Lasallian Research Forum
L A SALLE UNIVERSITY
Ozamiz City

August 2009 Vol. 14 No. 3

Message of the Dean

On behalf of the College of Arts & Sciences, I congratulate the faculty members who, despite teaching loads and other requirements, were able to conduct research works. You have indeed live up to our institution's vision-mission of our tri-focal functions as university educators; teaching, research and extension. Your achievements are not only yours; they are achievements of the university as its contribution to humanity and the world we live in. Our research endeavors are one of our contributions in making this world a better place to live in.

Kudos!

Your success will surely inspire others to do research willingly and sincerely.

Fernando D. Sumondong, PhD.
Dean

On the Three Most Frequent Source of Earthquakes in Luzon from 1973 to 2009

Merven M. Pailden

Abstract

Analyses of earthquake magnitudes relative to time in the island of Luzon are presented in this study. The data used in this study came from the archives of United States Geological Survey (USGS). An analysis of variance of six equally spaced time intervals with regard to the average daily quake magnitude was presented. An investigation on the periodicity using fourier transforms was also carried in the study. Interpretations and analyses were accompanied with graphical illustrations to enhance the thought presented.

Keywords: earthquake magnitude, epicenter

1. Introduction

Philippines being a country located at the edges of two colliding tectonic plates experiences frequent seismic activities (Bolt, 2008). These seismic activities vary from slight ground movements to quakes that destroy human properties and even cost human lives such as the events in Mindanao in 1976 and Luzon in 1990 (United States Geological Survey). A study in geology relates earthquakes with the tectonic structure of the crust itself. Geologists use the structure of the crust as basis to identify potential hazards. But through time, the formation of the crust changes, thus shifting potential hazard priorities. This is the reason why predicting these ground shakes is next to impossible. But the frequency and location of its occurrence might shed light to this problem. Hence, this study limits only on the descriptions of earthquakes that has previously occurred and not on the condition of the crust underneath. Earthquakes were usually described in terms of the epicenter, magnitude and date or times of occurrence were detected using seismographs. In the

Philippines, the entity that collects and analyzes these data is the Philippine Institute of Volcanology and Seismology (PHILVOLCS). These descriptions were compiled and were made available online through the United States Geological Survey (USGS) website (http://earthquake.usgs.gov/regional/index.php).

Data Used

The data used in this study came from the archives of the United States Geological Society (USGS) that recorded earthquake activities around the world. They compiled a detailed collection of earthquake's date of occurrences, epicenters, and magnitudes from 1973 to August 2009. The researcher asked a permission to use the data from the USGS archives and was confirmed and permitted by Dr. Walter Mooney, Ph.D from the EHP Web Team of USGS website.

Objective of the Study

Using a mapping toolbox, the quakes of Luzon from 1973 to 2009 were plotted in figure 1:

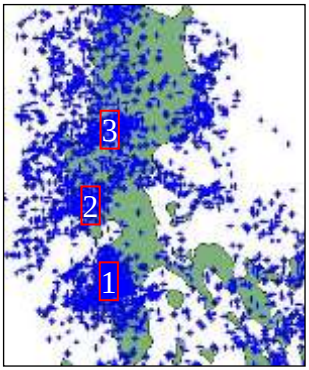


Figure 1. The scatter plot of the quakes in Luzon from 1973 to 2009. Notice that one can locate three regions with high density of events in the figure above. Region 1 is located in the vicinity of Nasugbu, while region 2 is in the area around Angeles City and region 3 in the neighborhood of Baguio City.

The objective of the study is to investigate the behavior of earthquakes in the three identified regions in Luzon. Particularly, the study seeks to answer questions such as: Is there a significant difference in the average daily magnitude when divided into exclusively mutual time intervals? Is there a periodic pattern? How frequent do these patterns occur?

2. Results

The coordinates of Nasugbu is $14^{o}04'N$ latitude and $120^{o}35'E$ longitude. By constructing a circle centered at Nasugbu with a radius of 75 km, 493 events are seen. Refer to figure 2a:

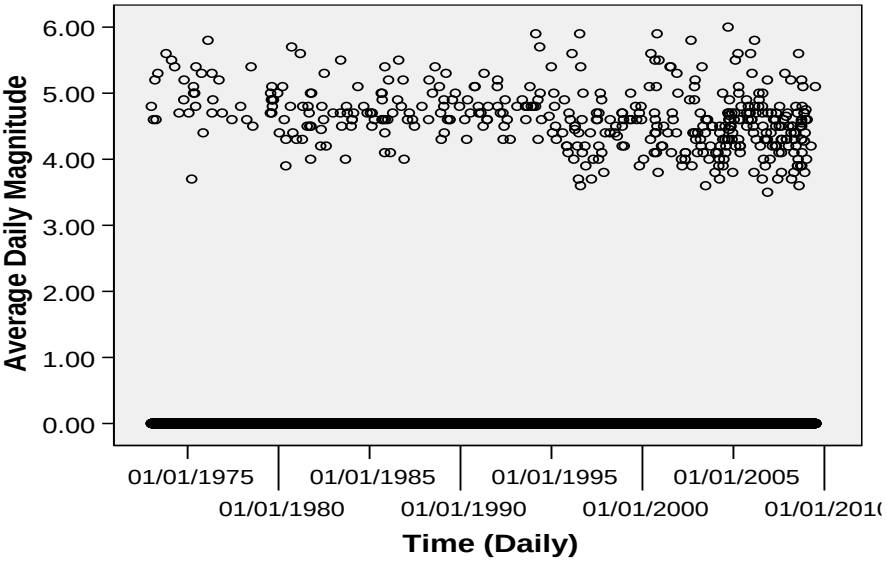


Figure 2a. Treating Nasugbu as the center, and using 75km as radius of the circle, there were 493 earthquakes in this region from January 1, 1973 to August 15, 2009. The figure above shows the time versus the average daily magnitude.

