Fig. 2.0 : Sampling locations of Solus dumpsite area, Igando, Lagos

The average concentration of nitrate in groundwater around Olusosun was almost ten times that of nitrate value in Solus groundwater. The mean and range of nitrate values in water around Olusosun and Solus were 14.1 ± 6.4 (7.5 -35.3) mg/L and 1.47 ± 1.1 (7.4 - 35.3) mg/L respectively. The nitrate concentration

© 2014 Global Journals Inc. (US)

in over 85% of the water from Olusosun area exceeded the 10 mg/L permissible limit by WHO[31] and Nigeria Standard drinking quality water[30]. This portends great danger. However, all samples analysed in Solus dumpsite area are safer from nitrate toxicity. The health effect of excess nitrate concentration beyond acceptable limit includes death of infant of about age six, while shortness of breath and blue-baby syndrome has also been identified. Generally, the sources of nitrate in groundwater include domestic sewage, runoff from urban on agricultural field and leachate from landfill site[34]. The leachate from the refuse dump is suspected to be responsible for the high nitrate level observed. The low value of NO_3- level observed in the Solus refuse dumpsite unlike most of the Olusosun samples investigated, could be as a result of age of Olusosun dumpsite, the nature and volume of the solid waste received and the level of clay soils in the Solus area. Tindas 39 also pointed out that low level of nitrate in an area indicate low level of nitrifying bacteria which convert nitrogen to nitrate under aerobic condition. Phosphate, total hardness and acidity were observed to have weak correlation with nitrate in Solus as shown in Table 6.0.

The mean and range of phosphate value water collected around Olusosun were 0.39 ± 0.27(0.07 - 0.84) mg/L while that of Solus groundwater were 0.44 ± 0.22(0.22 - 0.96). Generally, the phosphate concentration in Solus observed was relatively higher than that of Olusosun. The result is similar to Ibadan and Lagos studies by Ikem [37]. However, it is lower than the values reported in Lebanon Basins [40]. This indicates low level of detergent pollutant from the landfills. The mean and range of Cu value water around Olusosun and Solus were 0.12 ± 0.17(0.01 to 0.23) mg/L and 0.08 ± 0.03 (0.03 to 0.15) mg/L respectively. Copper is an essential nutrient as well as a toxic element, depending on the level of its concentration. It acts as aco-factor in specific cupro- enzymatic reaction. High concentration of copper can cause gastrointestinal irritation in man. The sources of copper in groundwater include leachate from landfills, runoff from agricultural field and geochemical composition of the soil/rock holding the water.

The mean and range of iron values in water around Olusosun and Solus dumpsites 12.9 ± 7.0(4.12 – 31.2) mg/L and 11.7 ± 7.7 (0.36 – 20.1) mg/L. The rusting of water pipes often resulted in unnecessary high level of iron "red water". Other major sources of iron include nature of rock and soil which house the groundwater particularly the igneous rock, leachate from refuse dumps, industrial waste, and seepage from septic tank in residential areas. Iron is an essential element in human nutrient; it helps in the formation of hemoglobin which is important during pregnancy and lactation. Zinc is an essential trace element found virtually in all food and potable water. It is necessary in minimal quantity for animal and plant metabolism. However, high levels of zinc often result in zinc toxicity, which may cause cancer in the body system. 0.59 ± 0.58(0.12 – 1.90) mg/L and 0.86± 0.78(0.18 – 2.24) mg/L were mean and range of zinc values in the groundwater collected around Olusosun and Solus dumpsites respectively.

Sodium, Calcium, Potassium and Magnesium are of nutritional importance to life, so they are referred to as essential metals. They help in various metabolic activities in the human body system. The mean of sodium (Na) Sodium, in water around Olusosun and Solus were 171 ± 128 mg/L and 143 ± 109 mg/L respectively; potassium, 24.3 ± 8.8 mg/L and 20.3 ± 11 mg/L respectively; calcium, 59.0 ± 41 mg/L and 57.9 ± 48 mg/L and magnesium,10.5 ± 8.6 mg/L and 13.9 ± 7.0 mg/L. These minerals (K, Na, Mg and Ca) are probably derived from chemical weathering of feldspars as micas which are some of the minerals characterizing the plain sands. The three cations Na+, Ca2+ and Mg2+ are among the species that are constantly involved in cations exchange process and interactions with the aquifer materials. The concentration of these quality parameters were mainly compared to (WHO) guidelines for drinking water.

The extents by which some of the parameters exceed the WHO guidelines are expressed as exceedance level. This level is calculated as ratio of mean concentration of each water quality variable to respective guideline values and expressed with no unit41. exceedance level of variables such as nitrate, lead, iron, cadmium and magnesium are presented in Table 7.0.

© 2014 Global Journals Inc. (US)

© 2014 Global Journals Inc. (US)

Table 3.0 : Concentration of physicochemical parameters and trace metals in groundwater around Olusosun dumpsite

Sample Code	pH	Tem	Alk	Acid	TH	EC	TDS	TSS	TS	Cl^-	PO_4^{3-}	NO_3^-	SO_4^{2-}	Cu	Ni	Pb	Cd	Fe	Zn	Mg	Ca	Na	K
OWS1	4.1	25.4	120	45.4	20.4	0.49	240	215	455	47.5	0.93	10.5	21.4	0.08	0.07	ND	0.01	10.1	0.22	8.13	10.3	190	31.1
OWS2	4.9	25.6	102	18.5	37.5	0.42	201	258	459	30.2	0.62	13.7	13	0.08	0.04	ND	ND	0.61	0.3	3.53	9.8	200	31.1
OWS3	3.9	25.2	373	21.7	43.4	1.13	483	509	992	132	0.15	23.8	19	0.07	0.03	ND	ND	3.99	0.34	4.34	9.48	175	43.2
OWS4	5.1	25.5	60.2	22.9	15	0.82	400	128	523	76.2	0.33	21.2	9.6	0.08	0.05	ND	0.01	9.04	0.27	3.97	10.1	200	30.7
OWS5	6.3	25	98.6	65.3	20.7	1.77	849	426	1245	62.8	0.18	17.5	13.1	0.11	0.02	ND	ND	15	0.12	4.2	9.01	123	25.1
OWS6	6.6	25.1	80.3	62.2	32.5	1.59	758	475	1423	59.9	0.07	10.6	12.9	0.1	0.06	ND	0.01	0.36	0.13	6.19	26.9	11.7	33
OWS7	5.4	25	24.5	41.5	42.5	0.52	209	114	323	100	0.23	35.3	22.4	0.11	0.03	ND	0.01	19.7	0.25	10.8	101	38.1	31.4
OWS8	4.8	25.4	218	25.4	20.6	0.91	311	123	434	23.9	0.36	14.4	11.7	0.23	0.02	ND	ND	21.3	0.22	6.12	118	26.2	25.5
OWS9	5.1	26.5	126	15.4	6.7	0.42	213	155	368	19.9	0.35	12.6	12.4	0.03	0.07	ND	ND	2.76	0.15	7.31	231	134	17.6
OWS10	5.2	26.4	132	13.5	4.8	0.41	214	223	475	89	0.84	10.7	17.3	0.08	0.03	ND	0.02	2.01	0.21	31.2	130	22.2	25.3
OWS11	6.7	24.8	119	88.4	27.3	0.82	321	247	568	75.9	0.65	12.9	21.5	0.11	0.06	ND	0.01	1.11	0.22	28.2	141	376	10.8
OWS12	7.1	25.1	122	73.4	20.6	1.0	421	337	758	91.1	0.53	11.8	20.5	0.13	0.05	ND	0.01	17.1	0.28	30	176	429	10.2
OWS13	4.6	25	219	60.5	108	1.03	541	363	904	86.3	0.07	7.7	12.5	0.05	0.05	ND	ND	20	0.25	8.02	40.1	304	30.2
OWS14	4.0	25.7	240	152	125	1.21	529	446	989	105	0.74	7.4	10.7	0.06	0.01	ND	ND	20.1	1.9	4.11	71.5	426	32.1
OWS15	4.3	25.2	223	56.7	65.6	1.09	529	484	1103	118	0.15	9.6	17.6	0.08	0.01	ND	ND	18.2	1.41	9.17	49.5	152	20.8
OWS16	5.2	25.5	141	100	116	1.26	621	542	1164	32.9	0.16	14.5	21.4	0.08	0.02	ND	ND	15.2	1.24	9.03	6.03	20	22.2
OWS17	4.5	27.4	94.2	22.4	34.1	1.38	610	515	1125	31.8	0.64	12.6	25.7	0.08	0.01	ND	ND	10.9	1.74	9.84	7.99	170	21.1
OWS18	4.4	26.5	71.1	33.3	23.3	0.72	331	468	799	36.1	0.57	12.8	23.6	0.06	0.01	ND	ND	14.2	0.94	8.39	22.1	100	20.1
OWS19	6.1	26	302	99.5	79.6	0.72	327	417	744	67.2	0.24	12.4	69.5	0.04	0.02	ND	ND	15.2	1.2	8.91	12.1	157	13.8
OWS20	6.4	25	152	43.8	22.6	1.41	697	429	1275	66.2	0.428	18.3	18.5	0.01	0.01	ND	ND	17.1	0.35	8.28	8.02	166	11.4
Mean	5.23	25.6	144	55.8	45.7	0.9	412	349	775	68	0.38	14.1	22.4	0.12	0.03	0	0.01	11.7	0.59	10.5	59	171	24.3
SD	0.97	0.7	91	37	36.4	0.42	179	151	327	32.7	0.27	6.4	17	0.17	0.02	0.01	0.01	7.7	0.58	8.6		128	8.8
WHO	6.5-8.5		1000		500	1.4	1000			250		10	250	1.5	15	10	3	2.5	3	50		200	

N.B : All units are mg/L except EC (mS/cm) and Temperature (°C) and pH with no unit

Table 4.0. Concentration of physicochemical parameters and trace metals in groundwater around Solus dumpsite

Sample Code	pH	Tem	Alka	Acid	TH	EC	TDS	TSS	TS	Cl^-	PO_4^{3-}	NO_3^-	SO_4^{2-}	Cu (mg/L)	Ni	Pb	Cd	Fe	Zn	Mg	Ca	Na	K
SWS1	4.80	26.9	59.6	37.5	15.9	0.44	598	243	842	299	0.260	0.840	8.37	0.10	0.08	ND	ND	5.43	1.67	31.2	40.3	95.0	5.43
SWS2	5.40	25.6	195	43.4	14.5	0.41	261	242	517	261	0.760	0.690	6.08	0.08	0.02	ND	ND	4.11	1.21	22.5	10.2	125	4.11
SWS3	6.90	25.7	310	167	108	1.01	1294	521	1872	378	0.380	1.55	25.3	0.07	0.02	ND	ND	6.86	0.89	11.1	19.0	19.9	6.86
SWS4	4.60	25.7	41.8	26.6	30.4	0.71	120	139	256	25.2	0.240	1.57	14.1	0.09	0.03	ND	ND	9.00	0.18	23.0	16.1	23.9	9.00
SWS5	5.30	25.3	10.5	6.60	13.5	1.62	802	411	1213	354	0.280	0.29	5.95	0.08	0.01	ND	ND	15.0	0.18	10.2	21.0	210	15.0
SWS6	5.90	25.8	29.3	62.8	24.7	1.41	724	425	1235.	107	0.360	1.59	22.0	0.11	0.06	ND	ND	2.00	0.32	10.0	26.2	103	2.00
SWS7	6.80	25.6	110	98.5	90.6	0.38	209	140	347	158	0.340	2.85	12.9	0.12	0.03	ND	ND	27.0	0.22	10.1	102	38.1	27.0
SWS8	6.60	25.7	291	96.8	202	0.64	300	167	478	34.9	0.270	2.92	16.6	0.05	0.01	ND	ND	21.3	0.39	8.21	116	126	21.3
SWS9	6.10	24.9	221	110	181.8	0.39	209	184	417	241	0.220	2.64	24.1	0.03	0.07	ND	ND	31.3	0.09	11.0	14.0	152	31.3
SWS10	5.80	26.3	376	157	210.4	0.33	211	243	452	235	0.440	1.96	11.1	0.09	0.03	ND	0.01	21.9	0.20	11.2	85.6	203	21.9
SWS11	5.90	26.7	65.8	17.4	44.50	0.71	302	269	670	139	0.340	0.820	3.24	0.12	0.07	ND	0.01	10.2	0.01	21.1	55.0	347	10.2
SWS12	4.70	26.2	12.9	39.1	61.80	1.00	397	364	769	138	0.320	3.80	9.35	0.15	0.02	ND	0.01	16.1	2.23	22.0	24.0	420	16.1
SWS13	5.80	25.7	125	86.9	72.60	1.02	517	365	883	43.0	0.390	3.44	8.37	0.05	0.05	ND	0.01	21.1	0.25	12.0	41.0	304	21.1
SWS14	6.10	25.8	14.5	27.5	36.40	1.09	511	473	985	135	0.850	1.65	14.2	0.06	0.02	ND	ND	20.0	1.87	8.22	74.1	22.0	20.0
SWS15	6.30	25.6	21.3	13.4	31.30	1.22	501	452	982	21.2	0.960	0.760	20.2	0.06	0.01	ND	ND	18.1	1.32	12.0	50.4	152.	18.1
SWS16	6.90	25.7	124	72.6	94.70	1.13	609	598	1206	17.4	0.700	0.180	11.4	0.04	0.01	ND	ND	15.5	2.24	4.12	125	20.0	15.5
SWS17	5.70	25.8	65.4	27.6	57.98	1.14	581	583	1070	75.6	0.540	0.47	14.7	0.07	0.01	ND	ND	4.10	1.99	9.00	28.0	112	4.10
SWS18	4.70	25.9	126	65.7	71.70	0.13	317	423	738	67.4	0.520	0.390	3.54	0.07	0.01	ND	ND	2.29	0.34	6.13	177	120	2.29
SWS19	4.80	25.8	143	71.4	56.40	0.60	314	465	772	112	0.360	0.260	14.4	0.05	0.01	ND	ND	2.00	1.11	18.0	112	155	2.00
SWS20	5.25	26.4	113	73.2	61.60	0.23	112	549	669	81.1	0.250	0.760	12.4	0.08	0.02	ND	ND	4.21	0.30	16.9	98.0	115	4.21
Mean	5.71	25.9	123	65.1	74.04	0.78	393	362	763	146	0.440	1.47	12.9	0.08	0.03	0.0	0.01	12.9	0.86	13.9	57.9	143	12.9
SD	0.75	0.5	106	44	60.03	0.42	186	149	289	112	0.22	1.1	6.4	0.03	0.02	0.0	0.01	9.0	0.78	7.0	48	109	9.0
WHO	6.5-8.5		1000.0		500.0	1.4	1000			250		10	250	1.5	15	10	3	2.5	3.0	50		200	

© 2014 Global Journals Inc. (US)

Table 5.0: Correlation coefficient between physicochemical parameters in groundwater of Olusosun area

Temp	-0.21718	1.0									
Alkalinity	-0.40342	0.066897	1.0								
Acidity	0.268037	-0.4445	0.159297	1.0							
TH	-0.21486	-0.30143	0.382054	**0.732725**	1.0						
EC	0.060558	-0.21612	0.189625	0.249704	0.245912	1.0					
TDS	0.03774	-0.20213	0.185418	0.240107	0.263872	**0.985504**	1.0				
TSS	-0.05724	0.019458	0.235771	0.452321	**0.524919**	**0.537175**	**0.554534**	1.0			
TS	-0.02186	-0.12031	0.241032	0.379682	0.45227	**0.90107**	**0.906597**	**0.834783**	1.0		
Cl	-0.05185	-0.34861	0.393472	0.255431	0.256245	0.137506	0.131044	0.176222	0.151613	1.0	
PO_4	-0.07713	0.178037	-0.18431	-0.05344	-0.32311	-0.37861	-0.41783	-0.32448	-0.44323	-0.1604	1.0
NO_3	0.04809	-0.17466	-0.18086	-0.32171	-0.23698	-0.0617	-0.12299	-0.35315	-0.19063	0.199378	0.29723	1.0
SO4	0.300221	0.094885	0.015351	0.357699	0.227248	-0.33853	-0.34706	0.332921	-0.04984	0.013524	0.14355	0.08608	1.0

Table 6.0: Correlation coefficient between physicochemical parameters in groundwater of Solus area

pH	1.0											
Temp	-0.33669	1.0										
Alkalinity	0.344473	-0.10326	1.0									
Acidity	0.434588	-0.12313	**0.869089**	1.0								
TH	0.412146	-0.18854	**0.816777**	**0.770859**	1.0							
EC	0.247354	-0.28313	-0.46869	-0.36718	-0.36674	1.0						
TDS	0.147805	-0.34406	-0.4795	-0.37336	-0.3696	**0.93467**	1.0					
TSS	0.108837	0.024777	-0.23197	-0.10425	-0.28894	0.451343	0.482027	1.0				
TS	0.167952	-0.19255	-0.44806	-0.30514	-0.40398	**0.851505**	**0.901455**	**0.796885**	1.0			
Cl	0.01982	-0.0109	0.28214	0.262232	0.010354	-0.01232	-0.10794	-0.14883	-0.14586	1.0		
PO_4	0.294353	-0.15374	-0.15364	-0.2637	-0.24819	0.246632	0.241836	0.398825	0.35071	-0.23463	1.0	
NO_3	0.165828	-0.13376	0.196807	0.36781	0.453334	-0.06226	-0.17714	-0.48943	-0.35521	-0.05891	0.32869	1.0
SO_4	0.4809	-0.4529	0.246798	0.421234	0.325313	0.220085	0.102509	0.109578	0.128819	0.028624	0.00475	0.213417	1.0

This approach according to Saroj42 has effectively visualized the levels. The order concentration levels of different water quality parameters in relation to the non-uniform increase in exceedance value in Olusosun groundwater sample was Mg > Fe > Cd > NO_3- -N >Pb, while in that of Solus groundwater, order concentration levels of different water quality parameters was Mg > Fe > Cd > Pb > NO_3- -N. Apart from the leachate as a major probable source of these pollutants in groundwater, there are other possible sources. The major source of magnesium (Mg) in the groundwater for instance, is due to ion exchange of minerals in rocks and soils by water[41].

Table 7.0: Exceedance levels of groundwater parameters with respect to WHO

Dumpsite	NO_3^-	Cd	Pb	Mg	Fe
Olusosun	1.57	1.8	1.0	21.1	11.5
Solus	-	1.85	1.0	20.7	13.4

b) Assessment of the water quality

The quality of groundwater under consideration in respect of drinking purpose has been established based on the WHO guidelines for drinking water. The calculated WQI values of these water samples put them water in excellent - good – poor class for Solus water and good - poor – very poor class for Olusosun using classification shown in Table 2.0. WQI vales ranged from

© 2014 Global Journals Inc. (US)

39.1 to 126 mg /L and from 61.8 to 205 mg /L respectively for Solus and Olusosun water. The spatial variations revealed that about 10% of the samples collected around Solus are in excellent grade; 65%, good and 25%, poor for Solus water, while in Olusosun, it is 35% good, 55% poor and 5% very poor. Some sampling locations are critical to human health and need urgent attention. These locations include OWS 3, OWS 4, OWS 8, OWS 14, OWS 17 and OWS 18 around Olusosun area and SWS1 and SWS 12 around Solus area.

IV. Conclusion

The level of physico-chemical parameters in groundwater around Olusosun dumpsite was observed to be higher than the corresponding groundwater around Solus area. Age of Olusosun dumpsite, nature and volume of solid waste deposited as well as the percentage of clay content in the soil from the sampling area could be some of the factors responsible for the observation. All groundwater samples analyzed from the study area are acidic in nature. This might be as a results of high population density and industrialization in the area, consequently, the high level of CO2 in the atmosphere can result in acidic nature of water that percolates into aquifer. Very low pH in water is a form of health treats to human. Correlation coeficiency applied shows possible contribution of contaminant from diverging multiple sources. Water quality index (WQI) further revealed that the impact of the dumpsites is still minimal in groundwater around Solus dumpsite compared to Olusosun dumpsite. WQI delineate water samples around Solus dumpsite as excellent – good – poor and that of Olusosun dumpsite as good – poor – very poor. The level of Chloride in groundwater around solus dumpsite demonstrates a buildup of the anion in the aquifer and this may continue as the dumpsite matures. Almost all the groundwater collected around Olusosun dumpsite showed level of nitrate higher than that WHO permissible limit of 10 mg/L. This situation is of great health risk as nitrate pollution has been linked to mith and sometimes death. Some sampling locations in both dumpsites with very poor quality water samples require some treatment measures to make the water therein potable.

References Références Referencias

1. Lagos Organization Review, 2008. "A tale of Two kinds of cities". 5:115-128.
2. Osibanjo, O. and Majolagbe, A. O. 2012.physicochemical quality assessment of groundwater based on land use in Lagos city, southwest, Nigeria. *Chemistry Journal*, 2 (2): 79-86.
3. Okoronkwo, N. E., Odemelam, S.A. and Ano, A.O. 2006.Levels of Toxic elements in soil of abandoned dumpsite. *African Journal of Biotechnology*. 5:1241 – 1244.
4. Longe, E. O. and Enekwechi, L. O. 2007. Investigation on potential groundwater impacts and influence of local hydrogeology on natural attenuation of leachate at a municipal landfill . *Int. J. Environ. Sci. Tech.*, 4 (1): 133-140.
5. Mor, S., Ravindra, K., Vischher, A. R. P. Dahiya and A. Chandra, 2005. Municipal Solid Waste Characterisation and its assessment for potential methane generation at Gazipur Landfill Site, Delhi: A case study. Bioresource Technology, Communicated.
6. Singh, U.K, Kumar M, Chauhan HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed?term=Chauhan%20R%5BAuthor%5D&cauthor=true&cauthor_uid=17899419" R, Jha HYPERLINK http://www.ncbi.nlm.nih.gov/pubmed?term=Jha%20PK%5BAuthor%5D&cauthor=true&cauthor_uid=17899419 PK, Ramanathan HYPERLINK http://www.ncbi.nlm.nih.gov/pubmed?term=Ramanathan%20A%5BAuthor%5D&cauthor=true&cauthor_uid=17899419 A, Subramanian V. 2008. Assessment of the impact of landfill on groundwater quality: a case study of the Pirana site in western. India. *Environ HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed/17899419"nit HYPERLINK"http://www.ncbi.nlm.nih.gov/pubmed/17899419" Assess*. 2008 Jun; 141 (1-3):309-21.
7. Majolagbe, A.O., Kasali, A.A., and Ghaniyu, L.O. 2011.Quality assessment of groundwater in the vicinity of dumpsites in Ifo and Lagos, Southwestern Nigeria. *Advances in Applied Science Research,* 2 (1):89-29.
8. Lagos state Waste Management Agency (LAWMA). 2008. Assessment Report, 1, Lagos.
9. Amusan, A.A., Ige, D.V. and Olawale, R. 2005.Characteristics of soils and Crops uptake of metals in Municipal waste dumpsites in *Nigeria. J. Hum.* Ecol. 17(3):167 – 171.
10. Okoli, C.C., Cyril, A. and Itiola, O.J. 2013. Geophysical and Hydrogeochemical Investigation of Odolomi Dumpsite in Supare-Akoko, Southwestern Nigeria. The Pacific Journal of Science and Technology. 14:1,492 _ 504.
11. Abu-Rukah Y, and Al-Kofahi O. 2001. 'The assessment of the effect of landfill leachate on groundwater quality – a case study', El-Akader Landfill Site – North Jordan, Arid *Environ.* 4: 615-630.
12. Sarela, J. 2003. Pilot investigations of surface parts of three closed landfills and factors affecting them. *Environ. Monit.* Assess. 84:183-192.
13. Magnus. U. Igboekwe, N. J. and Achi A. 2011.Finite Difference Method of Modelling Groundwater Flow *Journal of Water Resource and Protection,* 3:192-198. doi: 10.4236/jwarp.2011. 33025.

© 2014 Global Journals Inc. (US)

14. Moo-Young, H., Johnson, B., Johnson. A., Carson, D., Lew, C., Liu, S, and Hancock, K. 2004. Characterization of infiltration rates from landfills: Supporting groundwater modeling efforts. *Environ. Monit.* Assess. 96:283-311.
15. Abdul Nassir, S.S., Loke, M.H., Lee, C.Y., Nawawi, M.N.M. 2000. Salt-water Intrusion Mapping by Geoelectrical Imaging Surveys. *Geophys.* Prospect 48:647-661.
16. Adepelumi, A.A., Ako, B.D., Ajayi, T.R., Afolabi, O., Ometoso, E.J., (2008). Delineation of saltwater intrusion into the freshwater aquifer of Lekki. Penninsula, Lagos, Nigeria. *Environ Geol.* 56: 927-933.
17. Adegbola R.B, Oseni S.O, Anyanwu V.C, Majolagbe A.O and Sovi S.T. 2012.Application of electrical resistivity and hydrochemical methods to investigate agricultural pollution in some parts of Ojo, Lagos, Southwest, Nigeria. *International Journal of Innovative Research & Development,* 1 (4):398 – 413.
18. Srinivas, G. R. and Nageswarara, G. 2013.Assessment of Groundwater quality using Water Quality Index. Arch. Environ. Sci. 7, 1-5.
19. Edet, A.E. 1993. Groundwater quality assessment in parts eastern of Niger Delta. *Environmental Geology,* 22: 41-46.
20. Oketola, A.A., Adekolurejo, S. M. and Osibanjo, O. 2013. Water Quality Assessment of River Ogun Using Multivariate Statistical Techniques. Journal of Environmental Protection, 2013, 4, 466-479 .doi:10.4236/jep.2013.45055.
21. Halkidi, M., Batistakis, Y. and Vazirgiannis, M 2001. On Clustering Validation Techniques. Journal of Intelligent Information Systems, 17:2/3, 107–145.
22. Bharti N, and Katyal, D. 2011. Water quality indices used for surface water vulnerability assessment. International Journal of Environmental Sciences. 2:1.
23. Aboyade, A. 2004. The potential for climate change mitigation in Nigeria solid waste disposal sector. A case study of Lagos. MSc thesis, Lund University, Sweden. pp1- 47.
24. Protano, G., Riccobono, F., and Sabatini, G. 2005. Does Salt Intrusion Constitute a mercury contamination risk for coastal fresh water aquifers? *Environmental Pollution,* 110: 451- 458.
25. APHA / AWWA / WPCF. 2005. Standard Methods for the Examination of Water and Wastewater. 21st ed. Washington, APHA / AWWA / WPCF.
26. Department of Environmental (DOE). 1972. Analysis of Raw, Portable and Wastewaters. London, Department of Environmental, 12-16.
27. Taras, M.J.1964. Phenoldisulfonic Acid Method. *Analytica. Chemical*. 36: 3. pp 6-10.
28. Aluko, O.O., Srinda, M.K.C and Oluwande, P. A. 2003. Charaterisation of leachate from municipal solid wastes landfill site in Ibadan, Nigeria. J. *Environm. Health Research* 2(10):32-37.
29. America Society for Testing and Materials (ASTM). 1982. Water; Annual Book of ASTM Standards. Part 31, Washington, America Society for Testing and Materials (ASTM).
30. NSDQW. 2007. *Nigerian Standard for Drinking Water Quality*. Nigerian Industrial Standard NIS 554, Standard Organization of Nigeria: Lagos, Nigeria.
31. World Health Organization (WHO). 2006. Guidelines for Drinking-Water Quality. First addendum to 3rd ed. 1, Recommendation. *J. Hydrol* Geneva, WHO (World Health Organization), p. 595.
32. Paul, R. 2003. Hunter Drinking water and diarrheal disease due to Escherichia coli.*Journal of Water and Health,* 1: 2.
33. Ragunath, H.M. 1987.Groundwater. New Delhi, Wiley Eastern Ltd., p. 563.
34. Sanjay, S., Kale, Ajay K., Kadam, K. A ., Kumar,S. and Pawar, N. J. 2010. Evaluating pollution potential of leachate from landfill site, from the Pune metropolitan city and its impact on shallow basaltic. *Enviromental Monitoring Assessment.* 162:327– 346 DOI 10.1007/s10661-009-0799-7.
35. Olabaniyi, S.B. and Owoyemi, F.B. 2006. Characterization by factor analysis of the Chemical facies of groundwater in the Deltaic plain Sands Aquifer of Warri, Niger Delta, Nigeria. AJST *Science and Engineering Series* 2. 7 (1):73-81.
36. Langeneggar, O. 1990. Groundwater quality in rural areas of western African UNDP project, 81(26): 10.
37. Ikem, A., Osibanjo, O., Shridar, M.K.C., and Sobande, A.2002. Evaluation of ground water quality characteristics near two waste sites in Ibadan and Lagos, Nigeria. *Water, Air, and Soil Pollution,* 140: 307-333.
38. Lahluraj, S.M. 2005. Groundwater Chemistry of shallow aquifer. *Applied Ecology and Environmental Research,* 3(1): 133-199.
39. Tindasl, J.A., Petrusak, R.L., and McMonan, P.B. 1995. Nitrate transportation and transformation process in unsaturated vacuous media. *J. Hydrol* 169: 51-94.
40. Brian, D. 2001. Evaluation of water quality of the Qaraoun reservoir, Lebanon and suitability for multipurpose usage. *Environmental Monitoring and Assessment.* 77: 11- 30.
41. Aghazadeh, N., Asghari, A. and Mogaddam, A. 2010. Assessment of Groundwater Quality and its Suitabilityfor Drinking and Agricultural Uses in the Oshnavieh Area, Northwest of Iran *Journal of Environmental Protection*, 1:30-40.doi:10.4236/-jep.201011005.
42. Saroj K. C., Pandey, Vishnu V.P., Shrestha, S., Nakamura,T. and Futaba K.2010.Assessment of

© 2014 Global Journals Inc. (US)

Deep Groundwater Quality in Kathmandu Valley Using Multivariate Statistical Techniques. Water Air Soil Pollut 210:277–288.

© 2014 Global Journals Inc. (US)

This page is intentionally left blank

© 2014 Global Journals Inc. (US)

Global Journal of Science Frontier Research: B
Chemistry
Volume 14 Issue 7 Version 1.0 Year 2014
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Phytochemical and Therapeutic Studies of the Fruit Essential Oil of *Thuja orientalis* from Nigeria

By Ololade Z. S., Fakankun O. A., Alao, F. O. & Udi O. U.

Bells University of Technology, Nigeria

Abstract- The aim of this study was to establish correlations between the identified phytocompounds in the fruit essential oil of Thuja orientalis from Nigeria and their medicinal properties (free radical scavenging, antioxidant and antimicrobial). Forty-seven compounds were identified in the fruit essential oil of T. orientalis making up 97.5% of the total percentage composition. The essential oil was predominantly made up of monoterpenoids (62.2%). The most abundant components was 1R-**α**-pinene (15.2%) followed by **α**-pinene (9.6%), 1S-**α**-pinene (5.6%), cyclofenchene (5.6%), (+)-3- carene (4.5%), DL-pinene (4.5%) and trans-**β**-ocimene (4.0%). The high amount of terpenoids leads to more potent radical scavenging, antioxidant and antibiotic properties. The essential oil showed high potential as natural antioxidant and free radical inhibitor with IC50 value: 2.5µgml-1, the percentage inhibition of free radical ranged between 68-70%. Screening of the fruit essential oil for antimicrobial activities using the agar-well diffusion assay showed that the oil had high antibacterial properties against all bacteria isolates tested with zones of inhibition ranging from 10-30 mm.

Keywords: *Thuja orientalis, fruit essential oil, phytochemical, antioxidant, antibacterial.*

GJSFR-B Classification : *FOR Code: 780105p*



Strictly as per the compliance and regulations of :

© 2014. Ololade Z. S., Fakankun O. A., Alao, F. O. & Udi O. U. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Phytochemical and Therapeutic Studies of the Fruit Essential Oil of *Thuja orientalis* from Nigeria

Ololade Z. S. [α], Fakankun O. A. [σ], Alao, F. O. [ρ] & Udi O. U. [ω]

Abstract- The aim of this study was to establish correlations between the identified phytocompounds in the fruit essential oil of *Thuja orientalis* from Nigeria and their medicinal properties (free radical scavenging, antioxidant and antimicrobial). Forty-seven compounds were identified in the fruit essential oil of *T. orientalis* making up 97.5% of the total percentage composition. The essential oil was predominantly made up of monoterpenoids (62.2%). The most abundant components was 1R-α-pinene (15.2%) followed by α-pinene (9.6%), 1S-α-pinene (5.6%), cyclofenchene (5.6%), (+)-3-carene (4.5%), DL-pinene (4.5%) and *trans-β*-ocimene (4.0%). The high amount of terpenoids leads to more potent radical scavenging, antioxidant and antibiotic properties. The essential oil showed high potential as natural antioxidant and free radical inhibitor with IC_{50} value: 2.5μgml^{-1}, the percentage inhibition of free radical ranged between 68-70%. Screening of the fruit essential oil for antimicrobial activities using the agar-well diffusion assay showed that the oil had high antibacterial properties against all bacteria isolates tested with zones of inhibition ranging from 10-30 mm. This study confirms that the fruit essential oil of this plant contains phytochemicals that can form the basis for the development of a potential natural antioxidant and antibiotic which are safe, cheap, and readily available at a large scale for pharmaceutical industries for further investigation and processing.

Keywords: Thuja orientalis, fruit essential oil, phytochemical, antioxidant, antibacterial.

I. Introduction

Essential oil is one of the plant based secondary metabolites that are used as the basis of many of the modern pharmaceuticals used today to treat some major diseases (Buchbauer, 2000). Essential oils are more environmentally friendly than synthetic products because they are biodegradable and have no residual effect. The impacts of essential oils and aroma-chemicals on the nervous system, gastrointestinal system, immune system, respiratory system, antimicrobial and antifungal activities have in recent years been the area of interest for researchers. Currently, there is global interest in finding new and safe antioxidants and antibiotics from natural sources, to prevent oxidative deterioration of foods and to minimize oxidative effect on living cells. The antioxidant and antimicrobial potentials of several essential oils extracted from odoriferous medicinal plants are very important to human because antioxidants inhibit free oxygen radicals and free radicals formed from the substrate by donating hydrogen atoms or electrons (Prior *et al*., 2005). The increasing prevalence of multidrug resistant strains of bacteria and the recent appearance of strains with reduced susceptibility to antibiotics raise serious concern of health delivery and accessibility due to untreatable infections. There is therefore the needed urgency to the search for safe and more active antibiotics. Plants are important sources of potentially useful structures for the development of new chemotherapeutic agents (Savithramma *et al*., 2011; Ibrahim *et al*., 2012).

Thuja orientalis (*Cupressaceae*) commonly known as arborvitae, is a medicinal plant whose leaves have been locally used to treat flu and cough, high blood pressure, bleeding arthralgia, cancer, haemostatic, gout, rheumatism, diarrhoea, and chronic tracheitis (Zhu *et al*., 2004). Homeopathic preparations of *T. orientalis* include pills, granules, oils, ointments and liquid dilutions. Due to its scent it has been traditionally used for clothing protection from moths and nowadays is added to pest repellant sprays and paints to protect against mites, moths, and rodents.

To the best of our knowledge, there is paucity of information on the phytochemicals, free radical scavenging, antioxidant and antimicrobial potentials of fruit of this plant from Nigeria. Therefore present study was undertaken for the first time with the aim at looking into these quantitative and qualitative parameters in the fruit of *T. orientalis grown in Nigeria*.

II. Material and Methods

a) Identification, Collection of Plant Material and Isolation of the Essential Oil

Fresh fruits of the plant were collected from its natural habitat in Ota, Nigeria and it was authenticated as *Thuja orientalis* (*Cupressaceae*). Fruit of the plant was subjected to hydro-distillation for 2 hours using a Clevenger-type apparatus and the essential oil extracted was stored at -4°C in a refrigerator (European Pharmacopoeia, 2004).

b) GC and GC-MS Analyses

Analysis of the fruit essential oil of *T. orientalis* was performed using multi-dimensional gas

Author α σ ω: Department of Chemical Sciences, Bells University of Technology, P.M.B. 1015, Ota, Nigeria.
e-mails: zacchsnatpdt@gmail.com; suntolgroup@yahoo.com
Author ρ: Department of Biological Sciences, Bells University of Technology, P.M.B. 1015, Ota, Nigeria.