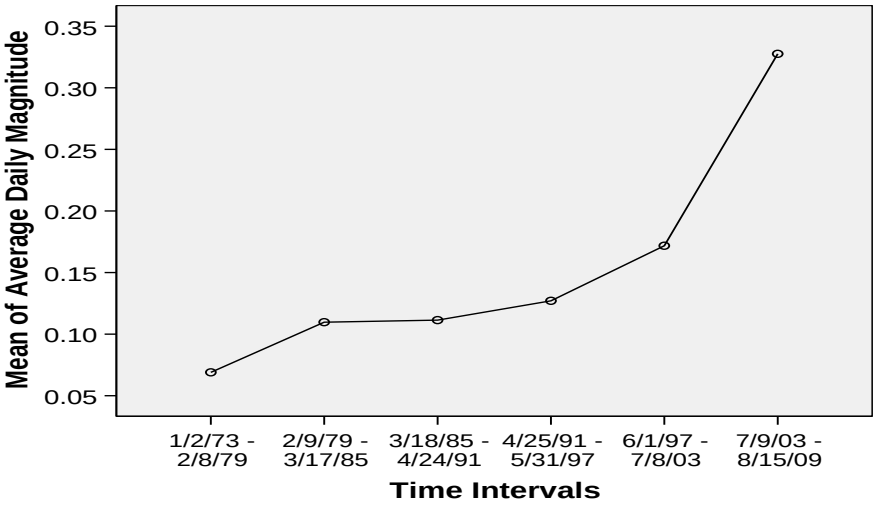


Figure 2b. The figure above shows the mean of the average daily magnitude of six equally space time intervals from January 2, 1973 to August 15, 2009.

Notice that the graph of figure 2a shows an increase in the density of quakes as time lapses. In figure 2b, the overall interval of approximately 36 years was divided into six equally spaced time intervals and plotted against it was the mean of the average daily magnitude. Using an analysis of variance in the six time intervals, the results showed a significant difference with a p-value of 1.114×10^{-27}. After running a Duncan multiple range test (DMRT), it was found out that the average daily magnitude in the time interval 7/9/03 – 8/15/09 was significant higher than the other time intervals. This implies that more higher magnitude quakes were observed in the region lately.

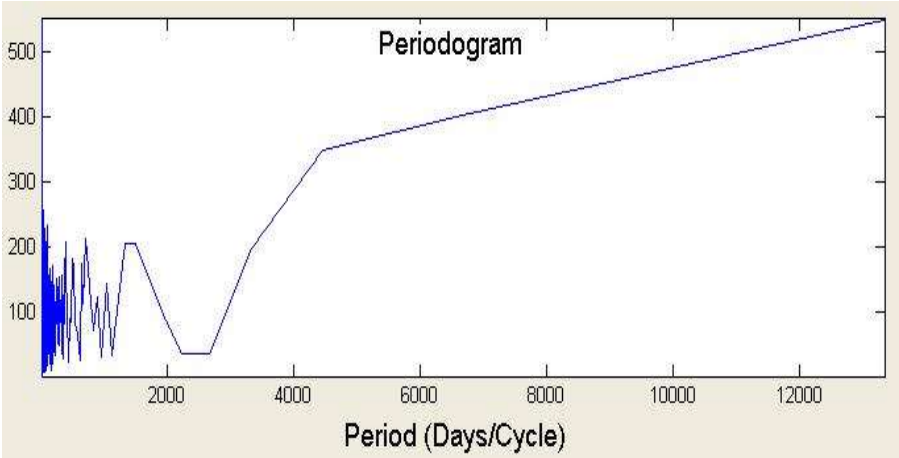


Figure 3. The graph above shows a periodogram with the period in days per cycle in the horizontal while the 2nd degree power of the fast fourier transform in the vertical components.

Figure 3 shows the periodogram of the average daily magnitude of the quakes in region 1. From the figure, one can deduce that there is no evident peak and thus there is no evident periodic pattern in the recorded quake from 1973 to 2009.

In the second region, Angeles City is located at $15^{o}07'N$ latitude and $120^{o}35'E$ longitude. By constructing a circle centered at Angeles City with a radius of 75 km, 241 events are seen. See figure 4:

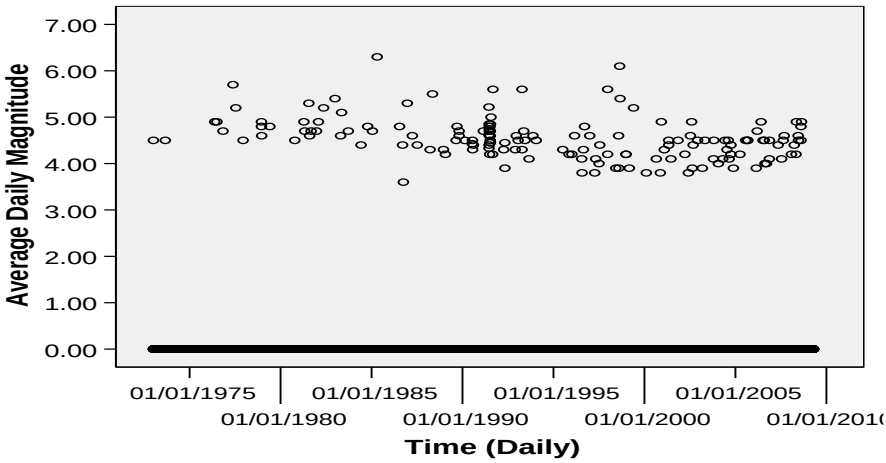


Figure 4a. Treating Angeles City as the center, and using 75km as radius of the circle, there were 241 earthquakes in this region from January 1, 1973 to August 15, 2009. The figure above shows the time versus the average daily magnitude.

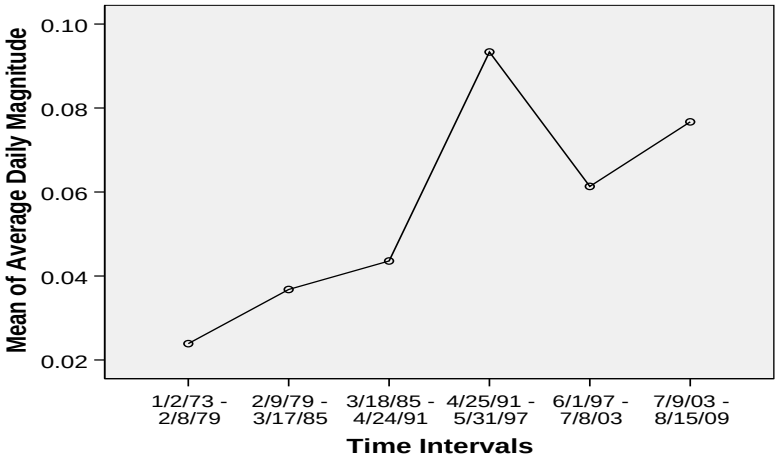


Figure 4b. The figure above shows the mean of the average daily magnitude of six equally space time intervals from January 2, 1973 to August 15, 2009.