© 2014 Global Journals Inc. (US)

chromatograph coupled with Gas Chromatography-Mass Spectrophotometer (Shimadzu, Japan) equipped with non-polar and polar double capillary columns (25.0 m x 0.25 µm i.d., 0.25 µm df). High purity helium was used as the carrier gas at a constant flow rate of 0.99 ml/min. A total of 1 µl sample was injected (split ratio 100:1) into GC and GCMS using AOC20i auto injector for analysis. The initial temperature was set at 60°C, heated at a rate of 3℃/minutes to 280°C and held isothermally for 6 minutes. Ion source temperature for these analyses was set at 200°C, while the interface temperature was set at 250°C, solvent cut time was 3.0 minutes and the mass spectrometer was set to operate in electron ionization mode with an ionizing energy of 70 eV as acquisition mass range from 40-700 a.m.u. at 0.50 scan/s. The constituents were identified by comparison of their retention indices with those of the literature. The retention indices were determined in relation to a homologous series of *n*-alkanes under the same operating conditions. Further identification was made by comparison of their mass spectra with those stored in National Institute for Standards and Technology (NIST) and with mass spectra from literature.

c) Free Radical Scavenging and Antioxidant Capacity

The free radical scavenging and antioxidant activities of the fruit essential oil against the stable free radical DPPH were measured using different concentrations (1000, 100 and 10 μgml^{-1}) of the essential oil in methanolic solution of DPPH. After 30 minutes of incubation at room temperature in the dark, the absorbance at 517nm was measured spectrophotometrically. Ascorbic acid was used as reference compound. The assay was carried out in triplicate. The percentage inhibition (I%) for each concentration was calculated by using the absorbance (A) values according to the following formula:

$$I\% = [(A_{blank} - A_{eo})/A_{blank}] \times 100$$

Where: A_{blank} is the absorbance of blank solution and A_{eo} is the absorbance of different concentrations of the essential oil. The dose-response curve was plotted and IC_{50} value for the essential oil and the standard were calculated (Formagio *et al*., 2011).

d) Antimicrobial Activity

Antibacterial activities of the fruit essential oil of *T. orientalis* were measured against Grampositive bacteria *(Streptococcus agalactiae, Streptococcus species and Staphylococcus aureus)*and Gram-negative bacteria *(Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa and Salmonella typhimurium)* using agar-well diffusion method. Briefly, Petri dishes containing 20 ml of nutrient agar medium were swabbed using cotton applicator with an overnight starter culture of the bacteria isolates which were prepared in dilution to match the turbidity intensity of the 0.5 McFarland standards. Wells (6mm diameter) were punched in the agar and filled with 10µl of different concentrations of the essential oil. The plates were incubated at 37°C for 24 hours. The quantification of microbial growth inhibition was determined by measuring the diameters (mm) of clear zones of microbial growth including the well itself. Gentamicin (GEN) and augmentin (AUG) were used as control (Pimentel *et al.,* 2013).

III. Results and Discussion

a) Essential Oil Composition

Hydrodistillation of the fruits of *T. orientalis gave* a crude essential oil with pleasant odour. Forty-seven compounds were identified from the GC and GC-MS analyses of the fruit essential oil amounted to 97.5% of the percentage total composition (Table 1). The most abundant components was 1R-α-pinene (15.2%) followed by α-pinene (9.6%), 1S-α-pinene (5.6%), cyclofenchene (5.6%), (+)-3-carene (4.5%), DL-pinene (4.5%) and trans-β-ocimene (4.0%). The principal classes of organic compounds in the fruit essential oil were monoterpenes (62.2%), sesquiterpenes (8.3%), sesterpenes (5.4%) and diterpenes (1.6%).

Comparatively, the chemical composition of this fruit essential oil was different from those reported in other studies such as foliage essential oils of four varieties of *Thuja* species from Poland which are *T. occidentalis 'globosa'*, *T. occidentalis 'aurea'*, *T. plicata* and *T. plicata 'gracialis'*. The study of the four samples resulted in the identification of thirty-one compounds in the essential oil of *T. occidentalis "globosa"* (96.92%) while in the oil of *T. occidentalis "aurea"* twenty-seven constituents have been identified (94.34%), major constituents in both were:α-thujone (50.14 and 51.60%, respectively), beyerene (8.54% and 11.28%, respectively), sabinene (4.55% and 3.43%respectively) and camphor (4.47 and 3.09 % respectively). The characteristic difference between them is that T. *occidentalis "globosa"* has a high content of the ketones (β-thujone and fenchone), while *T. occidentalis "aurea"* has high levels of the diterpene (rimuene). The chemical profiles of the oils of the two *T. plicata* were also comparable, as thirty-two compounds have been identified in *T. plicata* (94.75%) and thirty in the oil of *T. plicata* "*gracialis"* (96.36%) having also α-thujone (62.12% and 54.48%, respectively), β-thujone (7.06% and 6.39%), terpinen-4-ol (4.66% and 3.11%) and sabinene (6.00% and 2.94%) as the most abundant compounds. On the other hand, *T. plicata* shows higher content of the ketone (fenchone), while *T. plicata* "*gracialis"* has high levels of the diterpene (beyerene) (Tsiri *et al*., 2009), but fruit essential oil of *T. orientalis* was characterised with high hydrocarbon terpenes rather than ketone. The above results show that the fruit essential oil of *T. orientalis* grown in Nigeria could serve

© 2014 Global Journals Inc. (US)

as good source of these pharmaceutical and industrial useful compounds.

Table 1: Chemical Composition of the Fruit Essential Oil of *T. orientalis*

Compounds	% Composition	RI
cyclofenchene	5.6	729
artemesia triene	1.0	896
(+)-sabinene	1.0	897
2-bornene	1.0	932
1R-α-pinene	15.2	937
α-pinene	9.6	938
1S-α-pinene	5.6	941
DL-pinene	4.5	943
(+)-2-carene	1.0	948
camphene	0.4	952
β-mycene	1.5	958
1S-camphene	0.4	964
β-pinene	1.5	970
trans-β-ocimene	4.0	976
(+)-3-carene	4.5	1003
4-methyl-3-(1-methylethylidene)-1-cyclohexene	1.0	1023
α-terpinolene	1.0	1052
camphene hydrochloride	0.4	1069
L-4-terpineol	1.0	1137
4-terpineol	2.0	1174
2-cyclopropylidene-1,7,7-trimethylbicyclo[2.2.1]heptane	0.2	1251
megastigma-7(*E*),9,13-triene	0.2	1278
α-terpineol acetate	1.0	1333
aromadendrene	0.5	1386
α-bergamotene	0.8	1430
γ-muurolene	0.2	1435
α-amorphene	0.2	1440
α-farnesene	0.8	1458
β-*cis*-caryophyllene	1.0	1477
β-*trans*-caryophyllene	1.0	1494
α-humulene	1.6	1497
germacrene	0.2	1515
L-globulol	1.0	1530
ledol	2.0	1565
Z,Z,Z-1,5,9,9-tetramethyl-1,4,7-cycloundecatriene	0.4	1579
epi-globulol	1.0	1582
globulol	1.0	1588
13-tetradecenal	2.8	1591

© 2014 Global Journals Inc. (US)

9Z-9-tetradecenal	2.8	1609
α-bisabolol	0.4	1625
cis-9-hexadecenal	2.8	1808
dichloroacetic acid, undec-2-enyl ester	2.8	1834
n-pentadecanoic acid	1.6	1869
palmitic acid	3.0	1968
cis-9-octadecenal	2.8	2007
arachidic acid	1.6	2366
1-(+)-ascorbic acid 2,6-dihexadecanoate	1.6	4765
Percentage Total	**97.5**	

RI = Retention Index

b) Radical Scavenging and Antioxidant Activities

The free radical scavenging and antioxidant properties of the fruit essential oil of *T. orientalis* were examined using stable DPPH. The essential oil showed high potentials as a natural antioxidant and free radical inhibitor with IC_{50} value 2.5μgml^{-1}, the percentage inhibition of free radical was 68% at 10μgml^{-1}, 69% at 100μgml^{-1} and 70% at 1000μgml^{-1}. The results of antioxidant and free radical scavenging activities showed that the fruit essential oil of *T. orientalis* from Nigeria had better radical scavenging and antioxidant properties than the aerial (twigs) ethanolic extract of *Thuja occidentalis (Cupressaceae)* with DPPH IC_{50} values of 202.45μgml^{-1} and percentage radical scavenging values of 73% at concentration 300μgml^{-1}, 62.7% at 250μgml^{-1}, 50% at 200μgml^{-1}, 43.5% at 150μgml^{-1}, 16.8% at 100μgml^{-1} (Dubey and Batra, 2009) while the fruit methanolic extract of *T. occidentalis* had IC_{50} values of 150.98 μgml^{-1} (Das and Rani, 2013). Natural antioxidants are essential for helping the body maintain its natural health. They protect cells from free radicals, harmful oxygen molecules thought to damage cells that result in cancer, atherosclerosis and rheumatoid arthritis. Natural antioxidants also have many industrial uses, such as preservatives in food and to prevent the degradation of rubber and gasoline (Hamid *et al.,* 2010). The benefits of antioxidants are very important to good health, because if free radicals are left unchallenged, they can cause a wide range of illnesses and chronic diseases. The human body naturally produces free radicals and the antioxidants to counteract their damaging effects. However, in most cases, free radicals far outnumber the naturally occurring antioxidants. In order to maintain the balance, a continual supply of external sources of antioxidants is necessary in order to obtain the maximum benefits of antioxidants. Therefore, natural antioxidants benefit the body by neutralizing, removing the free radicals from the bloodstream, protects the cells against their toxic effects and contribute to disease prevention (Pham-*Huy et al*., 2008).

Table 2 : IC_{50} of the Antioxidant Properties of the Fruit Essential Oil of *T. orientalis*

Essential Oil and Reference Compound	DPPHIC_{50} μgml^{-1}
T. orientalis	2.5
Ascorbic acid	9.0

Data are presented as triplicate of the mean

c) Antibacterial Potentials

The fruit essential oil of *T. orientalis* was screened for the antibacterial activities against clinically isolated Gram-positive and Gram-negative bacteria with the following results as shown in table 3 below. The antibacterial activities obtained were categorized as follows: (a) - = no inhibition, (b) 6-9 mm = low inhibition, (c) 10-15 mm = moderate inhibition and (d) ≥ 15 mm = high inhibition. The antimicrobial properties of the fruit essential oil showed different selectivity for each organism. The results revealed that the fruit essential oil have high activities against all the tested organisms with the inhibition zones ranging from 10-30mm. The difference in susceptibility of the bacteria to the essential oil is thought to arise as a result of the differences in their cell membrane structure (Angienda *et al.,* 2010).The fruit essential oil of *T. orientalis* gave a comparable result with other related species in the *Cupressaceae* family such as *Thuja occidentalis*: *S. aureus* (17mm), *E. faecalis* (11mm), *E. coli* (11mm), *P. vulgaris* (-), *P. aeruginosa* (9mm), *Salmonella sp.* (11mm), *K. pneumoniae* (13mm). Moreover, *Thuja plicata* shows the following activities with the following organisms: *S. aureus* (30mm), *E. faecalis* (10mm), *E. coli* (11mm), *P. vulgaris* (7mm), *P. aeruginosa* (10mm), *Salmonella sp.* (11mm), *K. pneumoniae* (-) (Jirovetz et al., 2006), *Thuja koraiensis* extract gave the following zones of inhibition with *S. aureus* (17 mm), *B. subtilis* (13 mm), *E. coli* (15 mm) and *S. typhimurium* (12 mm) (Zhang *et al.,* 2014) while the fruit essential oil of *Juniperus excelas (Cupressaceae)* has no activity

© 2014 Global Journals Inc. (US)

against *S. aureus, E. coli* and *P. aeruginosa (*Weli *et al.,* 2014).

Table 3 : Zones of Inhibition (mm) showing the Antimicrobial Properties of the Fruit Essential oil of *T. orientalis*

	Fruit Essential Oil			GEN	AUG
Conc. / Organism	1000	100	10	10µg	30µg
E. coli	14	-	-	22	-
K. pneumoniae	15	15	15	21	-
P. aeruginosa	12	12	-	20	11
P. mirabilis	10	10	10	20	-
S. agalactiae	15	13	10	-	-
S. aureus	13	12	11	-	-
S. typhimurium	14	14	12	21	-
S. species	30	30	30	-	-

Keynote:--- = Resistant, 6-9 mm = low inhibition, 10-14 mm = moderate inhibition and ≥ 15 mm = high inhibition.

IV. Conclusion

This study demonstrated that the fruit essential oil of *T. orientalis* produces a pronounced free radical scavenging, antioxidant and antimicrobial activities and could be further investigated for possibility of developing a cheap, acceptable and easy available therapeutic agent. The study therefore not only reveals the plant excellent natural antioxidants to be utilized nutritionally and pharmaceutically, but also provides good scientific justification for increased in traditional use of the plant.

Conflict of interest: We have no conflict of interest.

References Références Referencias

1. Angienda PO, Onyango DM, Hill DJ.Potential application of plant essential oils at sub-lethal concentrations under extrinsic conditions that enhance their antimicrobial effectiveness against pathogenic bacteria, *African Journal of Microbiology Research.* 2010; 4 (16): 1678-1684.
2. Buchbauer G. The detailed analysis of essential leads to the understanding of their properties, *Perfumer flavorist.* 2000; 25: 64-67.
3. Das S, Rani R.Antioxidant and gastroprotective properties of the fruits of *Thujaoccidentalis* Linn, *Asian Journal of Biochemical and Pharmaceutical Research*. 2013; 3(3): 80-87.
4. Dubey SK, Antioxidant Activities of *Thuja Occidentalis Linn., Asian Journal of Pharmaceutical and Clinical Research.* 2009; 2(1): 73-76.
5. Baharoglu Z, Garriss G, Mazel D. Multiple Pathways of Genome Plasticity Leading to Development of Antibiotic Resistance. *Antibiotics.* 2013; 2: 288-315.
6. European Pharmacopoeia Commission. *European Pharmacopoeia 5th Ed.* Council of Europe: Strasbourg Cedex, France. 2004.
7. Hamid AA, Aiyelaagbe OO, Usman LA, Ameen OM, Lawal A. Antioxidants: Its medicinal and pharmacological applications, *African Journal of Pure and Applied Chemistry.* 2010; 4(8):142-151.
8. Ibrahim HA, Imam IA, Bello AM, Umar U, Muhammad S, Abdullahi SA. The Potential of Nigerian Medicinal Plants as Antimalarial Agent: A Review, *International Journal of Science and Technology.* 2012; 2(8): 600-605.
9. Jirovetz L, Buchbauer G, Denkova Z, Slavchev A. Stoyanova A, Schmidt E. Chemical composition, antimicrobial activities and odour descriptions of various *Salvia sp. and Thuja* sp. essential oils, *Ernahrung/Nutrition*. 2006;30:4.
10. Pimentel RBQ, Costa CA, Albuquerque PM, Junior SD. Antimicrobial activity and rutin identification of honey produced by the stingless bee *Meliponacompressipesmanaosensis* and commercial honey. *BMC Complementary and Alternative Medicine* . 2013;13(151): 1-14.
11. Pham-Huy LA, He H, Pham-Huy C.Free Radicals, Antioxidants in Disease and Health, *Int. J. Biomed. Sci.* 2008; 4(2): 89-96.
12. Prior RL, Wu X, Schaich K. Standardized methods for the determination of antioxidant capacity and phenolics in food and dietary supplements. *J. Agric. Food Chem*. 2005;53: 4290-4302.
13. SavithrammaN, Rao ML, Suhrulatha D.Screening of Medicinal Plants for Secondary Metabolites, *Middle-East Journal of Scientific Research,* 2011; 8 (3): 579-584.
14. Shah SMM, Sadiq A, Shah SMH, Ullah F. Antioxidant, total phenolic contents and antinociceptive potential of *Teucrium stocksianum methanolic* extract in different animal models, *BMC Complementary and Alternative Medicine*. 2014; 14(181): 1-14.
15. Tsiri D, Graikou K, Pobłocka-Olech L, Krauze-Baranowska M, Spyropoulos C, Chinou I. Chemosystematic Value of the Essential Oil Composition of *Thuja* species Cultivated in Poland-Antimicrobial Activity, *Molecules. 2009;* 14: 4707-4715.
16. Weli AM, Al-Hinai SRK, Hossain MM, Al-Sabahi JN. Composition of essential oil of Omani *Juniperus excelsa* fruit and antimicrobial activity against foodborne pathogenic bacteria, *Journal of Taibah University for Science.* 2014; 8(3):225-230.
17. Zhang XW, Choe YH, Park YJ, Kim BS. Effect of Korean arbor vitae (Thuja koraiensis) extract on antimicrobial and antiviral activity, *Afr. J. Pharm. Pharmacol*. 2014; 8(10): 274-277.

© 2014 Global Journals Inc. (US)

18. Zhu K. Information transparency of business-to-business electronic markets: A *game-theoretic analysis* 2004;50(5):670-685.

© 2014 Global Journals Inc. (US)

Global Journal of Science Frontier Research: B Chemistry
Volume 14 Issue 7 Version 1.0 Year 2014
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

The Mechanism of Hail Formation and a Method to Prevent it

By Sokhrab Ismailov
Institute of Petrochemical Processes, Academy of Sciences of Azerbaijan, Azerbaijan

Abstract- The new hypothesis about the building mechanism of hail showers is made under atmosphere conditions. It is suggested, contrary to other famous theories that hail showers building is stipulated by the generation of high temperature in lightning strike in atmosphere. Quick water evaporation along and around the discharge channel leads to its rough freezing with the advent of hail showers of different sizes. The transition of zero-degree isotherm is not necessary for the building of hail showers; they are formed in the lower atmosphere. Storm is accompanied by hail showers. Hailstorm is observed only in case of severe thunderstorm.

In contrast to the previous well-known theory of hail showers, in this paper we propose an original and simple method to prevent hail with the use of a lightning rod. Lightning rod in turn, can prevent together with hail and lightning discharge.

Keywords: *hailstone; zero temperature; evaporation; cold; lightning, storm.*

GJSFR-B Classification : *FOR Code: 259999p*



Strictly as per the compliance and regulations of :



© 2014. Sokhrab Ismailov.This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

The Mechanism of Hail Formation and a Method to Prevent it

Sokhrab Ismailov

Abstract- The new hypothesis about the building mechanism of hail showers is made under atmosphere conditions. It is suggested, contrary to other famous theories that hail showers building is stipulated by the generation of high temperature in lightning strike in atmosphere. Quick water evaporation along and around the discharge channel leads to its rough freezing with the advent of hail showers of different sizes. The transition of zero-degree isotherm is not necessary for the building of hail showers; they are formed in the lower atmosphere. Storm is accompanied by hail showers. Hailstorm is observed only in case of severe thunderstorm.

In contrast to the previous well-known theory of hail showers, in this paper we propose an original and simple method to prevent hail with the use of a lightning rod. Lightning rod in turn, can prevent together with hail and lightning discharge.

Keywords: hailstone; zero temperature; evaporation; cold; lightning, storm.

I. Introduction

People are often confronted with terrible natural phenomena of nature and constantly fight against them. Natural disasters and the consequences of catastrophic natural events (earthquakes, landslides, lightning, tsunamis, floods, volcanic eruptions, tornadoes, hurricanes, hail) attracted the attention of scientists from all over the world. It was not by chance, when UNESCO had established a Special Commission on account of UNDRO disaster (disaster response of the United Nations, the United Nations). Knowing the objective world and acting in accordance with it, the man subdues nature forces them to serve their purposes and turns from a slave to nature in the Lord of nature and ceases to be powerless before nature, becomes free. One of those scourges is hail.

The fall of the hail, first of all, destroys cultural combines of plants, kills livestock, as well as the man himself. The fact of the matter is that a sudden and large influx of offensive hail eliminates protection against it. Sometimes the surface is covered with minute read barrage with a thickness of 5-7 cm. In the area of Kislovodsk in the 1965 year was hail, covering the ground layer in 75 cm. Normally hail covers the 10-100 km distance. Let us remember some terrible events of the past.

In 1593, in one of the provinces of France due to the raging winds and lightning knocked out the sparkling hailstones with a huge weight of 18-20 pound! This has caused great damage to crops and destroyed many churches, castles, houses and other structures. The victims of this terrible event began and the people themselves. *(Here it is necessary to consider that in those days the pound as a unit of weight has several meanings).* It was a terrible natural disaster, one of the most disastrous hailstones that hit France. In the eastern part of the State of Colorado (United States) annually about six hailstones, each of them brings great losses. Hail most frequently occur in the North Caucasus, Azerbaijan, Georgia, Armenia, in the mountains of Central Asia. With 9 on June 10, 1939, in the city of Nalchik fell hail size about an egg, accompanied by strong rain. In the result has been destroyed more than 60 thousand hectares of wheat and about 4,000 hectares of other crops; killed 2,000 sheep. When it comes to hail, first of all, pay attention to the size of it. Hail, as usual, vary in size. It is interesting to know about absolutely fantastic hail. In India and China it was found falling from the sky ice blocks weighing 2-3 kg. Even say that in 1961 in North India heavy hailstones killed an elephant. 04.14.1984 In the small town of Gopalganj district of Bangladesh hail fell 1 kg, which killed 92 people and several dozen elephants. Even this hail entered the Guinness Book of Records. In 1988, 250 people in Bangladesh were victims hail. And in 1939, the hail was found with a weight of 3.5 kg. More recently (20/05/2014) in Sao Paulo, Brazil, large hailstones, many of which were recovered from the streets with the help of heavy machinery. All these data show that life with a barrage important than the nature of the unusual phenomenon. On this basis, a comprehensive study of the causes and finding his formation using modern physical and chemical methods of research, as well as the fight against this terrible natural phenomenon is the primary problem facing humanity around the world.

II. What is the Mechanism of Hail Formation

In advance, I note that there is still no proper and positive response to this question. Despite the creation of the first hypothesis about this back in the first half of the 17th century with Descartes, however, scientific theory hail processes and practices impact on Physics and meteorologists have developed only in the middle of the last century. It should be noted that even in the middle ages and in the first half of the 19th

Author: Doctor. Chem. Sciences, Senior Researcher, Institute of Petrochemical Processes, Academy of Sciences of Azerbaijan, Baku. e-mail: sokhrab@yahoo.com

© 2014 Global Journals Inc. (US)

century there have been several assumptions of different researchers, such as, Bussengo, Swedes, Klossovskiy, Volta, Rayee, Ferrell, Gan, Faraday, Zonke, Reynold, etc. Unfortunately, their theory did not receive their confirmation. It should be noted that recent views thereon do not constitute scientific validity, and there is still no comprehensive views on the mechanism of hail formation. The presence of numerous experimental data and a set of literary materials, dedicated to this topic were given the opportunity to assume the next formation mechanism of hail, which was recognized by the World Meteorological Organization and continues to operate so far *(to avoid controversy, we literally give these arguments)* [1, 6, 21]:

"Rising from the Earth's surface on a hot summer day, the warm air cools with height, and the moisture is condensed, formed a cloud. Cooled liquid droplets in the clouds are found even when the temperature is –40 °C at a height of about 8-10 km). But these drops are very unstable. Raised from the Earth's surface the smallest particles of sand, salt, combustion products and even bacteria with super cooled drops disturb the fragile balance. Cooled liquid drops that came into contact with solid particles, turn into an ice embryo of hailstones.

Small hailstones are in the top half of almost every cumulonimbus clouds rain, but most often such hailstones when approaching the Earth's surface are melting. So, if the speed of the upward flow in a cumulonimbus cloud rain reaches 40 km/h, they cannot keep the hailstones formed, therefore, passing through a warm layer of air at a height of 2.4 to 3.6 km, they fall out of the clouds in the form of small soft hail or rain at all. Otherwise, the updrafts lift the small hailstones up to layers of air with temperature from-10° c to-40° c (height between 3 and 9 miles), a diameter of hailstones begins to grow, reaching sometimes several centimeters. It should be noted that in exceptional cases the speed of ascending and descending cloud flows can reach 300 km/h! And the higher the speed the upward flow in a rain cloud, cumulonimbus, the larger the hail.

For the formation of hailstones the size of a golf ball more than 10 billion needed super cooled water drops, and hailstone cloud must remain at least 5-10 minutes to reach such a large size. It should be noted that a single drop of rain is about a million such small super cooled droplets. Hailstones with a diameter of more than 5 cm in cumulonimbus clouds, which are very powerful rising air currents. It is thunderstorms produce tornadoes, heavy downpours and gusts.

Hail usually falls when severe thunderstorms in the warm season, when the temperature at the Earth's surface not is below 20 °C ".

It must be stressed that even in the middle of the last century, or rather, in 1962; p. By Ludlam also proposed a similar theory [16] provides the education prerequisite hailstones. They also discussed the formation of hailstones in the super cooled part of the cloud of small water droplets and ice crystals by coagulation. Last operation must be strong lifting and lowering of the hailstones several kilometers, passing a null isotherm. On the type and size of hailstones and modern scholars say that the hailstones during his life repeatedly to get up and down the strong convection currents. As a result of the collision with the super cooled drops of hailstones increase their size. The World Meteorological Organization in 1956 gave a definition of what a hail*: "Hail-precipitation in the form of spherical particles or pieces of ice (hailstones) with a diameter ranging from 5 to 50 mm, sometimes more, falling separately or in the form of incorrect complexes. Hailstones consist only of transparent ice or of a number of layers with a minimum thickness of 1 mm, alternating with translucent layers. Hail is observed usually in strong thunderstorms ".*

Almost all of the former and contemporary sources on the subject indicate that the hail is formed by a powerful concentrate the cloud at strong upward air flows. This is true. Unfortunately, most forgotten about lightning and thunderstorms. And the subsequent interpretation of the formation of hailstones, in our view, It is not logical and pointless.

Professor Klossovskij carefully reviewed the appearances of hailstones and discovered that they also have a number of spherical form other geometric forms of existence [8]. These data indicate the formation of hailstones in the troposphere on a mechanism. After reading all of these theoretical perspectives, caught our attention several intriguing questions:

1. Composition of the clouds, found at the top of the troposphere, where temperature is approximately — 40 °C operating system already contains a mixture of super cooled of water droplets, ice crystals and sand particles, salts, bacteria. Why not disturbed the fragile power balance?

2. With the recognized modern general theory [1, 6, 21], hailstone could emerge and no lightning or thunder storm. For the formation of hailstones with a larger size, small ice must climb a few kilometers up (at least 3-5 km), and fall down, passing a null isotherm. While this should be repeated until it was formed in a sufficiently large amount of hail. Still the same, the greater the upward flow velocity in the cloud should get, the bigger the hailstone (from 1 kg to several kg) and for the consolidation of it should remain in the air for 5-10 minutes. Interesting!

3. In general, it is difficult to imagine that in the upper atmosphere will focus as huge ice blocks weighing 2-3 kg? It turns out that the hailstones were still large in cumulonimbus cloud rain than seen on earth because of it melted when falling through the warm layer of the troposphere.

© 2014 Global Journals Inc. (US)

4. Because meteorologists often confirm: ". ... hail usually falls when severe thunderstorms during summer, when the temperature at the Earth's surface is below 20 °C ", however, does not indicate the cause of the phenomenon. Of course, the question is: what is the effect of a lightning storm? Hail almost always falls to the shower or at the same time with him and never after. He falls for the most part in the summer and during the day. Hail at night - a very rare phenomenon. The average duration of hail - from 5 to 20 minutes. Hail as usual, going to the place where there is a strong bolt of lightning, and is always associated with a thunderstorm. *Without lightning hail does not happen!* Hence, the reason for the formation of hail, we need to look for in it. The main drawback of all existing mechanisms for the formation of hail, in our opinion, is the lack of recognition of the dominant role of the lightning discharge.

Studies of the distribution of hail and thunderstorms in Russia, produced A.V. Klossowski [8] confirm the existence of a particularly close link between these two phenomena: hail with thunderstorms usually happens in the south-eastern part of the cyclone; he often where most thunderstorms. North of Russia is poor cases of hail, in other words, hail, the cause of which is explained by the lack of strong lightning. And what role is played by lightning? No explanation several attempts to find a connection between the hail and the storm still were in the middle of the 18th century. [9]. Guyton de Morvo Chemist, rejecting all the existing ideas, offered his theory: electrified the cloud better conduct electricity [20]. But Nolle [23] put forward the idea that water evaporates faster when she electrified and reasoned that it must amplify the chill and the fantasized that couples can become the best conductor of heat, if you put electricity on them. Guyton criticized Jean Andre Monsey and wrote, [22]: it is correct that electricity increases evaporation, but electrified drops must mutually repel and not merge into large hailstones. The electrical theory of hail was offered another famous physicist Alexander Volta [25]. In his view, the electricity was used as the root causes of the cold, and to explain why hailstones remain suspended for so long, that manage to grow. Cold is the result of very rapid evaporation of clouds, which contributed to the strong sunlight, rarefied dry air, lightness of volatilization of bubbles, which are made of clouds, and the estimated effect of electricity, which helps evaporation. But as the hailstones are kept in the air for sufficient time? For this reason Volta to look only for electricity. Well, how?

Anyway, to the 20 years of the 19th century there was a general belief that the combination of hail and lightning simply means that both of these effects occur when the same weather conditions. This was clearly expressed in 1814; the view of von Bush [17] and in 1830 it was strongly asserted Olmsted of Denison Ielâ [24]. Since then, the theory of hailstones was mechanical and based more or less steadily on perceptions of ascending air flows. On the theory of Ferrell [18], each hailstone may repeatedly fall and rise. The number of layers in the hailstone, which are sometimes up to 13, Ferrell′ judged the speed of hailstone. Circulation occurs until the hailstones do not become very large. By his calculation, rising current speeds of 20 m/s is unable to hail in 1 cm in diameter, and the speed for tornadoes is quite moderate.

There are a number of relatively new scientific research [11, 13, 14], devoted to the issues of formation of hail. In particular, argue that the history of the hail is reflected in its structure: large hailstone, cut in half, is similar to the root: it is composed of multiple layers of ice. Sometimes hailstones like pie, where alternate ice and snow. And this is his explanation for such layers, you can calculate the number of times a piece of ice was on a journey from the rain clouds in the supercool layers of the atmosphere. It is hard to believe: Grad with a weight 1-2 kg could jump back up to distances of 2-3 km? The layering of ice (hailstones) can appear for a variety of reasons. For example, the difference between the ambient pressures will cause such a phenomenon. There have already talked about the snow. Where is the snow? Unclear.

In a recent site http://tornado2.webnode.ru/-obrazovanie-grada/YegorChemezov puts forward his idea and tries to explain the formation of hail and his ability to stay for a few minutes in the air with the advent of the "black hole" in the cloud. In his view: "The hailstone has a negative charge. The greater the negative charge of the object, the less the concentration of ether (physical vacuum) in the site!? And the less the concentration of air in the material object, the more anti-gravity he possesses. On Chemezov, the black hole is a good trap for hailstones. Once, lightning, is a negative charge, and start falling hailstones.

Analysis of the literature shows that in this area of science has a lot of flaws and often speculation.

On completion of the all-Union Conference in Minsk in 13.09.1989, devoted to the theme: "Synthesis and investigation of prostaglandins," we are in the middle of the night with the staff of the Institute were returning by air from Minsk in Leningrad. A flight attendant reported that our plane flies at an altitude of 9 km. We watched the monstrous spectacle. Below us from us in a distance of about 7-8 km (just above the surface of the Earth) that was a terrible war. These were powerful storm level. While the above our cloudy and shining star. And when we were over Leningrad, reported to us that an hour ago in the city the hail fell out with the rain. With this episode I want to emphasize, that the strong lightning often sparkles closer to the ground. For the occurrence of hail and lightning did not necessarily raise the flow of cumulonimbus at the height of 8-10 km. And there is no need to move the clouds above a zero isotherm. Huge ice blocks are formed in the warm layer of the troposphere. For such a process

© 2014 Global Journals Inc. (US)

does not require freezing temperatures and high altitude. Everyone knows that without lightning hail does not happen. Apparently, for electrostatic fields don't have collision and friction for small and large crystals of solid ice, as often write, although the phenomenon of friction hot and cold enough clouds in the liquid state (convection). For the formation of thundercloud requires plenty of moisture. When the same relative humidity, warm air contains more moisture than cold air. Therefore, Thunder and lightning, usually occur during the warm seasons-spring, summer, autumn. The mechanism of electrostatic field in the clouds also remains an open question. There is much speculation on the subject [9]. In one recent reported [5] that the rising moist air flows along with not charged cores are always present, positively and negatively charged nucleus. Any of them could be condensation. Found that the condensation of moisture in the air, the first begins to negatively charged nuclei, than neutral or positively charged nuclei [10.12]. For this reason, at the bottom of the clouds accumulate negative particles, and the top is positive. Therefore, inside the clouds is created a huge electric field intensity which is 10^6-10^9 V and the current 10^5— 3 • 10^5 A. such a strong difference of potentials, in the end, leads to a powerful electric discharge. Lightning can last 10-6 (one millionth) of a second. When discharge lightning releases enormous thermal energy, and temperature reaches – 30 000 °K. This is about 5 times greater than the Sun's surface temperature. Of course, this huge energy area particle must exist in the form of plasma, which after recombination becomes neutral atoms or molecules.

III. What can Cause this Terrible Heat

Many know that when a strong lightning discharge neutral molecular oxygen air is easily converted into ozone, and felt his peculiar smell:

$$2O_2 + O_2 \rightarrow 2O_3\uparrow \quad (1)$$

In addition, it is established that in these harsh environments simultaneously reacts chemically inert nitrogen with oxygen to form mono-NO and nitrogen dioxide NO_2:

$$N_2 + O_2 \rightarrow 2NO + O_2 \rightarrow 2NO_2 \quad (2)$$

$$3NO_2 + H_2O \rightarrow 2HNO_3\downarrow + NO \quad (3)$$

Formed NO_2 nitrogen dioxide in turn, aligning him with water, becomes a nitric acid HNO_3, which in the sediment falls to the ground.

Previously thought that containing in cumulonimbus clouds of table salt (NaCl), carbonate (Na_2CO_3) alkaline and alkaline earth metals ($CaCO_3$) react with nitric acid and eventually is formed nitrates.

$$NaCl + HNO_3 = NaNO_3 + HCl \quad (4)$$

$$Na_2CO_3 + 2\,HNO_3 = 2\,NaNO_3 + H_2O + CO_2 \quad (5)$$

$$CaCO_3 + 2HNO_3 = Ca(NO_3)_2 + H_2O + CO_2 \quad (6)$$

Nitrate when mixed with water leads to cold. Adhering to this, Gassendi fantasized that the upper layers of air are cool, not because they are far away from the source of heat reflecting from the Earth, and because of the "corpuscles" nitrogen (nitrate) out there that are very numerous. In winter the less and they generate only snow, but in summer there are more, so there may be hail [19]. Subsequently, this hypothesis has also been subject to criticism by his contemporaries.

IV. What Might Happen to the Water in Such a Harsh Environment

In the literature, there is no information. Heating to a temperature of 2500 ° C [2], or the water passing through the non-alternating electric current at room temperature, [7], it is decomposed into its constituent parts and the heat of the reaction is shown in equation (7):

$$2H_2O\,(liq) \rightarrow 2H_2\uparrow(g) + O_2\uparrow(g) - 572\ kC \quad (7)$$

$$2H_2\uparrow(g) + O_2\uparrow(g) \rightarrow 2H_2O\,(liq) + 572\ kC \quad (8)$$

The decomposition reaction of water (7) is an endothermic process and energy to break the covalent bonds must be introduced externally. In this case, the energy comes from the system (in this case the electrostatic polarized – water). This system resembles an adiabatic process, after which there is no gas heat exchange with the environment, and such processes are very fast (lightning).

In short, in an adiabatic process (the decomposition of water into hydrogen and oxygen) (7) is internal energy and hence it starts to cool itself. Of course, when the balance shifts toward the right side to form a gases - hydrogen and oxygen by the action of the electric arc instantly snap ("explosive mixture") reverse reaction occurs between the hydrogen and oxygen (8). This reaction is performed in the laboratory. Despite a decline in volume of reactive components in this reaction, the result is a strong rumbling. The speed feedback based on Le Chatelier's principle affects favorably received by reaction (7) high pressure. The fact of the matter is that and direct reaction (7) should be strong with a roar, as liquid water modular condition instantly formed gases (most authors attribute this to intense heating and expansion within or around the channel of air created by a discharge of Lightning). It is possible that the sound of thunder, therefore, is not monotonous, that is, not to mention the sound of an explosive or weapon. First comes the decomposition of water (first thunder), followed by accession of hydrogen

© 2014 Global Journals Inc. (US)

with oxygen (the second thunder). However, these processes are occurring so quickly, they discern not everyone.