Notice that there is an increase in the density of quakes sometime in 1991. Using an analysis of variance in the six time intervals, the results showed a significant difference with a p-value of 1.518×10^{-5}. The DMRT also showed that the quakes in the time interval 4/25/91 -5/31/97 was significantly higher than the other time intervals.

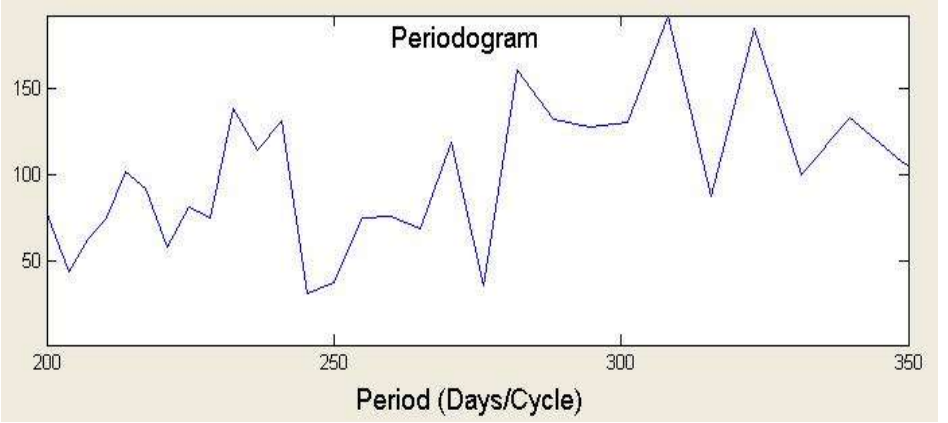


Figure 5. The graph above shows a periodogram with the period in days per cycle in the horizontal while the 2nd degree power of the fast fourier transform in the vertical components.

Figure 5 shows the periodogram of the average daily magnitude of the quakes in region 2. From the figure, A relative peak was evident and it was on the 308.23 on the horizontal. Since the power value is relatively small then a slightly evident periodic pattern of earthquake magnitudes was observed every 308.23 days.

In the third region, Baguio City is located at $16^{o}24'N$ latitude and $120^{o}35'E$. Again by constructing a circle centered at Baguio City with a radius of 75 km, there were 265 events see figure 6:

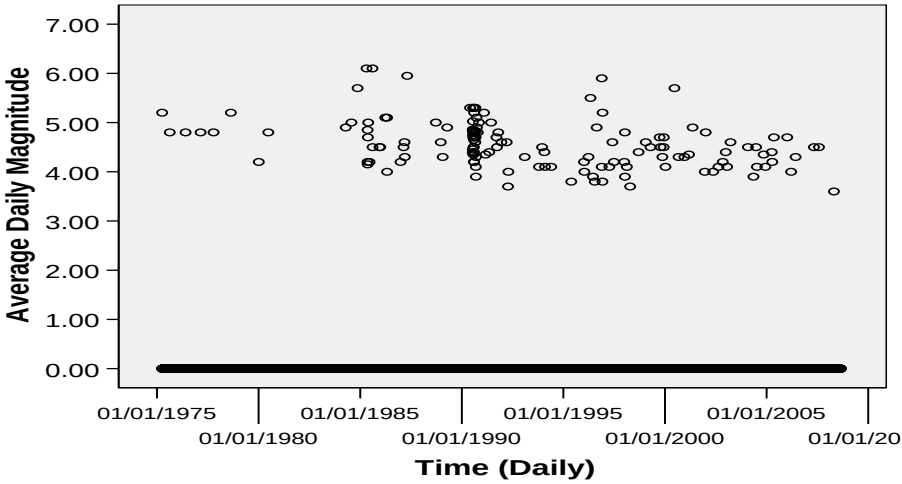


Figure 6a. Treating Baguio City as the center, and using 75km as radius of the circle, there were 265 earthquakes in this region from January 1, 1973 to August 15, 2009. The figure above shows the time versus the average daily magnitude.

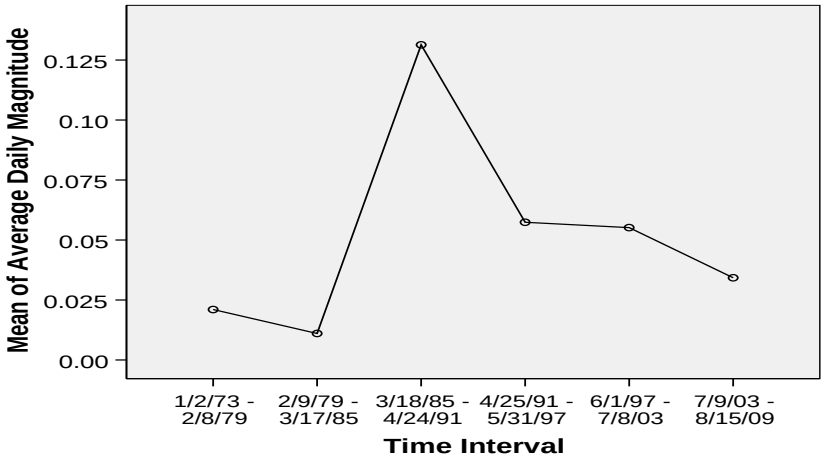


Figure 6b. The figure above shows the mean of the average daily magnitude of six equally space time intervals from January 2, 1973 to August 15, 2009.

The figure above shows that before 1985, the seismic activities in the region were minimal and it suddenly became very active in 1990. Since then, most of the activities in the region were mostly minimal. The ANOVA reported a p value of 8.602×10^{-16} signifying a significantly higher mean for the time interval 3/18/85 – 4/24/91. The periodogram below showed no periodic pattern in region 3.