V. As is Formed Hail

When the discharge of lightning happen because of the huge amount of heat, the water in lightning channel or around his intensely evaporates as soon as stop flashing lightning, water begins to freeze. In the well-known law of Physics: a strong evaporation leads to cooling. It is noteworthy that the heat during discharge of lightning is not imposed from the outside, on the contrary, it derives from the system itself (in this case system: polarized electrostatic water). The process of evaporation is the kinetic energy of the polarized water system. In this process, a strong and instant evaporation of water causes a sharp its solidification. The stronger the evaporation, the more intense is the process of solidification of water.

For such a process is not necessary that the ambient temperature was below zero. When lightning flashes produced the hailstone in different sizes. A dimension of hail depends on the power and intensity of lightning. The stronger and more intense lightning are, the larger the hailstone. Typically residue hailstones quickly stop as soon as will cease flashing lightning.

Similar processes operate in other areas of nature. Here are a few examples.

1. Refrigeration systems work on this principle. That is, the artificial cold (sub-zero temperature) in the evaporator is formed by boiling of liquid refrigerant that is fed back through the capillary tube. Due to the limited capacity of the capillary tube, the refrigerant enters the evaporator is relatively slow. Boiling refrigerant – usually about 30 ° C. Getting in warm evaporator, the refrigerant boils instantly, strongly cooling evaporator wall. The refrigerant vapor generated as a result of its boiling point, fall from the evaporator to the suction pipe of the compressor. Evacuating the gaseous refrigerant from the evaporator, the compressor pumps it under high pressure to the condenser. Gaseous refrigerant in the high pressure condenser cooled gradually condenses in the gas passing from the liquid state. Re-liquid refrigerant from the condenser is fed through the capillary tube into the evaporator and the cycle is repeated.

2. Chemists are well known to produce solid carbon dioxide (CO_2). Carbon dioxide is usually transported in steel cylinders in liquefied liquid aggregate phase. With slow passage of gas from the cylinder at room temperature passes to a gaseous state, if it produce intense, it immediately goes into the solid state, forming a "snow" or "dry ice" having a temperature of sublimation of –79 to –80 °C. Intensive evaporation leads to solidification of the carbon dioxide, passing the liquid phase. Obviously, the temperature inside the container above zero, however, this highlighted by solid carbon dioxide ("dry ice) has a sublimation temperature of about –80° C [15].

3. Another important example regarding this topic. Why does a person sweats? Everyone knows that in normal conditions or on exertion, as well as in nervous excitement person sweats. Pot - liquid secreted by the sweat glands and containing 97.5 - 99.5% water, small amounts of salts (chlorides, phosphates, sulphates), and several other compounds (organic compounds - urea, uric acid salts, creatine esters, sulfuric acid) [3]. However, excessive sweating may indicate the presence of serious diseases. May be several reasons: colds, tuberculosis, obesity, violation of the cardiovascular system and etc. However, more importantly, sweating regulates body temperature. Increased sweating under the hot and humid climate. We usually covered with sweat when we are hot. The higher the ambient temperature, the more we sweat. The body temperature of a healthy person is always equal to 36.6 ° C and one of the methods of maintaining a normal temperature - is sweating. Through the enlarged pores is an intensive evaporation of moisture from the body - a person sweats heavily. A moisture evaporation from any surface, as indicated above, it promotes cooling. When the body is in danger to the health of overheating, the brain triggers sweating and evaporating from our skin sweat cools the body surface. That's why people sweat in the heat.

4. Furthermore, water may also be converted into ice in a conventional glass laboratory setup (Figure 1) under reduced pressure without external cooling (at 20 ° C). You need only connect to this setting the deep vacuum pump and trap.

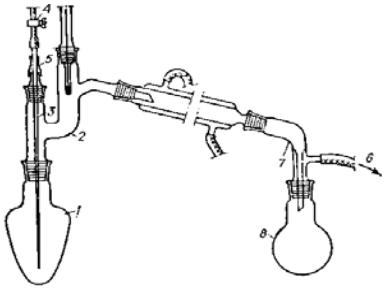


Figure 1 : Laboratory vacuum unit for distillation



Figure 2 : The amorphous form of ice inside a hailstone

© 2014 Global Journals Inc. (US)



Figure 3 : Aggregation of hailstones

In conclusion, I want to address a very important question regarding the layering of hailstones (see Fig. 2-3). What causes turbidity in the structure of hailstones? The authors report that [5, 13, 14]: *"To be hailstone diameter of about 10 centimeters, the ascending air stream in the thundercloud must have a speed not less than 200 km / h, and thus it includes snowflakes and air bubbles. Such layer looks turbid. But if the temperature is higher, the ice freezes slowly and included snowflakes have time to melt, and the air escapes. Therefore, such a transparent layer of ice. The rings can be traced, in which layers of clouds visited-air before falling to the ground".* Of Fig. 2,3 clearly shows that the ice that makes up the hailstones, really, is not uniform. Almost every hailstone is pure and in the center of a muddy ice. The opacity of the ice may be caused by various reasons. In large hailstones sometimes alternating layers of transparent and opaque ice. In our opinion, the white layer is responsible for the amorphous and the transparent layer of ice - the crystalline form. In addition, the amorphous form of ice aggregate is obtained by extremely rapid cooling of liquid water (at a rate of about 10^{7o}K/sec), as well as the rapid increase in the ambient pressure, so that the molecules do not have time to form a crystal lattice [4]. In this case this is a discharge of lightning, which is fully in line with the favorable condition of formation of metastable amorphous ice. From Figure 2-3 shows clearly that the huge boulders were formed from clusters of relatively small hailstones. Both of these factors suggest that the formation of a transparent or opaque layers of hail, caused by exposure to extremely high pressures generated during lightning.

The hail is one of the most terrible natural disaster causing damage to mankind. In the United States the hail destroyed an average of 1 to 2% of crops. In some areas the figure is 6%. Damage is 1-1.5 billion United States Dollars [26]. Extremely great damage from hail in North America was registered in May 1995 in Texas (about $ 2 billion). May 14, 2001 in Stavropol region of Russia hail damaged 4,500 homes, killed the agricultural crops area of 1000 sq km and perennials on the area of 30 sq km, the damage reached $ 17 million USA. The Midwest United States hit by storm. 12 Tornadoes recorded in the states of Nebraska, Iowa, Wyoming, and Kansas. In Blair town suffered 4,500 cars dealer network Woodhouse Auto Family. The total value of the damaged property is $ 152 million [27]. About the formation of hail and its of negative consequences are given detailed information in the recently published articles [28_35].

It should be noted that, the reason for the formation of hail have been determined incorrectly, the false views and the theories put forward till today. That is why, these scientists have been unable to prevent or avoid it. The major trends in this research are not to prevent hail, but to diminish it from a large part of the mass [36-42]. Thus, to this end, were used the various chemical reagents (eg, CO_2, AgI, NaCl, tetraalkilamoniumun in freon solution, and so on) the rockets and the projectiles, as carriers. The aim of this difficult operation was: to create a large number of crystallization centers, with this way replaced hail with large mass with smaller particles and thus reduce the amount of damage caused.

In February 2010, the newspaper RIA "News" reported that the Moscow scientists have developed a new modified aircraft or so-called "multi-functional aviation complex" Nart ", designed to prevent catastrophic natural weather events, such as hail, torrential rain, tornadoes and typhoons, through active impacts on meteorological processes. According to the developers, the range influence of the complex is 300-350 kilometers and has passed several tests in the south of Russia. Nevertheless, the use of this device produced no tangible results; Moscow and its region again are showered of hail with the size of the Greek walnut.

In the review [42] emphasize that there is a relationship between the parameters of the number of days with hail and thunderstorm. The authors clearly recognize that the hail is almost always falls during a thunderstorms and it is interesting to compare the parameters of the number of days with hail and thunderstorms. The comparison shows that there is quite a distinct and strong correlation between these parameters. Found that it in the years before the defense was 2.5:26.4 = 0.095, and in the years protect 1.5:31 = 0.048. However, recognize that, despite the continuous improvement of technical equipment and technological schemes impact hail albeit reduced, but each year brought significant damage to the protected areas in all regions where the work was carried out. On this basis, it can be concluded that the current methods of influence on hail processes exhausted its possibilities. It should come up with a new type of protection hail.

On the formation of hail and its negative consequences described in detail in the recently published studies [28-35], and we strongly emphasize

© 2014 Global Journals Inc. (US)

that in this context, the use of chemicals as a protective agent against the hail will not give positive results.

We believe:"When the lightning begins due to the tremendous amount of heat, the water in the channel of lightning or around his intensely evaporates as soon as stop flashing lightning, the water starts to freeze. In accordance with the known law of Physics: the strong evaporation causes cooling. It is noteworthy that the heat during discharge of lightning is not imposed from the outside, on the contrary, it derives from the system itself (in this case system: polarized electrostatic water). In this process, a strong and instant evaporation of water causes a sharp its solidification. The stronger the evaporation, the more intense is the process of water solidification. For such a process is not necessary that the ambient temperature was below zero. The lightning discharge generates a variety the size of the hailstones. The hailstones depend on the power and intensity of lightning. The stronger and more intense lightning are, the larger the hailstone. Usually the hail stops as soon as quickly stops flashing lightning."

VI. How to Prevent Damage by Hail

From the point of view of the authors of [42], developed in the sixties, scientists and specialists of several institutes and other academic institutions world missile way to impact on sedimentation processes of hailstorm voted the world's most efficient. According to them, the method is most appropriate to the modern concepts of physics and hail precipitation and management in order to prevent the growth of hail and increase rainfall. Its development has been invested efforts of large teams of scientists and much money. In addition, the implementation of this method requires an extremely high cash costs, to use of sophisticated equipment (radars, missiles, computers, etc.), the highest level of training and work organization. Nevertheless, even if all these conditions are realized often hail destroys crops and planting of large areas.

The above requirements it extremely difficult to implement. Need for new science-based, effective, but less complex and less expensive methods of process control in the clouds.

Methods are based on the influence on cloud processes with the aim of suppressing the growth processes of hail. Works on the effects of clouds with a view to their scattering attenuation hail, precipitation increase are conducted in many countries for over 50 years. Nevertheless, the problem is so complex that their level of efficiency so far is controversial according to theorists and experimentalists.

In our opinion, the only way ofhail prevention to overcome the lightning discharge or at least mitigate it. We suggest using the following construct for this purpose (Fig.4.):

It is known that the only way to protect against lightning first developed in 1750, the American scientist, Benjamin Franklin. He showed that electric charges or a bolt of lightning can be easily and safely escort to the ground through the metal wires. The latter is called "lightning rod" and is actively used today. Regarding to this, his invention helps prevention of hail.

In this sense, this invention can help in the prevention of hail. So, one end of the cable connects to the protected ground ("grounding") and the other end fastened balloon, filled with helium.Then the balloon is released into the air. The greater the distance between the balloon and the Earth (1-2 miles), the better the efficiency of the installation. In this case, the lightning rod closer to the cumulonimbus clouds and its effective conical effect will be even greater. Absolutely, electrical charges accumulated in the cloud will descend through a metal wire is easier than through the airspace or water layer. Here is the principle.

As for the engineering, construction and Assembly, this question gets their decision in other more specific professionals.

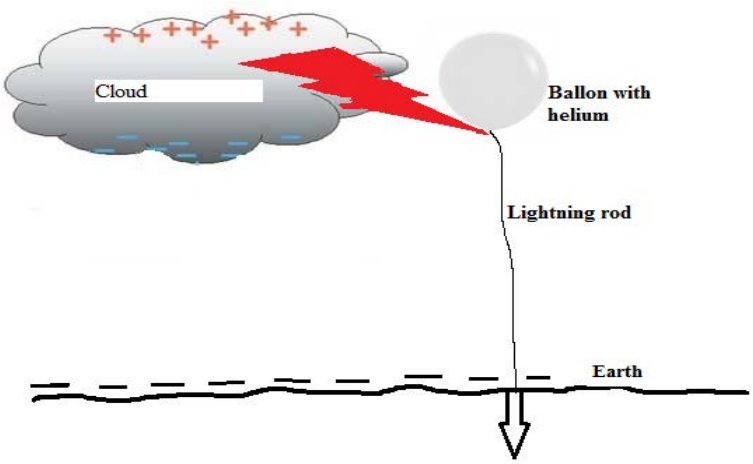


Figure 4 : Construction to prevent lightning and hailstone

© 2014 Global Journals Inc. (US)

VII. Conclusions

- Without the lightning and strong thunderstorms not grad. A thunderstorm accompanied by hail.
- The cause of hail is instant and massive amounts of heat lightning discharge in the cumulonimbus clouds. The mighty heat produced leads to strong evaporation ofwater in the channel and around the lightning. Strong water evaporation is rapid cooling ice formation, respectively.
- The process does not require the need to shift the zero isotherm atmospheres, with negative temperatures, and can easily occur at low and warm troposphere.
- The process is essentially close to adiabatic process, since the thermal energy generated is not entered into the system from the outside, and it comes from the system itself.
- Powerful and intense lightning provides the condition for the formation of large hailstones.
- On the basis of our theory thelightning rodis original tool to prevent of the hail.

References Références Referencias

1. Battal L. J. (1965). Person will change the weather. // Gidrometeoizdat. L.:.111 p.
2. Hydrogen properties, production, storage, transportation and application. (1989) Under the. Ed. Hamburg, D. Yu, Dubovkin J.F. M.: Chemistry, 672 p.
3. Grashin R. A, Barbin V., Babkin A. V. (2004). Comparative evaluation of the effect of liposomal and conventional soaps functional activity apocrine sweat glands and the chemical composition of human sweat // journal "Dermatology and Cosmetology», IN.
4. Russell J. (2013). Amorphous ice. —Izd. «VSD»,. 157 p.
5. Ermakov V.I, Stozhkov Y.I. (2004). Physics of thunderclouds. LPI RF them. P. N. Lebedev. M.:. 26 p.
6. Zhelezniak G.V,. Kozko A.V. (2006). Mysterious phenomena of nature. Proc. club, Kharkiv,. – 180.
7. Beginning Ph.M. (2009). Physchemistry microcosm. Monograph. T. II. Krasnodar.. 450
8. Klossowskiy A. // Works meteor. network NW Russia in 1889, 1890, 1891.
9. Middleton W. (1969). History of the Theories of Rain and other forms of precipitation. L.: Gidrometeoizdat.. 198 p.
10. Millikan R. (1939) (Electrons (+ and -), protons, photons, neutrons, and cosmic luchi.180 with. English. M-L.: GONTI.. 311p.
11. Nazarenko A.V. (2008). Hazardous weather convective origin. Teaching aid for higher education. Publishing and Printing center of Voronezh State University. 62.
12. Rusanov A.I. (1978).Thermodynamics of nucleation on charged centers. // Dokl. USSR Academy of Sciences T. 238. No.4. S. 831.
13. Tlisov M.I. (2002). Physical characteristics of hail and the mechanisms of its formation. *Gidrometeoizdat*. 385 s.
14. Huchunaev B.M. (2002). microphysics of origin and prevent hail. Diss. uch. on competition. step. Doctor of Physical and Mathematical Sciences. Nalchik, 289s.
15. St. George Yu. (1957). Practical working in organic chemistry. MSU, No. 2. No. 1. C.39.
16. Browning, K.A., Ludlam F.H. (1962). Airflow in convective storms. Quart.// J. Roy. Meteor. Soc. V.88. P.117.
17. Buch Ch. L. (1814). // Abh. Akad. Berlin. V.15. S. 74.
18. Ferrel W. (1886). Recent advances in meteorology. Washington: App. 7L
19. Gassendi P. (1658). // Opera omnia in sex tomos divisa. Leyden. V. 11. P. 70.
20. Guyton de Morveau L. B. (1777).// Obs. sur la Phys.. Vol. 9. P. 60.
21. Ian Strangeways. (2006). Precipitation Theory, Measurement and Distribution.// Cambridge University Press. 290 p.
22. Mongez J. A. (1778). // Obs. sur la Phys. Vol. 12. P. 202.
23. Nollet J.A. (1764). Recherches sur les causes particulieres des phenomenes electriques. Paris. P. 324.
24. Olmsted D. (1830). // Amer. J. Sci. Vol. 18. P. 1.
25. Volta A. (1808). // Metapo sopra la grandine. Giornale de Fisica. Pavia, Vol.1. PP. 31. 129. 179.
26. Changnon S.A., (1997). Climatology of hail risk in United States, CRR-40, Changnon Climatologist, Mahomet, Illinois, pp.1-89.
27. Hill C. (1996). Mayday!. Weatherwise, June/July 25-28.
28. Ismailov S.A.(2014).A new hypothesis about the mechanism of the hail formation. //Meždunarodnyj naučno-issledovatel'skij žurnal. No.6.(25). Part1. pp.9-12;
29. Ismailov S.A. About the building mechanism of hail showers.//Universum7universum.com/en/tech/archive/item/1463;
30. Ismailov S.A. About the building mechanism of hail showers.// www.academia.edu/7789706/;
31. Ismailov S.A. About the building mechanism of hail showers.//www.hexachlorocyclopentadiene.jimdo.com ;
32. Ismailov S.A. A new hypothesis about the mechanism of the hail formation.//www.-hexachlorocyclopentadiene.jimdo.com;

© 2014 Global Journals Inc. (US)

33. Ismailov S. A. (July 2014). About the mechanism of the hail formation.// Intellectual Archive.. Vol. 3. No. 4. pp. 58-77.
34. Ismailov S.A. (2014). About the mechanism of the hail formation.// Problems of modern science and education. Moscow,. No.2 (20). Pp.16-27.
35. Ismailov S.A. (2014). About the Mechanism of the Hail Formation.// Science Discovery. Vol. 2, No. 2, pp. 27-33.
36. Abshaev M.T. (1989). On a new method effects on hail processes. - Scientific works; of the WGI. V.72, pp.14-28.
37. Bibilashvili N. Sh., Bourtsev I.I., Seregin N.A. (1981). Guidelines for the organization and conducting anti-hail work. L.: Gidrometeoizdat, 168 p.
38. Tlisov M.I., Kagermazov A.H. (1995). Statistical analysis of the special hail measuring network during the active effects and in their absence, based on grades / in the book. "Review of Industrial and Applied Mathematics" - M.: Scientific Publishers "RTA", Vol. 2, No.2. pp.187-194.
39. Tlisov M.I., Khuchunaev B.M. (August 1996). "Physical characteristics of Hail from naturally developed and seeded cloud processes. Recommendations on modification of present hail suppression Methods // 12-th International Conferense on Clouds and Precipitation Zurich, Switzerland, 19-22, Proceedings - Vol. 1, pp. 1275-1276.
40. Tlisov M.I., Huchunaev V.M. Patent RU 2119741. Method for preventing the formation large hail in the clouds.
41. Beytuganov M. N .; Zalikhanov M.CH .; Romanov VG Patent RU 2076579. Method prevent hail.
42. Dinevich L., Kamalov B. (2013). Ways of optimization methods to influence the processes formation of precipitation.// Modern high technologies. - No.12. pp. 94-100.