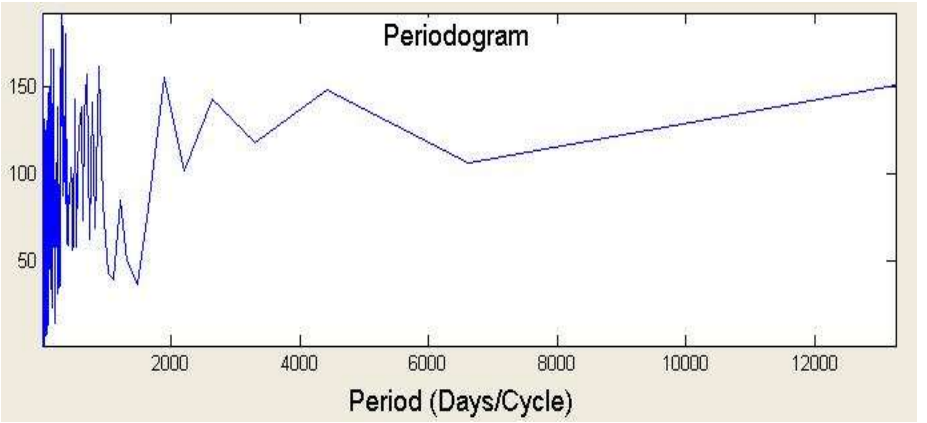


Figure 7. The graph above shows a periodogram with the period in days per cycle in the horizontal while the 2nd degree power of the fast fourier transform in the vertical components.

Comparing the three regions, region 1 manifested higher magnitude of quakes compared to the other two. Also in recent events, region 1 displayed a consistent increase in the number of event happening every year.

3. Conclusion

The island of Luzon displayed three regions with active seismic events. These are the regions around Nasugbu, Angeles City and Bagiuo City. The region around Nasugbu expressed an increasing number of

seismic events while the regions around Angeles City and Bagiuo displayed deterioration in terms of the number of seismic events and in the magnitude of earthquakes as time lapses from 1973 to August 2009.

List of References

Bolt, Bruce. "Earthquake." Microsoft® Student 2009 [DVD]. Redmond, WA: Microsoft Corporation, 2008.

United States Geological Survey. Uploaded from: http://earthquake.usgs.gov/regional/index.php. Date Retrieved: August 20, 2009

Philippine Institute of Volcanology and Seismology. Uploaded from: http://www.phivolcs.dost.gov.ph. Date Retrieved: August 21, 2009

*** This paper was accepted and presented during the 27th Samahang Pisika ng Pilipinas National Physics Conference at the Development Academy of the Philippines Convention Center, Tagaytay City in October 28-30, 2009.*

Acknowledgement

I wish to acknowledge the contribution of **Ms. Almarian S. Pailden** of Tawagan Sur National High School, Pagadian City.

On the Minimum Velocity of a Projectile in a Linear Resisting Medium

Merven M. Pailden

Abstract

A projectile moving in linear resisting medium was considered in this study. A projectile experiencing a drag force will eventually move with terminal velocity as the limiting value. This study discusses a minimum velocity that is less than the terminal velocity. This paper also describes some characteristics of the minimum velocity especially the coordinates in the trajectory where the object moves with minimal speed. Numerical calculations were employed to solve some derived equations. Some graphical user interfaces were used to present the results.

Keywords: linear drag force, projectile motion, terminal velocity, minimum velocity

1. Introduction

In introductory physics, the trajectory of a projectile moving in a linear resisting medium traces detailed analytical and numerical studies (Groetsh, 1997, Larder, 1986, Long et.al., 1999, Miranda et.al., 2004, Packel et.al., Stewart, 2006). One learned that a projectile in a resisting medium with an initial velocity V_o at an initial launching angle θ_o would eventually reach a terminal velocity V_{term} (Long et.al., 1999). The papers of (Lardner, 1986) and (Miranda, 2004) showed that there is a velocity (the minimum velocity $V_{\min}$) that was less than V_{term} . They both showed also that the velocity diminishes until it reaches the minimum velocity and starts increasing until it reaches the terminal velocity (Lardner, 1986, Long, 1999, Miranda, 2004). But they did not discuss the location and the angle of the projectile's velocity and the horizontal at the instant in a "minimum velocity". Thus, the motivation to investigate these

characteristics of a projectile traveling in minimum velocity is the purpose of this paper.

Suppose a projectile of mass m is launched with an initial velocity V_o at an initial launching angle θ_o - see Figure 1.

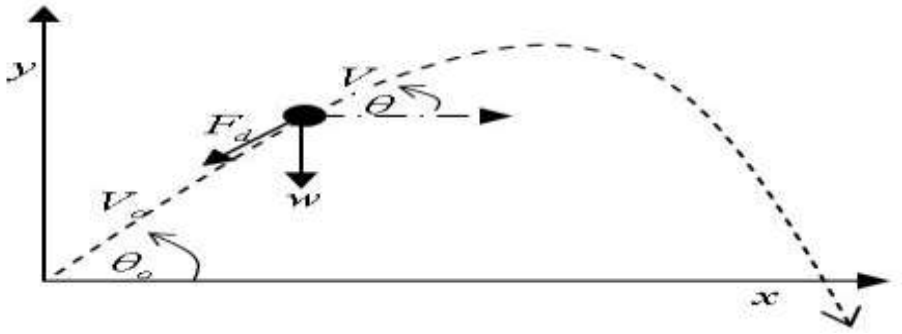


Figure 1. The projectile above has an initial velocity V_o and an initial angle of θ_o. It moves under the action of gravitational force w and a drag force F_d that is proportional to the speed of the projectile.