© 2014 Global Journals Inc. (US)

This page is intentionally left blank

© 2014 Global Journals Inc. (US)

Global Journal of Science Frontier Research: B
Chemistry
Volume 14 Issue 7 Version 1.0 Year 2014
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Ocimum basilicum var. *purpureum* Floral Essential Oil: Phytochemicals, Phenolic Content, Antioxidant, Free Radical Scavenging and Antimicrobial Potentials

By Ololade Z. S., Fakankun O. A., Alao, F. O. & Udi O. U.
Bells University of Technology, Nigeria

Abstract- This study examined the phytochemicals and medicinal properties of the floral essential oil of *O. basilicum* var. *purpureum* from Nigeria. The GC and GC-MS analyses revealed the presence of twenty-five organic compounds making up 99.7% of the total percentage composition of the essential oil. The most abundant components was phenolic compound called methyleugenol (15.5%), followed by 2-phenyl-1-hexanol (14.0%), 1-(4,5-dimethyl-2-nitrophenyl)-1H-tetraazole (14.0%), 2-methyl-3,5-dodecadiyne (14.0%), *o*-nitrocumene (14.0%) and patchoulane (6.7%). The total phenolic content was quantitatively determined as 459 μgmg^{-1} gallic acid equivalent (GAE) confirming the presence of high amount of phenolic compounds in the floral essential oil. The DPPH IC_{50} value was 1.0 μgml^{-1}, the essential oil was capable of scavenging free radicals in a range of 73-86% and the antioxidant power of the essential oil increased with concentration.

Keywords: *Ocimum basilicum var. purpureum, floral essential oil, phytochemical, phenolic content, pharmacological potentials.*

GJSFR-B Classification : *FOR Code: 259999p*



Strictly as per the compliance and regulations of :

© 2014. Ololade Z. S., Fakankun O. A., Alao, F. O. & Udi O. U. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Ocimum basilicum var. *purpureum* Floral Essential Oil: Phytochemicals, Phenolic Content, Antioxidant, Free Radical Scavenging and Antimicrobial Potentials

Ololade Z. S. [α], Fakankun O. A. [σ], Alao, F. O. [ρ] & Udi O. U. [ω]

Abstract- This study examined the phytochemicals and medicinal properties of the floral essential oil of *O. basilicum* var. *purpureum* from Nigeria. The GC and GC-MS analyses revealed the presence of twenty-five organic compounds making up 99.7% of the total percentage composition of the essential oil. The most abundant components was phenolic compound called methyleugenol (15.5%), followed by 2-phenyl-1-hexanol (14.0%), 1-(4,5-dimethyl-2-nitrophenyl)-1H-tetraazole (14.0%), 2-methyl-3,5-dodecadiyne (14.0%), *o*-nitrocumene (14.0%) and patchoulane (6.7%). The total phenolic content was quantitatively determined as 459 μgmg^{-1} gallic acid equivalent (GAE) confirming the presence of high amount of phenolic compounds in the floral essential oil. The DPPH IC_{50} value was 1.0 μgml^{-1}, the essential oil was capable of scavenging free radicals in a range of 73-86% and the antioxidant power of the essential oil increased with concentration. The essential oil was found to be 90% more active than the synthetic antioxidant (ascorbic acid). The essential oil was also found to exert excellent antibacterial properties compared to standard antibiotics. The floral essential oil was significantly active against all tested species of Gram-positive and Gram-negative bacteria with high zones of inhibition between 15-30mm. The bacteria inhibition of the essential oil was found to be positively correlated with their terpenoid and phenolic contents. The results from this study indicated that the floral essential oil showed potential as a good source of natural antioxidant and antimicrobial drugs and may impart health benefits by its pharmacological properties.

Keywords: Ocimum basilicum var. purpureum, floral essential oil, phytochemical, phenolic content, pharmacological potentials.

I. Introduction

Phytochemicals are huge varieties of organic substances which accumulated in plants. Plant essential oils are recognized as one of the most promising secondary metabolites for the development of cheap and safer drugs (Varma and Dubey, 2001). Essential oils are volatile, natural and complex compounds characterized by a strong odour and are produced from odoriferous medicinal plants. In addition to essential oils, odoriferous plants are also characterized by the presence of phenolic compounds that have been shown to possess multiple pharmacological activities. Essential oils, their fractions and isolated aroma chemicals are valuable ingredients of flavour foods, toiletries, fine chemicals and pharmaceutical industries, they are utilized as such or in diluted forms in therapy or by the aromatherapy sector (Daferera *et al.,* 2000; Mimica-Dukic and Bozin, 2008). According to world health organization (WHO), greater than 80% of the total world's population depends on natural products in order to satisfy their primary health care needs. Investigations of these secondary metabolites intensified when some commercial synthetic antioxidants were found to exhibit toxic, mutagenic and carcinogenic effects and other problems associated with their usage (Rajendran *et al.,* 2014). Knowledge of the chemical composition of medicinal plants is desirable because such information will be of value for the synthesis of complex chemical substances (Yadav and Agarwala, 2011).

The genus *Ocimum* comprises more than 150 species and is considered as one of the largest genera of the *Lamiaceae* family. *Ocimum basilicum* var. *purpureum* is an annual plant which grows well in Nigeria. The purple colour of the plant is due to the presence of anthocyanins mainly cyanidin-3-(di-*p*coumarylglucoside)-5-glucoside and small amount of peonidin compounds, therefore, this plant is considered a potential source of red pigments for the food industry (Janick *et al.,* 1999). The plant is widely used in food and oral care products. The plant is a good source of magnesium, which promotes cardiovascular health, also helps muscles and blood vessels to relax, thus improving blood flow and lessening the risk of irregular heart rhythms or a spasming of the heart muscle or a blood vessel. It is also an excellent source of vitamin K and manganese; a very good source of copper, vitamin A and vitamin C; a good source of calcium, iron, folate, and omega-3 fatty acids (Patil *et al*., 2011). The plant is also used as condiment, calmative and flavouring agents. Traditionally, it is commonly used in treatments

Author α σ ω: Department of Chemical Sciences, Bells University of Technology, P.M.B. 1015, Ota, Nigeria.
e-mails: zacchsnatpdt@gmail.com; suntolgroup@yahoo.com
Author σ: Department of Biological Sciences, Bells University of Technology, P.M.B. 1015, Ota, Nigeria.

© 2014 Global Journals Inc. (US)

of diuretic, constipation, intestine ache, galactogogue, headaches, coughs, diarrhoea, warts, worms, kidney, anti-inflammatory and antispasmodic agent (Khelifa *et al.,* 2012; Uyoh *et al.,* 2013).

To the best of our knowledge, there is paucity of information on the phytochemical, total phenolic content, free radical scavenging, antioxidant and antimicrobial potentials of this plant so far. Therefore, the present research was undertaken for the first time with the aim of looking into the composition and pharmacological properties in the floral essential oil of *O. basilicum* var. *purpureum* from Nigeria.

II. Material and Methods

a) Plant Materials and Isolation of the Essential Oil

The floral parts of the plant were collected from their natural habitat in Ota, Nigeria and were authenticated as *O. basilicum* var. *purpureum*. The floral parts of the plant were extracted by hydrodistillation using clevenger-type apparatus to give a neat essential oil which was preserved in a vial at low temperature to prevent evaporation (European pharmacopoeia, 2004).

b) GC and GC-MS Analyses

Analyses of the floral essential oil of *O. basilicum* var. *purpureum* were performed using multi-dimensional gas chromatograph coupled with Gas Chromatography-Mass Spectrophotometer (Shimadzu, Japan) equipped with non-polar and polar double capillary columns (25.0 m x 0.25 µm i.d., 0.25 µm df). High purity helium was used as the carrier gas at a constant flow rate of 0.99 ml/min. A total of 1 µl sample was injected (split ratio 100:1) into GC and GCMS using AOC20i auto injector for analyses. The initial temperature was set at 60°C, heated at a rate of 3°C/minutes to 280°C and held isothermally for 6 minutes. Ion source temperature for these analyses was set at 200°C, while the interface temperature was set at 250°C, solvent cut time was 3.0 minutes and the mass spectrometer was set to operate in electron ionization mode with an ionizing energy of 70 eV as acquisition mass range from 40-700 a.m.u. at 0.50 scan/s. The constituents were identified by comparison of their retention indices with those of the literature. The retention indices were determined in relation to a homologous series of n-alkanes under the same operating conditions. Further identification was made by comparison of their mass spectra with those stored in National Institute for Standards and Technology (NIST) and with mass spectra from literature.

c) Determination of Total Phenolic Content

Total phenolic content of the floral essential oil of *O. basilicum* var. *purpureum* was determined using the Folin-Ciocalteau method. 1 ml aliquot solution of the essential oil was mixed with 46 ml distilled water and 1 ml of Folin Ciocalteau reagent, then 3 ml of (2% w/v) Na_2CO_3 solution was added after 3 minutes and the mixture was allowed to stand for 2 hours for incubation in dark with intermittent shaking, the absorbance of the reaction mixture was measured on a UV-Visible spectrophotometer at 760 nm against a blank (containing all reagents except the test sample). The total phenolic content was expressed as gallic acid equivalents (Govindappa *et al.,* 2011).

d) In vitro 2,2´-Diphenyl-1-picrylhydrazyl (DPPH) Free Radical Scavenging and Antioxidant Activities

The free radical scavenging and antioxidant activities of the floral essential oil against the stable free radical DPPH were measured. Briefly, three different concentrations (1000, 100 and 10 µgml^{-1}) of the essential oil were incubated with a methanolic solution of DPPH for 30 minutes of incubation at room temperature in the dark, then absorbance at 517 nm was measured spectrophotometrically. Ascorbic acid was used as reference compound. The assay was carried out in triplicate. The percentage inhibition (I%) for each concentration was calculated by using the absorbance values according to the following formula:

$$I\% = [(A_{blank} - A_{eo})/A_{blank}] \times 100$$

Where: A_{blank} is the absorbance of blank solution and A_{eo} is the absorbance of the essential oil. The dose-response curve was plotted and IC_{50} value for the essential oil and the standard were calculated (Adeniran *et al.,* 2013).

e) In vitro Antimicrobial Activities

The antibacterial potentials of the floral essential oil were evaluated by agar-well diffusion method against representative multi-drug resistance Gram-positive organisms (*Streptococcus agalactiae*, *Staphylococcus aureus* and *Streptococcus* species) and Gram-negative bacteria (*Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa* and *Salmonella typhimurium*). The bacteria isolates were first sub-cultured in Nutrient agar and incubated at 37°C for 24 hours. All the bacteria cultures were adjusted to 0.5 McFarland standards, 20 ml of sterilized Nutrient agar medium was poured into each Petri dish aseptically and plates were then swabbed with inocula of the test organisms, and kept for 15 minutes for absorption. Using sterile cork borer of 6 mm diameter wells were bored into the seeded agar plates, and these were loaded with 10 µl of different concentrations (1000, 100 and 10 µgml^{-1}) of the essential oil in dimethylsulfoxide (DMSO). The plates were allowed to stand in the refrigerator for 1 hour to allow proper diffusion of the essential oil into the medium and incubated at 37°C for 24 hours before visual assessment of the inhibition zones. The Antibacterial potential of the essential oil were evaluated by measuring the clear zones of growth inhibition against the test organisms. Gentamicin (GEN)

© 2014 Global Journals Inc. (US)

and Cloxicillin (CXC) were used as control (Agu *etal.,* 2013).

III. Results and Discussion

a) Chemical Constituents of the Essential Oil

In this study, the floral essential oil of *O. basilicum* var. *purpureum* was investigated for its chemical constituents. The essential oil imparted pleasant aromatic odour. The GC and GC-MS analyses of the floral essential oil of *O. basilicum* var. *purpureum* showed the presence of 25 compounds making up 99.7% of the total percentage composition (Table 1). Compounds were listed in order of their retention indexes. The most abundant component was phenolic compound called methyleugenol (15.5%), the other major compounds present in the essential oil were 2-phenyl-1-hexanol (14.0%), 1-(4,5-dimethyl-2-nitrophenyl)-1H-tetraazole (14.0%), 2-methyl-3,5-dodecadiyne (14.0%), o-nitrocumene (14.0%) and patchoulane (6.7%). The principal classes of organic compounds in the floral essential oil were phenolic compounds (29.5%), sesquiterpenes (16.9%) and monoterpenes (1.4%). Comparatively, the chemical constituents of the investigated floral essential oil were different from those reported in other studies. The main constituents in the leaf essential oil of *O. gratissimum* were eugenol (68.8%), methyl eugenol (13.21%) and *cis*-ocimene (7.47%) (Matasyoh *et al.,* 2007) while linalool (65.38%, 74.22%, 38.60%), eugenol (5.26%, 3.47%, 10.20%) and *tau*-cadinol (8.18%, 3.47%, 10.20%) were the main components in *O. basilicum* var. *genovese*, *O. gratissimum* and *O. tenuiflorum* from Romania (Stefan *et al.,* 2013). Joshi (2013) also reported that the main composition of *O. gratissimum* and *O. sanctum* were eugenol (75.1%) and methyl eugenol (92.4%) respectively.

Table 1 : Chemical Composition of the Floral Essential Oil of *O. basilicum* var. *purpureum*

Compounds	% Composition	RI
2,3,4-trimethyl-1,4-pentadiene	0.4	687
2,3,3-trimethyl-1,4-pentadiene	0.7	689
1,3-dimethyl-1-cyclohexene	0.4	852
1,9-decadiyne	1.0	1011
3-[(1Z)-1-butenyl]-4-vinyl-1-cyclopentene	1.0	1100
1-(1-Ethylvinyl)-1-(2-methylene-3-butenyl)cyclopropane	1.0	1115
iso-borneol	0.4	1138
8-methylenedispiro[2.1.2.4]undecane	1.0	1215
copaene	0.3	1221
1-(4,5-dimethyl-2-nitrophenyl)-1H-tetraazole	14.0	1250
megastigma-7(*E*),9,13-triene	0.3	1278
2-methyl-3,5-dodecadiyne	14.0	1284
nopol	0.3	1290
trans-7-hydroxymethyl-3-cyclopropylbicyclo[4.1.0]heptane	1.8	1307
o-nitrocumene	14.0	1324
1-(2-nitro-2-propenyl)-1-cyclohexene	1.0	1339
α-cubebene	0.5	1344
methyleugenol	15.5	1361
aromadendrene	2.0	1386
2,4-diisopropenyl-1-methyl-1-vinylcyclohexane	1.8	1398
β-elemene	3.6	1403

© 2014 Global Journals Inc. (US)

(5E,9E)-12-methyl-1,5,9,11-tridecatetraene	2.0	1404
2-phenyl-1-hexanol	14.0	1469
β-cis-caryophyllene	2.0	1494
patchoulane	6.7	1968
Percentage Total	99.7	

RI = Retention Index

b) Total Phenolic Content (TPC)

Total phenolic content analysis revealed the presence of high quantity phenolic compounds in the floral essential oil. This was found to be 459 μgmg^{-1} gallic acid equivalents. The essential oil gave a higher TPC when compared with the previous studies on the related species such as methanolic seed extracts of *O. gratissimum* (168 mgg^{-1}), *O. americanum* (123 mgg^{-1}), *O. minimum* (110 mgg^{-1}), *O. citriodorum* (96 mgg^{-1}), *O. kilimandscharicum* (82 mgg^{-1}), *O. grandiflorum* (61 mgg^{-1}), *O. lamiifolium* (54 mgg^{-1}), *and O. selloi* (42 mgg^{-1}) (Hakkim *et al*., 2008). The floral essential oil of *O. basilicum* var. *purpureum* exhibited the high TPC due to the presence of low molecular mass phenolic compounds like methyleugenol and 2-phenyl-1-hexanol. Phenolic compounds in the floral essential oil were oxidized by Folin-Ciocalteu reagent which reduced to a mixture of blue oxides of tungsten, W_8O_{23}, and molybdenum, Mo_8O_{23} after oxidation of the phenolic compounds (Walch *et al.,* 2011). Phytophenolic compounds are very important because their hydroxyl groups which are highly effective scavengers of most oxidizing molecules, including reactive oxygen species, and various free radicals implicated in several diseases. Plant phenolic compounds have been widely consumed for many years as dietary components with no side effect, they play important beneficial roles in mammalian systems, they are especially important in prevention of cancers, cardiovascular diseases, and other degenerative diseases. Methyleugenol and 2-phenyl-1-hexanol are natural phenolic compounds that recently received attention for their extensive pharmacological properties, including anti-tumor, antibacterial, cardio-protective and gastroprotective effects (Georgiev *et al*., 2014). Phenolic compounds play a key role in scavenging free radicals that cause oxidative stress because they have substantial antioxidant capacity against peroxyl radicals. In addition, they have been shown to possess potential antioxidant abilities, which helps them to scavenge electrophiles and active oxygen species, slow down nitrosation and chelate metal ions to limit auto-oxidation and increase the ability to adjust some enzyme actions (Mediani *et al.,* 2013).

c) In vitro Free Radical Scavenging and Antioxidant Potentials

The free radicals scavenging and antioxidant potentials of the floral essential oil of *O. basilicum* var. *purpureum* were evaluated by DPPH assay. The essential oil was able to inhibit the formation of DPPH radicals in a concentration dependent manner. The percentage inhibitions of the essential oil at various concentrations (1000, 100 and 10 μgml^{-1}) were 86±0.001, 78±0.001 and 73±0.000% respectively; while the IC_{50} value was found to be 1.0 μgml^{-1} in comparison to ascorbic acid which gave 96±0.000, 69±0.002 and 54±0.002% as the percentage inhibitions with IC_{50} value of 9.0 μgml^{-1}. The DPPH radical scavenging capacity of the floral essential oil of *O. basilicum* var. *purpureum* was higher than that of ascorbic acid. The free radical scavenging and antioxidant properties of the essential oil were found to be nine times more active than the synthetic antioxidant (ascorbic acid) as shown in Table 2 below. Moreover, the floral essential oil of *O. basilicum* var. *purpureum* inhibited the DPPH free radicals than extracts of other related species such as *O. americanum* which has lower percentage inhibitions ranging from 32.9-67.4% (IC_{50}: 290 μgml^{-1}) in ethanolic extract, 20.9-63.2% (IC_{50}: 350 μgml^{-1}) in chloroform extract, 37.2-59.8% (IC_{50}: 430 μgml^{-1}) in petroleum ether extract and 26.5-56.2% (IC_{50}: 510 μgml^{-1}) in aqueous extract at different concentrations between 100-500 μgml^{-1} (Sarma and Babu, 2011). The antioxidant activity has been related to the number and position of free hydroxyl groups in terpenoids and phenolic compounds, which could be as a result of their hydrogen donating abilities (Burda and Oleszek, 2001). The essential oil showed significantly higher inhibition percentage and positively correlated with the content of the secondary metabolites in the essential oil. As shown in the equation below DPPH involved hydrogen atom transfer reactions (HAT) and single electron transfer (SET). Natural antioxidants (AH) neutralize the free radicals (R•) by interfere with the oxidation process by reacting with free radicals, chelating, catalytic and reactive oxygen scavenging activities (Prior *et al.,* 2005).

Hydrogen Atom Transfer

$$R^{\bullet} + AH \rightarrow RH + A^{\bullet}$$

Single Electron Transfer

$$R^{\bullet} + AH \rightarrow R^{-} + AH^{\bullet+}$$

$$AH^{\bullet+} \xleftrightarrow{OH_2} A^{\bullet} + H_3O^{+}$$

$$R^{-} + H_3O^{+} \rightarrow RH + H_2O$$

© 2014 Global Journals Inc. (US)

Table 2 : IC_{50} of the Antioxidant Property of the Floral Essential Oil of *O. basilicum* var. *purpureum* and Reference drug

Essential Oil and Reference Compound	DPPH IC_{50} μgml^{-1}
O. basilicum var. *purpureum*	1.0
Ascorbic acid	9.0

d) Antibacterial Potentials

The antimicrobial activities of the floral essential oil of *O. basilicum* var. *purpureum* against *E. coli, K. pneumoniae*, *P. mirabilis*, *P. aeruginosa*, *S. typhimurium*, *S. aureus, S. agalactiae* and *S. species* were shown in Table 3. The essential oil showed variable activities against tested bacteria. The essential oil was highly effective on all the tested bacteria. The highest inhibitory effect of the floral essential oil of *O. basilicum* var. *purpureum* was observed against *E. coli* (30 mm) followed by *S. aureus* (25 mm), *K. pneumoniae* (20 mm), *S. species (20 mm), P. aeruginosa (20 mm), P. mirabilis (20 mm), S. agalactiae (18 mm) and S. typhimurium (18 mm).* The tested bacteria were found to be resistant to Cloxicillin (CXC) but some were sensitive to Gentamicin (GEN) synthetic antibiotics. The antibacterial properties of this essential oil were comparable to that of leaf essential oil of *Ocimum gratissimum* which gave zones of inhibition between 7.0-26.6 mm for the following Gram positive (*S. aureus*, *Bacillus* spp.*)* and Gram negative (*E. coli, P. aeruginosa*, *S. typhi, K. pneumoniae, P. mirabilis*) bacteria (Matasyoh *et al.,* 2007). The observed antibacterial effects of the plant correlate its folk uses. In this study the essential oil of the plant inhibited the growth of Gram positive and Gram negative bacteria to a high degree. The observed activities may be due to the presence of some secondary metabolites such as terpenoids and phenolic compounds which are known to possess various medicinal activities in different organisms (Egharevba *et al., 2010). The antimicrobial activities* may also be due to numerous free hydroxyls that have the capability to combine with the carbohydrates and proteins in the bacteria cell wall. It has also been reported that the antimicrobial properties of essential oil results from the combined effect of direct vapour absorption on organisms and indirect effect through the medium that absorbed the vapour (Wang *et al.,* 2012). The vapour absorption on microorganisms is determined by their membrane permeability. Gram negative bacteria are less susceptible to essential oils than Gram positive bacteria because they possess outer membrane surrounding the cell membrane which restricts diffusion of hydrophobic compounds through its lipopolysaccharide covering (Angienda *et al*., 2010). Therefore, higher cell damage is expected to occur from the floral essential oil on the tested bacteria (Tyagi and Malik, 2010). Methyl eugenol is a phenolic compound that has been reported to have antimicrobial, central nervous system depressant, anaesthetic, hypothermic, myorelaxant, anticonvulsant, insecticidal, anthelminthic and nematocidal properties (Matasyoh *et al*., 2007). This study showed that the floral essential oil of *O. basilicum* var. *purpureum* has greater potential as antibiotic against bacteria and that they can be used in the treatment of infectious diseases caused by resistant pathogenic organisms in human beings.

Table 3 : Zones of Inhibition (mm) showing the Antimicrobial Properties of the Floral Essential oil of *O. basilicum* var. *purpureum*

	Floral Essential Oil			GEN	CXC
Conc. / Organism	1000	100	10	10µg	5µg
E. coli	30	30	30	22	-
K. pneumoniae	20	18	15	21	-
P. aeruginosa	18	18	18	20	-
P. mirabilis	20	20	20	20	-
S. agalactiae	18	18	18	-	-
S. aureus	25	25	25	-	-
S. typhimurium	18	18	18	21	-
S. species	20	18	18	-	-

Keynote:--- = Resistant, 6-9 mm = low inhibition, 10-14 mm = moderate inhibition and ≥ 15 mm = high inhibition.

IV. Conclusion

The results of the free radical scavenging, antioxidant and antimicrobial potentials of the part of the plant investigated in this study were basically due to the synergic effects of the phytochemical constituents in the floral essential oil. Natural antioxidants are helpful in assisting the body to neutralize free radicals in healthy individuals. Therefore, phytochemicals in the floral essential oil of this plant which are good antioxidants would help to reduce the harmful effects of oxidative stress and could be used to handle health problems caused by reactive oxygen species. Moreover, the ability of the floral essential oil to inhibit the growth of the bacteria in this study at low concentrations is an indication of its broad spectrum antimicrobial and great therapeutic potentials of this species. Plant having antimicrobial compounds have enormous therapeutic potentials as they can act without any side effect as often found with synthetic antimicrobial products.

References Références Referencias

1. Agu KC, Igweoha CA, Umeh CN. Antimicrobial Activity of the Ethanolic and Petroleum Ether

© 2014 Global Journals Inc. (US)

Extracts of Tangerine Seed on Selected Bacteria.*Inter. J. Agri. Biosci*. 2013; 2(1):22-24.

2. Angienda PO, Onyango DM, Hill DJ.Potential application of plant essential oils at sub-lethal concentrations under extrinsic conditions that enhance their antimicrobial effectiveness against pathogenic bacteria, *African Journal of Microbiology Research*. 2010; 4 (16): 1678-1684.
3. Burda S, Oleszek W, Antioxidant and antiradical activity of flavonoids. *J. Agric Food Chem*. 2001;49: 2774-2779.
4. Daferera DJ, Ziogas BN, Polissiou MG. GC-MS Analysis of Essential Oils from Some Greek Aromatic Plants and Their Fungitoxicity on *Penicillium digitatumJ. Agric. Food Chem.* 2010; 2(10): 35-40.
5. Egharevba HO, Abdullahi MS, Okwute SK, Okogun JI. Phytochemical Analysis and Broad Spectrum Antimicrobial Activity of *Laggera pterodonta (DC.)* Sch. Bip. (Aerial Part), *Researcher.* 2005;53: 1841-1856.
6. European Pharmacopoeia Commission. *European Pharmacopoeia 5th Ed.* Council of Europe: Strasbourg Cedex, France. 2004.
7. Georgiev V, Ananga A. Tsolova V.Recent Advances and Uses of Grape Flavonoids as Nutraceuticals, *Nutrients*. 2014; 6: 391-415.
8. Govindappa M, Naga SS, Poojashri, MN, Sadananda TS, Chandrappa CP.Antimicrobial, antioxidant and *in vitro* anti-inflammatoryactivity of ethanol extract and active phytochemicalscreening of *Wedeliatrilobata*(L.) Hitchc., Journal of *Pharmacognosy and Phytotherapy*.2011;3(3): 43-51.
9. Hakkim FL, Arivazhagan G, Boopathy R.Antioxidant property of selected Ocimum species andtheir secondary metabolite content, *Journal of Medicinal Plants Research*. 2008; 2(9):250-257.
10. Janick J, Simeon, J.E., Morales, M.R., Phippen,W.B., Vieira,R.F. and Hoa, Z. (1999): Basil: A Source of Aroma Compounds and a Popular Culinary and Ornamental Herb, reprinted from: *Perspectives on new crops and new uses,* ASHS Press, Alexandria VA. 1999; 499-505.
11. Joshi RK. Chemical Composition, In vitro Antimicrobial and Antioxidant Activities of the Essential Oils of *Ocimum gratissimum, O. sanctum* and their Major Constituents*. Indian J. Pharm. Sci*. 2013;75: 457-462.
12. Khelifa LH, Brada M, Brahmi F, Achour D, Fauconnier ML, Lognay G. Chemical Composition and Antioxidant Activity of Essential Oil of *Ocimum basilicum* Leaves from the Northern Region of Algeria, *Top class Journal of Herbal Medicine*. 2012; 1(2): 25-30.
13. Matasyoh LG, Matasyoh, J.C., Wachira, F.N., Kinyua, MG, Muigai, AWT, Mukiama, TK. Chemical composition and antimicrobial activity of the essential oil of *Ocimum gratissimum* L. growing in Eastern Kenya, *African Journal of Biotechnology*. .2007; 6(6): 760-765.
14. Mbagwu FN, Unamba, CIN, Nwosu, IC. Phytochemical Screening on the Seeds of *Treculia africana and Artocarpusatilis, New York Science Journal.* 2010; 3(12): 51-55.
15. Mediani A, Abas F, Khatib A, Tan CP. *Cosmos Caudatusas* a Potential Source of PolyphenolicCompounds: Optimisation of Oven Drying Conditions and Characterisation of Its Functional Properties. *Molecules*. 2013; 18: 10452-10464.
16. Mimica-Dukic N, Bozin B. Mentha L. species (*Lamiaceae*) as promising sources of bioactive secondary metabolites. *Curr. Pharm*. *Des*. 2008;14 (29): 3141-3150.
17. Patil DD. Mhaske, D.K., Wadhawa, G.C. (2011): Antibacterial and Antioxidant study of *Ocimum basilicum Labiatae* (sweet basil), *Journal of Advanced Pharmacy Education and Research*. 2011; 2: 104-112.
18. Prior RL, Wu X, Schaich K. Standardized methods for the determination of antioxidant capacity and phenolics in food and dietary supplements. *J. Agric. Food Chem.* 2005;53: 4290-4302.
19. Rajendran MP, Palliyan BB, Selvaraj N. Chemical composition, antibacterial and antioxidant profile of essential oil from *Murrayakoenigii* (L.) leaves, *AvicennaJ. Phytomed*. 2014; 4(3):200-214.
20. Sarma DSK, Babu, AVS.Antioxidant and Antimicrobial Activity of *Ocimum americanum, International Journal of Advances In Pharmaceutical Sciences*. 2011; 2: 211-218.
21. Stefan M, Zamfirache, M.M., Padurariu, C., Truta, E., Gostin, I. (2013): The composition and antibacterial activity of essential oils in three *Ocimum* species growing in Romania, *Central European Journal of Biology.* 2013; 8(6):600-608.
22. Tyagi AK, Malik, A. Liquid and vapour-phase antifungal activities of selected essential oils against *candida albicans*: microscopic observations and chemical characterization of *cymbopogoncitratus, BMC Complementary and Alternative Medicine.* 2010; 10:65.
23. Uyoh EA, Chukwurah PN, David IA, Bassey AC.Evaluation of Antioxidant Capacity of Two *Ocimum* Species Consumed Locally as Spices in Nigeria as a Justification for Increased Domestication, *American Journal of Plant Sciences*. 2013; 4, 221-229.
24. Varma J, Dubey NK. Efficacy of essential oils of *Caesuliaaxillaris* and *Mentha arvensis* against some storage pests causing biodeterioration of food commodities. *International Journal Food Microbiology*. 2001; 68: 207-210.

© 2014 Global Journals Inc. (US)

25. Wang YW, Zeng WC, Xu, PY, Lan YJ, Zhu RX, Zhong K, Huang YN,Gao H. Chemical Composition and Antimicrobial Activity of the Essential Oil of Kumquat (*Fortunella crassifolia Swingle*) Peel, *Int. J. Mol. Sci.* 2012; 13(3): 3382-3393.
26. Yadav RNS, Agarwala M. Phytochemical analysis of some medicinal plants, *Journal of Phytology*. 2011; 3(12): 10-14.

© 2014 Global Journals Inc. (US)

This page is intentionally left blank

© 2014 Global Journals Inc. (US)

Global Journal of Science Frontier Research: B Chemistry
Volume 14 Issue 7 Version 1.0 Year 2014
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Synthesis of New Macrocycles of Ortho-Methoxy Salicylaldehyde using Claisen-Schmidt Condensation

By Shana Balchi & Alireza Banaei
Payame Noor University, Iran

Abstract- In this research prepared some new families of macrocycles by reaction of ortho-methoxy salicylaldehyde sequently with ketone by claisen-Schmidt condensation. Claisen-Schmidt condensation proceed under base or acid catalysis, at moderate temperature, in high atom economy and with water as the sole by product. Macrocycle were characterized by IR, NMR and Mass spectroscopie.

Keywords: *macrocyclic compounds, claisen-schmidt condensation, ortho-methoxy salicylaldehyde.*

GJSFR-B Classification : *FOR Code: 030299*



Strictly as per the compliance and regulations of :

© 2014. Shana Balchi & Alireza Banaei. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Synthesis of New Macrocycles of Ortho-Methoxy Salicylaldehyde using Claisen-Schmidt Condensation

Shana Balchi [α] & Alireza Banaei [σ]

Abstract- In this research prepared some new families of macrocycles by reaction of ortho-methoxy salicylaldehyde sequently with ketone by claisen-Schmidt condensation. Claisen-Schmidt condensation proceed under base or acid catalysis, at moderate temperature, in high atom economy and with water as the sole by product. Macrocycle were characterized by IR, NMR and Mass spectroscopie.

Keywords: macrocyclic compounds, claisen-schmidt condensation, ortho-methoxy salicylaldehyde.

I. Introduction

Calixarenes, resorcinarenes, cyclotriveratrylenes, cucurbiturils, and crown ethers, exemplify families of macro cyclic compounds that found extensive use in supra molecular chemistry . Pedersen in 1967 he published two works that are now considered classics [1]. He describes the methods of synthesizing crown ether (cyclic polyethers). Discovered a simple method of synthesizing crown ether when he was trying to prepare a complexing agent for divalent cations. The donut-shaped molecules were the first in a series of extraordinary compounds that form stable structures with alkali metal ions and a hetero cyclic compound is a cyclic compound which has atoms of at least two different elements as members of its ring(s). Although heterocyclic compounds may be inorganic, most contain at least one carbon atom, and one or more atoms of elements other than carbon within the ring structure, such as sulfur, oxygen or nitrogen recently chemists try to produce new macro cycles by Claisen-Schmidt condensation. The reactions between a ketone and an aldehyde (crossed aldol condensation) or between two aldehydes also go by the name Claisen-Schmidt condensation [2]. Claisen-Schmidt condensations proceed under either acid or base catalysis, at moderate temperature, In high atom economy and with water as the sole byproduct. Chemo selectivity is also high. It was first reported in 1925 that arylaldehydes and cycloalkanones afford predominantly α , ά bisarylidene cycloalkanones instead of α-mono arylidene cycloalkanones. Subsequent workers have found that this applies even when the ratio of starting ketone to aldehyde is greater than 1:1the orientation of exocyclic bonds generated is exclusively trans with respect to the aryl ring and the carbonyl group of the cycloalkanone [3].

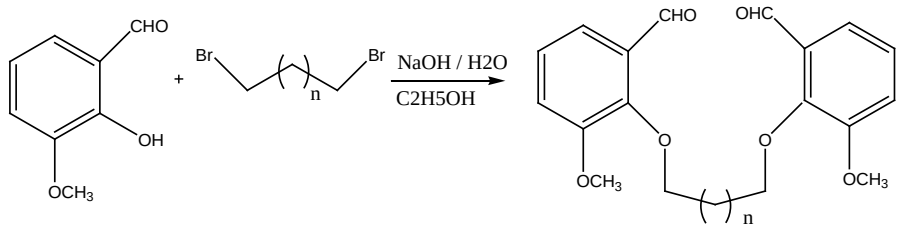
II. Results and Discussion

In this research prepared some new families of macro cycles by reaction of ortho-methoxy salicylaldehyde. These aspects of the Claisen-Schmidt condensation and green chemistry have been exploited in this work, to produce members of a new family of macro cycles in a single step as shown in Scheme above. Starting dialdehydes were prepared (step1), in each case by linking two ortho-methoxysalicylaldehyde molecules with bromoalkans, their derivatives or analogues, with flexible linear tethers. To such compoundsemployed Williamson etherification conditions that required long reaction times (100 hr athightemperatures). In the presence of ketone and base, Cyclization occurred through sequential Claisen-Schmidt condensations, at α position to the carbonyl group and macrocycles are obtaining meanto moderate yields.Workersfoundin 2004 during the investigation of α , ά bisary lidenecycloalkanones the tethering unit contained fewer than seven atoms, cyclization isdimeric macrocycleresulting from the condensation of two cyclohexanone molecules and two dialdehyde linkers. Against them we produce the monomer macrocycles.

Reaction of ortho-methoxy salicylaldehyde sequently with 1,2 dibromoetane , 1,3 dibromopropane and 1,4 diboroetane under base catalysis(step1) and output compound (I–III).Consequently inter- and intra molecular cyclization of one flexible connector with one type of ketones, through two sequential Claisen-Schmidt condensations, (step2) and output compound (IV - X).