The projectile is subject to the action of the gravitational force mg and of a drag force F_d which is proportional to the velocity. If θ is the angle between the projectile velocity and the horizontal, then the equations of motion are (Miranda et.al., 2004):

$$m\frac{dV_x}{dt} = -F_d\cos\theta = -kV\cos\theta = -kV_x$$

$$m\frac{dV_y}{dt} = -F_d\sin\theta - mg = -kV\sin\theta - mg = -kV_y - mg$$

where k is the proportionality constant (related to viscosity of fluid, size of object) [4]. Note that in equilibrium condition, $mg = -kV_{term}$ where V_{term} is the terminal velocity. Upon integrating both sides of (1) and applying the initial conditions one can have (Edwards, 2000)

$$x = \frac{V_o \cos\theta_o}{k}\left(1 - e^{\frac{-kt}{m}}\right) \quad , \quad y = \frac{m}{k}\left\{\left(V_o \sin\theta_o - gt\right) + \frac{mg}{k} - \left(\frac{mg + kV_o \sin\theta_o}{k}\right)e^{\frac{-kt}{m}}\right\}$$

(2)

and since the first equation of (2) can be rewritten as $e^{\frac{-kt}{m}} = 1 - \frac{kx}{mV_o \cos\theta}$, then it can be used in the second equation of (2) and the integral of (1) to yield

$$y = \frac{m^2 g}{k^2}\ln\left(1 - \frac{kx}{mV_o \cos\theta_o}\right) + \frac{x}{kV_o \cos\theta_o}\left(mg + kV_o \sin\theta_o\right)$$

(3)

Notice that (3) is the Cartesian equation of the trajectory of the projectile. Next, let us introduce dimensionless quantities v and τ such that [5]

$$v_x = \frac{V_x}{V_{term}}; \quad v_y = \frac{V_y}{V_{term}}; \quad \tau = \frac{gt}{V_{term}}; \quad v = \frac{\sqrt{V_x^2 + V_y^2}}{V_{term}}$$

(4)

By manipulating the derivatives in (4), (1) can be rewritten as:

$$\frac{dv_x}{d\tau} = -v\cos\theta; \qquad \frac{dv_y}{d\tau} = -v\sin\theta - 1$$

(5)

Thus, by combining the *x* and *y* components of *v* in (5) and doing the same for θ one can deduce the system of equations:

$$\frac{dv}{d\tau} = -v - \sin\theta; \qquad \frac{d\theta}{d\tau} = \frac{-\cos\theta}{v} \tag{6}$$

Hence, by eliminating the time τ in (6), one can get the differential equation;

$$\frac{dv}{d\theta} = v^2 \sec\theta + v\tan\theta \quad \text{where } -90^o < \theta < 90^o \tag{7}$$

Note that equations (4) to (7) are special cases for the more general derivation of the power law resistance force done by Lardner and Miranda.

2. Results

Using a Graphical User Interface (GUI) that implements a fourth order Runge-Kutta method to solve (7), one needs the following: dimensionless initial velocity v_o and launching angle θ_o. (7) must be evaluated from θ_o down to the equilibrium situation where $\theta \approx -90^o$. For the initial velocities greater and less than 1 we get:

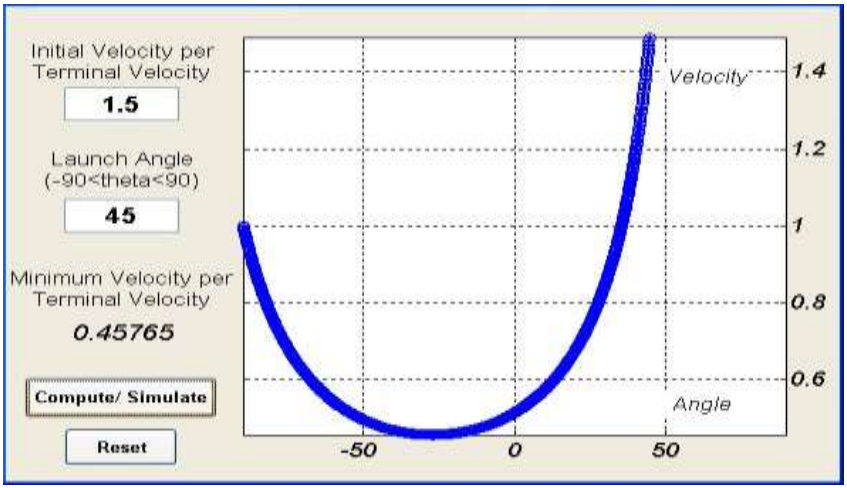


Figure 2a. The projectile velocity as a function of the angle θ. The initial velocity $v_o = 1.5$ and $\theta_o = 45^o$. Notice that the terminal velocity ($v = 1$) is different from the minimum one

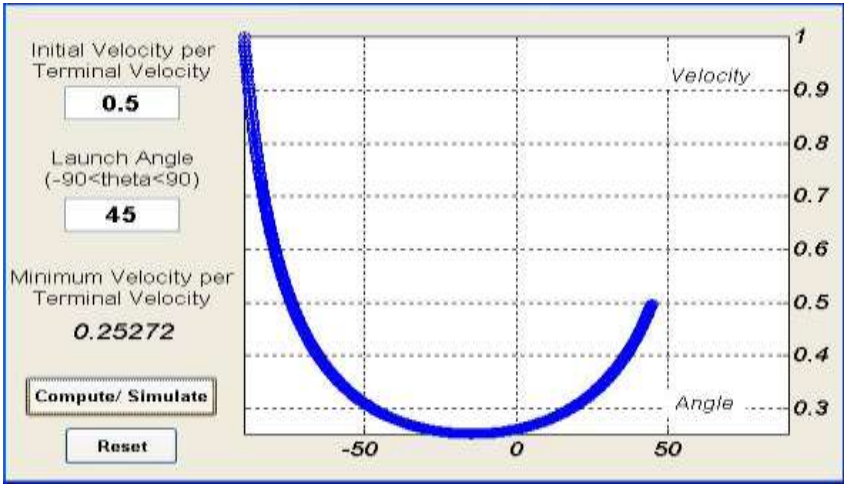


Figure 2b. The projectile velocity as a function of the angle θ. The initial velocity $v_o = 0.5$ and $\theta_o = 45^o$. Notice that the terminal velocity ($v = 1$) is different from the minimum one

Figures 2a and 2b give a counter intuitive result [5]. A normal intuition is that the minimum velocity is the terminal velocity [5]. Notice that in Figure 2, there is a particular $\theta_{\min v}$ where v is the minimum. By finding the value of $\theta_{\min v}$, one can locate the coordinates of the projectile cruising at the minimum velocity. In doing this, one must evaluate the slope of (3) at a given value of x and identify the $x_{\min v}$ and also the $y_{\min v}$ (the coordinates of the projectile cruising at the minimum velocity). First we get the slope of (3);

$$\frac{dy}{dx} = \frac{m^2 g}{k^2}\left(\frac{1}{1-\frac{kx}{mV_o\cos\theta_o}}\right)\left(-\frac{k}{mV_o\cos\theta_o}\right)+\frac{mg+kV_o\sin\theta_o}{kV_o\cos\theta_o} = \tan\theta = y'(x) \tag{8}$$

By iterating the value of x in (8) so as to have θ sufficiently close to $\theta_{\min v}$ hence $x \to x_{\min v}$ and compute the value of $y_{\min v}$. Thus one can locate the position of the projectile traveling at minimum velocity.

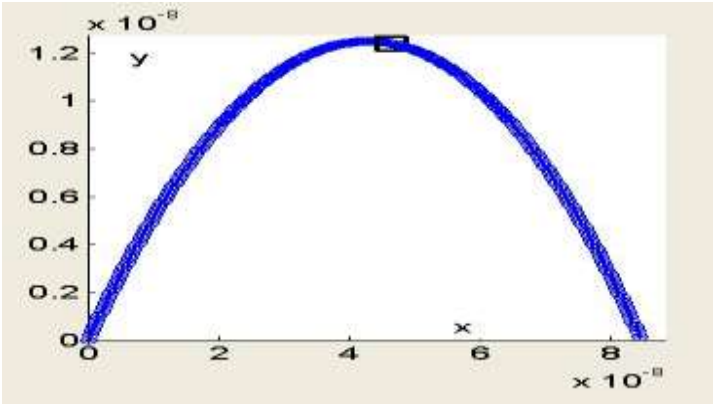


Figure 3a. The trajectory of a projectile with $V_o = 0.001\frac{m}{s}$, $\theta_o = 30^o$, $k = 0.03$ and $m = 0.00005kg$. Notice that the $(x_{\min v}, y_{\min v}) = (4.6351\times10^{-8}, 1.2402\times10^{-8})$ is the coordinate in which the projectile travels with a minimum speed of $0.00083922\frac{m}{s}$ compared to $V_{term} = 0.01635\frac{m}{s}$. The $\theta_{\min v} = -2.9398^o$

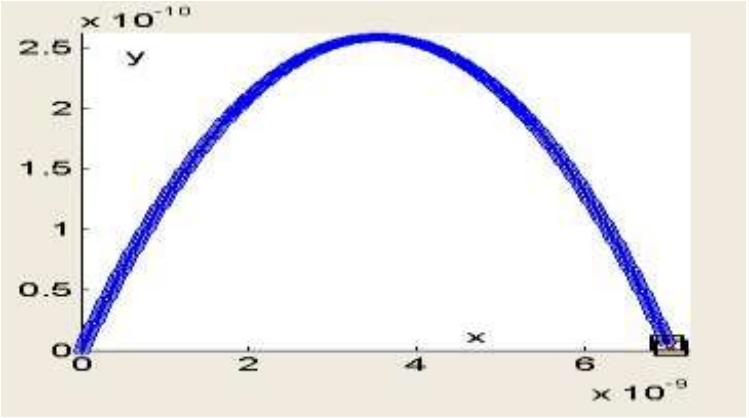


Figure 3b. The trajectory of a projectile with $V_o = 0.0005\frac{m}{s}$, $\theta_o = 8.25^o$, $k = 0.03$ and $m = 0.00001kg$. Notice that the $(x_{\min v}, y_{\min v}) = (6.9913\times10^{-9}, 5.9553\times10^{-12})$ is the coordinate in which the projectile travels with a minimum speed of $0.00047898\frac{m}{s}$ compared to $V_{term} = 0.00327\frac{m}{s}$. The $\theta_{\min v}$ = -8.3498^o

As mentioned by Long [4], the situation of a linear resisting medium is appropriately applicable to projectiles with minute size and moving in a very viscous medium. Using such limitations, Figure 3 shows two examples of such particles moving in a linear drag. One would think that, if the minimum velocity is not the terminal velocity, then it might be the case that the minimum velocity is at the maximum height since $V_y = 0\frac{m}{s}$. But in figures 3a and 3b, the minimum velocity ($V_{\min}$) is not on the maximum height. Figure 3b even shows that $V_{\min}$ happens when the projectile is very close to the ground. To explain this rather interesting property of a projectile in linear resisting medium, we recall that the motion can be divided in two parts, the horizontal and vertical components (Miranda, 2004). In both components, there is a drag force that lessens the velocity of the projectile. Though, in the vertical component, there is a gravitational force that accelerates the object. At

the start, the drag force ruled the motion and thus reduces the speed to the minimum but as gravity pulls downwards, the projectile starts to gain speed and therefore eventually attains the terminal velocity. This explanation may not be very satisfactory for the behavior of the projectile in figure 3b.

3. Conclusion

As presented in the Results section, the minimum velocity can be acquired using the Runge-Kutta method of the 4^{th} order on (7) from any launching angle between -90^0 to 90^0. Whereas the angle of the projectile's velocity where the velocity is minimum can be used to find the coordinates of the projectile at the instant the object cruises at minimum speed. It was found out that the location may not be the peak of the trajectory and in some cases it may occur at the bottom of the trajectory. Some trajectory plots were presented along with the plot of the point where the velocity is minimal with the use of GUIs.

List of References

P.Edwards, Bournemouth University, UK" 2000,
Uploaded from: http://mathinsite.bmth.ac.uk/html/applets.html.
Date Retrieved: August 5, 2009

C.W. Groetsch and B. Cipra, "Halleys comment- projectiles with linear resistance", Mathematics Magazine 70, 273-280, 1997.

T. J. Lardner, "Minimum value of projectile velocity", SIAM Review, 28, 385-388, 1986.

L.N. Long, H. Weiss, “The velocity dependence of aerodynamic drag: a primer for mathematicians”, Am. Mathematical Monthly 106, 127-135, 1999.

E.N. Miranda et al, "Minimum and terminal velocities in projectile motion," *Revista Brasiliera de Ensino de Fisica,* **27**(2), pp 125-127, 2004.

E. Packel , D. Yuen, “Projectile motion with resistance and the Lambert W function”, College Mathematics Journal 35, 337-350.

S.M. Stewart, “Characteristics of the trajectory of a projectile in a linearly resisting medium and the Lambert W function”, Australian Institute of Physics 17th National Congress 2006, December 2006, paper No.: WC0035.