Author α σ: Department of Chemistry, Payame Noor University, Ardabil, Iran. e-mail: s.ghorji@yahoo.com

© 2014 Global Journals Inc. (US)

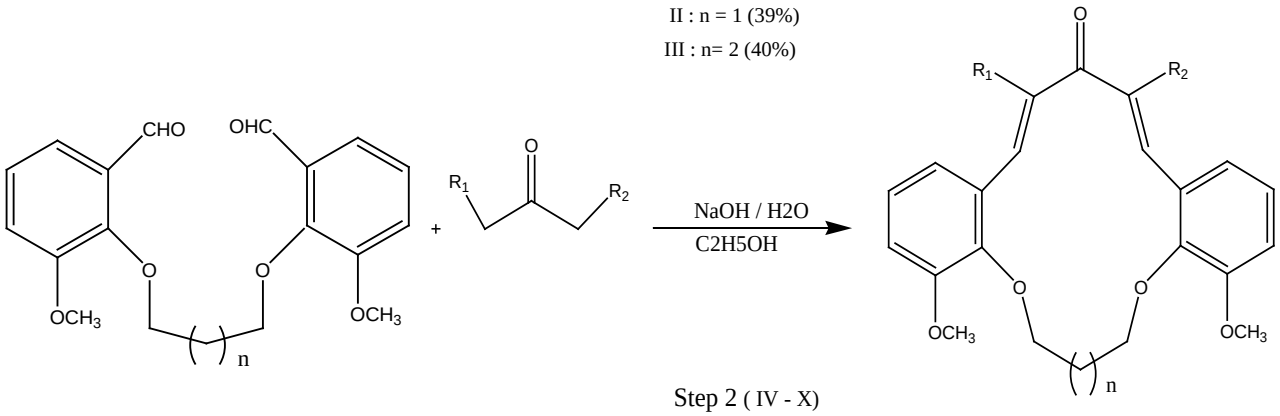


Step 1 (I- III)

I : n= 0 (36%)

II : n = 1 (39%)

III : n= 2 (40%)



Step 2 (IV - X)

I : n= 0, { IV = R1 = R2 = CH3 ; VII = R1 = CH3, R2 = H }

II : n = 1, { V = R1 = R2 = CH3 ; VIII = R1 = CH3, R2 = H ; X = R1 = H, R2 = H }

III : n= 2, VI = R1 = R2 = CH3

III. Experimental

a) Synthesis

The Synthesis of compound (I – III), to ortho-methoxy salicylaldehyde (24.4 g, 0.2 mol) in alcol (20 ml) was added sodium hydroxide (8.0g .02 mol) in water (400 ml) in three bollon then the mixture was warmed andin every of the bollonsequently1,2 dibromoetane1,3 dibromopropane and 1,4 dibroboetane (0.1 mol) was added. Sufficient alcohol (300 ml) to produce a homogeneous solution. The solution was refluxed under nitrogen for 100 hr and then cooled and let stand at 0°C The cream-colored crystals produced were washed with water of first two bollon and letter bollonproducedtan-colored crystals [3-4].

i. *Yield (36%) , Mp: 117.8- 118.3°C*

IR$\nu_{max(neat)/cm}^{-1}$: 2937.56 ,05/2785(CHO),1664.57(C=O), 785.03, 746.45

^{1}H-NMR ($CDCl_3$,TMS,300MHz) δ ppm : 3.905 (s,3H), 4.526 (s,2H), 7.183 (m,2H), 7.292-7.471 (m,1H), 10.547 (s,1H)

^{13}C-NMR($CDCl_3$,TMS,75MHz)δppm : 55.97,

117.94, 119.18, 124.33, 129.99, 151.11, 152.81, 190.57

MS m/z :[M =330],179,151,135,108,119

ii. *Yield (39%), Mp: 64.4 –66.7°C*

IR$\nu_{max(neat)/cm}^{-1}$: 2846.93, 2744.71(CHO), 1691.57(C=O), 734.88, 761.88

^{1}H-NMR ($CDCl_3$,TMS,300MHz) δ ppm : 2.309-2.317 (m,2H), 3.911(s,3H),4.400(t,2H), 7.318-7.190 (m,2H), 7.432-7.455 (m,1H) 10.489 (s,1H)

^{13}C-NMR (CDCl3,TMS,75MHz) δ ppm: 30.91, 56.04, 71.46, 118.04, 119.20, 124.19, 129.88, 151.62, 152.99, 190.27

MS m/z :[M = 344],151,165,193,122,137,108

iii. *Yield(40%),Mp: 111.3- 117.9°C*

IR$\nu_{max(neat)/cm}^{-1}$:2846.93,2765.74(CHO), 1672.14(C=O), 723.31, 765.74

^{1}H-NMR ($CDCl_3$,TMS,300MHz) δ ppm : 2.041(br.s,2H), 3.893(s,3H),4.218 (br.s,2H), 7.109- 7.147 (m,2H), 7.412-7.428 (m,1H), 10.465(s,1H)

© 2014 Global Journals Inc. (US)

^{13}C-NMR ($CDCl_3$,TMS,75MHz) δ ppm: 26.69, 56.03, 74.46, 118.08, 119.08, 124.11, 129.94, 151.80, 153.05, 190.25
MS m/z:[M = 358],207,165,151,55

b) Synthesis

The Synthesis of compound (IV - X),to an ethanolic solution (95%, 1.83 L) of compound I (1.02g, 3.10 mmol) and diethyl keone (0.49 ml, 4.60 mmol) was added aqueous NaOH (1.87g in 3.75 ml H2O, 4.6 mmol). After stirring at rt for 6 d, abright yellow solution heterogeneous produce of the reaction. then it washed with 1.0 M HCL and water. and dried, then recrystallisation in etanol and produce cream- powder, compound (IV). The Synthesis of compound compound of (V – X) similar manner refered.

iv. *Yield (31.1%), Mp:128-127.7 °C*

IR$\nu_{max(neat)/cm}^{-1}$: 1622.62(C=O), 765.10,744.52
^{1}H-NMR (CDCl3,TMS,300MHz) δ ppm : 2.057 (s,3H) 3.913(s,3H) 4.477 (s,2H), 6.943- 6.972(m,2H), 7.091-7.146(m,1H), 7.867(s,1H)
^{13}C-NMR ($CDCl_3$,TMS,75MHz) δ ppm: 13.84, 55.78, 72.40, 112.42, 121.30, 123.54, 130.61, 130.66, 137.50, 145.93, 152.62, 202.58
MS m/z :[M = 380],335,203,191,175,91,83,43,57

v. *Yield (46.6%), Mp:140-138 °C*

IR$\nu_{max(neat)/cm}$-1: 1662.31(C=O), 758.02, 742.57
1H-NMR ($CDCl_3$,TMS,300MHz) δ ppm : 2.248 (s,3H), 2.307 (m,1H), 3.921(s,3H), 4.221 (t,2H), 6.973(d,1H), 7.070 (d,H), 7.117- 7.157(t,1H), 7.580 (s,1H)
13C-NMR ($CDCl_3$,TMS,75MHz) δ ppm: 15.08, 31.34, 55.58, 68023, 112.39, 121.95, 123.99, 130.91, 133.52, 137.33, 146.51, 153.51, 202.47
MS m/z :[M =394],336,321,91,43,57,191,103,131,380

vi. *Yield (35.1), Mp:142-140 °C*

IR$\nu_{max(neat)/cm}^{-1}$:1692.85(C=O), 798.53, 746.45
^{1}H-NMR ($CDCl_3$,TMS,300MHz) δ ppm : 1.968 (br,s,2H), 2.078 (s,3H), 3.891(s,3H),4.069 (br,s,2H), 6.937 (d,1H), 7.012 (d,1H), 7.077- 7.116 (t,1H), 7.504 (s,1H)
^{13}C-NMR ($CDCl_3$,TMS,75MHz) δ ppm:15.20, 26.56, 55.85, 72.89, 112.40, 121.90, 123.62, 130.57, 134.28, 138.14, 146.43, 152.97, 201.88
MS m/z :[M = 408],91,55,148,175,333

vii. *Yield (54%), Mp:140-138 °C*

IR$\nu_{max(neat)/cm}^{-1}$: 1635.46 (C=O), 732.95, 785.03
1H-NMR ($CDCl_3$,TMS,300MHz) δ ppm : 2.0721 (s,3H), 3.917 (s,6H), 4.403 (m,2H), 4.582 (m,2H), 6.651 (d,1H), 6.977 (s,3H), 7.075- 7.156 (m,2H), 7.697(s,H), 8.512 (d,H)
^{13}C-NMR ($CDCl_3$,TMS,75MHz) δ ppm:13.62, 55.86, 55.94, 72.14, 73.85, 112.88, 113.69, 117.93, 121.25, 123.08, 124.47, 126.91, 129.71, 129.78, 135.70, 137.16, 142.80, 146.21, 146.93, 151.94, 153.07, 200.83
MS m/z :[M=366],321,336,188,91,161,17

viii. *Yield (26.3%), Mp:169 -171°C*

IR$\nu_{max(neat)/cm}$-1: 1622.13(C=O), 767.67,731.02
^{1}H-NMR ($CDCl_3$,TMS,300MHz) δ ppm :
2.193(s,3H), 2.317 (m,2H), 3.915 (s,6H), 4.231 (t,4H), 6.777-6.820 (d,1H), 6.953-7.007(m,2H), 7.055 (d,1H), 7.122-7.169 (m,2H), 7.291- 7.334 (t,1H), 7.584 (s,1H), 8.104 (d,1H)
^{13}C-NMR ($CDCl_3$,TMS,75MHz) δ ppm: 14.85, 31.49, 50.84, 55.86, 68.79, 68.95, 68.79, 68.95, 112.30, 113.76, 118.01, 121.84, 124.05, 124.74, 127.30, 129.45, 130.78, 133.37, 137.00, 139.22, 146.56, 146.88, 152.85, 153.45, 199.94
MS m/z :[M=380],149,307,322,91,161,175,350

ix. *Yield (53%) , Mp: 131-129°C*

IR$\nu_{max(neat)/cm}^{-1}$: 28/1618 (C=O),792.74,67/740
^{1}H-NMR ($CDCl_3$,TMS,300MHz) δ ppm :2.342-2.392 (m,2H), 3.931)s,3H), 4.237 (t,2H), 6.750 (d,1H), 7-7.301 (m,3H), 8.135-8.092 (d,1H)

© 2014 Global Journals Inc. (US)

References Références Referencias

1. A. N. Levov, Russian Journal of Organic Chemistry, 2008, Vol. 44, No. 11, pp. 1665–1670.
2. A. R. Katritzky and A. F. Pozharski, Handbook of Heterocyclic Chemistry, 2 nd Edition, 2000, Pergamon/Elsevier.
3. C. J. Perdersen, J. Am. Chem Soc., 89, 7017 (1967).
4. L. T. Higham, C. R. Strsuss, Cryst al Grow th & Design.Vol.10. No. 5,2010.

© 2014 Global Journals Inc. (US)

Global Journals Inc. (US) Guidelines Handbook 2014

www.GlobalJournals.org

FELLOWS

FELLOW OF ASSOCIATION OF RESEARCH SOCIETY IN SCIENCE (FARSS)

Global Journals Incorporate (USA) is accredited by Open Association of Research Society (OARS), U.S.A and in turn, awards "FARSS" title to individuals. The 'FARSS' title is accorded to a selected professional after the approval of the Editor-in-Chief/Editorial Board Members/Dean.



- The "FARSS" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSS or William Walldroff, M.S., FARSS.

FARSS accrediting is an honor. It authenticates your research activities. After recognition as FARSB, you can add 'FARSS' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, and Visiting Card etc.

The following benefits can be availed by you only for next three years from the date of certification:

FARSS designated members are entitled to avail a 40% discount while publishing their research papers (of a single author) with Global Journals Incorporation (USA), if the same is accepted by Editorial Board/Peer Reviewers. If you are a main author or co-author in case of multiple authors, you will be entitled to avail discount of 10%.

Once FARSB title is accorded, the Fellow is authorized to organize a symposium/seminar/conference on behalf of Global Journal Incorporation (USA). The Fellow can also participate in conference/seminar/symposium organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent.





You may join as member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. In addition, it is also desirable that you should organize seminar/symposium/conference at least once.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time.This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.



© Copyright by Global Journals Inc.(US) | Guidelines Handbook

The FARSS can go through standards of OARS. You can also play vital role if you have any suggestions so that proper amendment can take place to improve the same for the benefit of entire research community.



As FARSS, you will be given a renowned, secure and free professional email address with 100 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders,Auto-Responders, Email Delivery Route tracing, etc.



The FARSS will be eligible for a free application of standardization of their researches. Standardization of research will be subject to acceptability within stipulated norms as the next step after publishing in a journal. We shall depute a team of specialized research professionals who will render their services for elevating your researches to next higher level, which is worldwide open standardization.



The FARSS member can apply for grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.
Once you are designated as FARSS, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria. After certification of all your credentials by OARS, they will be published on your Fellow Profile link on website https://associationofresearch.org which will be helpful to upgrade the dignity.

The FARSS members can avail the benefits of free research podcasting in Global Research Radio with their research documents. After publishing the work, (including published elsewhere worldwide with proper authorization) you can upload your research paper with your recorded voice or you can utilize chargeable services of our professional RJs to record your paper in their voice on request.



The FARSS member also entitled to get the benefits of free research podcasting of their research documents through video clips. We can also streamline your conference videos and display your slides/ online slides and online research video clips at reasonable charges, on request.

© Copyright by Global Journals Inc.(US)| Guidelines Handbook



The FARSS is eligible to earn from sales proceeds of his/her researches/reference/review Books or literature, while publishing with Global Journals. The FARSS can decide whether he/she would like to publish his/her research in a closed manner. In this case, whenever readers purchase that individual research paper for reading, maximum 60% of its profit earned as royalty by Global Journals, will be credited to his/her bank account. The entire entitled amount will be credited to his/her bank account exceeding limit of minimum fixed balance. There is no minimum time limit for collection. The FARSS member can decide its price and we can help in making the right decision.

The FARSS member is eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get remuneration of 15% of author fees, taken from the author of a respective paper. After reviewing 5 or more papers you can request to transfer the amount to your bank account.



MEMBER OF ASSOCIATION OF RESEARCH SOCIETY IN SCIENCE (MARSS)

The ' MARSS ' title is accorded to a selected professional after the approval of the Editor-in-Chief / Editorial Board Members/Dean.



The "MARSS" is a dignified ornament which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., MARSS or William Walldroff, M.S., MARSS.

MARSS accrediting is an honor. It authenticates your research activities. After becoming MARSS, you can add 'MARSS' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, Visiting Card and Name Plate etc.

The following benefitscan be availed by you only for next three years from the date of certification.



MARSS designated members are entitled to avail a 25% discount while publishing their research papers (of a single author) in Global Journals Inc., if the same is accepted by our Editorial Board and Peer Reviewers. If you are a main author or co-author of a group of authors, you will get discount of 10%.

As MARSS, you will be given a renowned, secure and free professional email address with 30 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders,Auto-Responders, Email Delivery Route tracing, etc.



© Copyright by Global Journals Inc.(US) | Guidelines Handbook



We shall provide you intimation regarding launching of e-version of journal of your stream time to time.This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The MARSS member can apply for approval, grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.





Once you are designated as MARSS, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria.

It is mandatory to read all terms and conditions carefully.

© Copyright by Global Journals Inc.(US)| Guidelines Handbook

AUXILIARY MEMBERSHIPS

Institutional Fellow of Global Journals Incorporation (USA)-OARS (USA)

Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).



The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.





The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.



The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

© Copyright by Global Journals Inc.(US) | Guidelines Handbook

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.



After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:



Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

Open Association of Research Society (US)/ Global Journals Incorporation (USA), as described in Corporate Statements, are educational, research publishing and professional membership organizations. Achieving our individual Fellow or Associate status is based mainly on meeting stated educational research requirements.



Disbursement of 40% Royalty earned through Global Journals : Researcher = 50%, Peer Reviewer = 37.50%, Institution = 12.50% E.g. Out of 40%, the 20% benefit should be passed on to researcher, 15 % benefit towards remuneration should be given to a reviewer and remaining 5% is to be retained by the institution.

We shall provide print version of 12 issues of any three journals [as per your requirement] out of our 38 journals worth $ 2376 USD.

Other:

The individual Fellow and Associate designations accredited by Open Association of Research Society (US) credentials signify guarantees following achievements:

- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

© Copyright by Global Journals Inc.(US)| Guidelines Handbook

- In addition to above, if one is single author, then entitled to 40% discount on publishing research paper and can get 10%discount if one is co-author or main author among group of authors.
- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
- The Fellow can become member of Editorial Board Member after completing 3yrs.
- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

"

- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

"

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) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.

(II) Choose corresponding Journal.

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

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

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

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

© Copyright by Global Journals Inc.(US)| Guidelines Handbook

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 Swis 721 Lt BT.
- 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 three 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 Inc. (US) welcome the submission of original paper, review paper, survey article relevant to the all the streams of Philosophy and knowledge. The Global Journals Inc. (US) 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 Inc. (US) 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 Inc. (US) and Editorial Board, will become the copyright of the Global Journals Inc. (US).

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 Inc. (US) 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 Inc. (US), 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 Inc. (US) 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 Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) 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 Inc. (US) 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 Inc. (US) 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 Inc. (US).

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 Inc. (US) (Publication Prior to Print)

The Global Journals Inc. (US) 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 .



Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, 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 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 Computer Science and Information Technology. 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: As you are doing research in the field of Computer Science, then this point is quite obvious.

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.



© Copyright by Global Journals Inc.(US)| Guidelines Handbook

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.



© Copyright by Global Journals Inc.(US)| Guidelines Handbook

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.



© Copyright by Global Journals Inc.(US)| Guidelines Handbook

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.

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

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.

- 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.



© Copyright by Global Journals Inc.(US)| Guidelines Handbook

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

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 Inc. (US).

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

Abattoir · 4

C

Ciocalteau · 54, 55
Cumulonimbus · 36, 37, 39, 40, 46, 48

D

Delineate · 18
Dibroboetane · 65, 67

H

Hailstones · 35, 36, 37, 38, 39, 42, 44, 46, 48

I

Intriguing · 37

L

Landfill · 3, 12, 19, 21
Legionellosis · 7

M

Macrocycles · 65

N

Nematicidal · 60

P

Perennials · 44
Phenolphthalein · 7
Prostaglandins," · 39

S

Sedimentation · 46
Snowflakes · 44

T

Terpenoids · 24, 58, 59
Thunderstorms · 36, 37, 38, 45, 48

U

Unaccustomed · 9



Global Journal of Science Frontier Research

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

ISSN 9755896



© Global Journals