*** This paper was accepted and presented during the 27th Samahang Pisika ng Pilipinas National Physics Conference at the Development Academy of the Philippines Convention Center, Tagaytay City in October 28-30, 2009.*

Acknowledgement

The author thanks the topical editor for the comments, suggestion and additional references to improve the quality of the paper.

On Infinite Groups that are Isomorphic to its Proper Infinite Subgroup

Jaymar Talledo Balihon

Abstract

Two groups are isomorphic if there exists an isomorphism ϕ between them. Lagrange Theorem states that the order of a subgroup divides the order of the group. This implies that a finite group is not isomorphic to its proper subgroup. Some infinite groups which are isomorphic to some of its proper subgroup are illustrated in this paper. Moreover, it is shown through concepts in linear algebra that these groups really exist.

1. Introduction

This chapter presents the background of the study, objectives of the study, significance of the study, methodology and basic concepts in group theory.

Background of the Study

Many of the students taking introductory abstract aim to know whether a certain group is isomorphic to a proper subgroup of itself. Finite groups are not isomorphic to a proper subgroup of themselves since two groups having different cardinalities cannot be isomorphic. The additive group $\mathbb{Z}$ of all integers is isomorphic to the subgroup $2\mathbb{Z}$ of even integers via the map $f:\mathbb{Z}\to 2\mathbb{Z}$ given by $f(x)=2x$, for all $n\in\mathbb{Z}$. Also, the multiplicative group Q^+ of all positive rational is isomorphic to some of its proper subgroup using the function $f:Q^+\to Q^+$ defined by $f(x)=x^3$, for all $x\in Q^+$.

These groups show that indeed, there are infinite groups which are isomorphic to some of their proper subgroups. But being infinite is not

enough because some infinite groups are not isomorphic to their proper subgroups. Hence, this paper characterizes some infinite groups which are isomorphic to its proper subgroup.

Objectives of the Study

This paper will investigate those infinite groups which are isomorphic to its proper subgroup. Specifically, this paper aims to show the following:

1. The additive group $\mathbb{Z}$ is isomorphic to its proper subgroup $n\mathbb{Z}$, where $n \in \mathbb{Z}/\{0,1,-1\}$.
2. The additive group Q of all rational numbers is not isomorphic to any of its proper subgroup.
3. The additive group $Q \oplus Z$ is isomorphic to its proper subgroup $Q \oplus n\mathbb{Z}$, where $n \in \mathbb{Z}/\{0,1,-1\}$.
4. Suppose that G and H are groups, one of which is isomorphic to some of its proper subgroup. Then $G \oplus H$ is also isomorphic to some of its proper subgroup.
5. Let $G_1, G_2, \cdots, G_n$ be groups. If for some $i \in \{1,2,3,\cdots,n\}$, G_i is isomorphic to its proper subgroup then $G_1 \oplus G_2 \oplus \cdots \oplus G_n$ is also isomorphic to its proper subgroup.

Significance of the Study

If a group is isomorphic to its proper subgroup and this subgroup has a known structure, then the structure of the group can also be determined via this isomorphism.
Also, if one group is known to be isomorphic to its proper subgroup, then any group isomorphic to this group will also be isomorphic to its proper subgroup. Thus, this paper which involves basic concepts of group theory is of great importance to mathematics enthusiast.

2. Methodology

This paper exposes the work of Shaun Fallat, Chi Kwon Li, David Lutzer, and David Stanford entitled "On Groups That Are Isomorphic to a Proper Subgroup". Definitions, examples and preliminary concepts are being presented in order to provide detailed proof of the main results.

Preliminaries

This section contains definitions and preliminary concepts that are needed for further understanding of the study.

1.1 Basic Definitions and Known Results

Definition 1.5.1 (Hungerford, 1980)**:** A *function* $f : X \to Y$ is a relation between X and Y with the property that each $x \in X$ appears as the first member of exactly one ordered pair $(x, y) \in f$. Such a function is called a *map* or *mapping* of X into Y.

Definition 1.5.2 (Hungerford, 1980)**:** Let $f : X \to Y$ be a function, and let A be a subset of X and B be a subset of Y. The *image* of A in Y under *f* is the set $f[A] = \{ f(a) : a \in A \}$. The set *f*[X] is called the *range* of *f*. The *inverse image* of $B \in X$ is the set $f^{-1}[B] = \{x \in X : f(x) \in B\}$.

Definition 1.5.3 (Maclane, Birkhoff, 1967)**:** A function $f : X \to Y$ is

i. *well defined* if $a = b$ implies *f(a) = f(b)*
ii. *injective* if $\forall a, a' \in A$, *f(a) = f(b)* implies *a = b*
iii. *surjective* if for each $b \in B$, *b = f(a)* for some $a \in A$
iv. *bijective* if it is both injective and bijective.

Definition 1.5.4 (Fraleigh, 1994)**:** (*Principle of Mathematical Induction)*: Let *P (n)* be a statement concerning the positive integer *n.* Suppose that
1. *P(1)* is true, and

2. If *P (k)* is true, then *P (k+1)* is true.
Then *P (n)* is true $\forall n \in Z^+$.

Definition 1.5.5 (Fraleigh, 1994)**:** Let *G* be nonempty set with a binary operation ·. Then *G* is called a *group if* the following axioms hold:
[G1]: $a \cdot b \in G, \forall a, b \in G$ (closure property)
[G2]: $(a \cdot b) \cdot c = a \cdot (b \cdot c), \ \forall a, b, c \in G$ (associative property)
[G3]: There is an element *e* in *G* such that $\forall a \in G, e \cdot a = a = a \cdot e$.(existence of an identity element in *G*)
[G4]: Corresponding to each $a \in G$, there is an element $a^{-1} \in G$ such that $a \cdot a^{-1} = a^{-1} \cdot a = e$ (existence of inverses in *G*)

Definition 1.5.6 (Fraleigh, 1994)**:** The *order* of a group *G,* denoted by $|G|$, is the number of elements in *G.* A group with finite order is called a *finite group.* Otherwise, it is a *finite group.*

Definition 1.5.7 (Fraleigh, 1994)**:** Let G be a group. If $\varnothing \neq H \subseteq G$ and H is a group under the binary operation $\bullet$ in G, then H is a *subgroup* of G written $H \leq G$.

Definition 1.5.8 (Fraleigh, 1994)**:** If G is a group, then the subgroup consisting of G itself is called an *improper subgroup* of G. All the other subgroups of G are called *proper subgroups.*

Definition 1.5.9 (Fraleigh, 1994)**:** If G is a group, a is in G and $n \in N$, then a^n is a product of *n* factors each equal to *a*; that is, $a^n = a \cdot a \cdot a \cdots a (n \text{ - factors})$.

Definition 1.5.10(Fraleigh, 1994): Let G be group. If $a \in G$, then $\{a^n : n \in \square\}$ is called the *cyclic subgroup* of G generated by a and will be denoted by $< a >$. If $G = < b >$ for some $b \in G$, then G is said to be *cyclic*.

Definition 1.5.11(Fraleigh, 1994)**:** Let G be e group and $a \in G$. The *order of a,* denoted |*a*|, is the smallest positive integer n such that $a^n = e$. The order of the cyclic subgroup $< a >$ is equal to the order of *a,* that is, |<*a*>| = |*a*|.

Theorem 1.5.12 (Hungerford, 1980)**:** Every infinite cyclic group is isomorphic to the additive group Z and every finite cyclic group of order *m* is isomorphic to the additive group Z_n.

Theorem 1.5.13 (Fraleigh, 1994)**:** *Lagrange's Theorem:* Let *H* be subgroup of a finite group *G*. Then the order of *H* divides the order of *G*. In particular, if $a \in G$, then |*a*| divides |*G*|.

Definition 1.5.14 (Fraleigh, 1994)**:** Let $G_1, G_2, \cdots, G_n$ be groups. Consider

$$\otimes_1^n G_i = G_1 \oplus G_2 \oplus \cdots \oplus G_n = \{(g_1, g_2, \cdots, g_n) : g_i \in G\}.$$

Define a binary operation on $\oplus G_i$ by $(g_1, g_2, \cdots, g_n) + (h_1, h_2, \cdots, h_n) = (g_1 + h_1, g_2 + h_2, \cdots, g_n + h_n)$, $\forall g_i, h_i \in G$. Then $G_1 \oplus G_2 \oplus \cdots \oplus G_n$ is group called the *direct sum* of the groups G_i under the binary operation +.

Definition 1.5.15 (Fraleigh, 1994)**:** Let *G* and *H* be groups. A function $f : G \to H$ is a *homomorphism* provided that *f (a*b) = f (a)*f (b)* $\forall a, b \in G$. If *f* is injective, then f is called an *isomorphism.* In this case, *G* and *H* are said to be *isomorphic* written $G \cong H$. The *kernel* of *f,* denoted by $\ker f$, is the subgroup $f^{-1}(\{e'\})$ where *e'* is the identity element of *G'*.

Definition 1.5.16 (Fraleigh, 1994)**:** Let *n* and *d* be non-zero integers. Then *d divides n,* denoted by *d/n,* if there exist an integer *q* such that *n = dq.*

3. Results and Discussions

This chapter presents the isomorphism of group onto its proper subgroup for the case where the group is a direct sum.

3.1 Direct Sum of Groups

This section tells us when the direct sum of groups is isomorphic to some of its proper subgroup.

Theorem 3.1.1 The additive group $\mathbb{Z}$ of integers is isomorphic to some of its proper subgroup $n\mathbb{Z}$, where $n \in \mathbb{Z} \setminus \{0,1,-1\}$.

Proof: Let $f : \mathbb{Z} \to n\mathbb{Z}$ be defined by $f(a) = na, \forall a \in \mathbb{Z}$. Let $a, b \in \mathbb{Z}$. If $a = b,$ then $f(a) = na = nb = f(b)$. Thus, f is well-defined. Suppose $f(a) = f(b)$. Then, $na = nb$ which implies that $a = b$. Hence, f is one-to-one. Also $f(a+b) = n(a+b) = na + nb = f(a) + f(b)$. Hence, f is a homomorphism. Let $b \in n\mathbb{Z}$. Then $b = nm$ for some $m \in \mathbb{Z}$. Take $a = m$. Then $f(a) = na = nm = b$. So, f is onto. Therefore, the additive group $\mathbb{Z}$ is isomorphoc to the proper subgroup $n\mathbb{Z}$. □

The following corollary follows from Theorem 3.1.1 and Theorem 1.5.12.

Corollary 3.1.2 Every infinite cyclic group is isomorphic to some of its proper subgroup.

Theorem 3.1.3 The additive group $\mathbb{Q}$ of all rational numbers is not isomorphic to any of its proper subgroup.

Proof: Suppose that $f:\square \to \square$ is a nonzero homomorphism. Note that $1\in\square$ and $f(1)\in\square$.

Claim 1: $f(x)=f(1)x, \forall x\in\square$, where $f(1)\neq 0$

Let $x\in\square$. Then $x=\frac{a}{b}$ for some $a,b\in\square, b\neq 0$. Observe that

$$\begin{aligned} bf(x)=bf\left(\frac{a}{b}\right) &= f\left(\frac{a}{b}\right)+...+f\left(\frac{a}{b}\right) \\ &= f\left(\frac{a}{b}+...+\frac{a}{b}\right) \\ &= f\left(b\frac{a}{b}\right) \\ &= f(a) \\ &= f(a\square 1) \\ &= f(1+...+1) \\ &= f(1)+f(1)+....+f(1) \\ &= af(1) \\ &= f(1)a \end{aligned}$$

Thus, $f(x)=f(1)\frac{a}{b}=f(1)x$. Moreover, $f(1)\neq 0$ since f is a nonzero homomorphism.

Claim 2: f is one-to-one

Let $a,b\in\square$ with $f(a)=f(b)$. Then $f(1)a=f(1)b$ by Claim 1. Since $f(1)\neq 0$ and $f(\square)$ is a subgroup of $\square$, cancellation holds, that is, $a=b$. Hence, f is one-to-one.

Claim 3: f is onto

Let $x\in\square$. Then $x=\frac{a}{b}$ with $a,b\in\square, b\neq 0$. Since $0\neq f(1)\in\square$, there exist

nonzero integers c and b such that $f(1)=\frac{c}{d}$. This implies that $bc\neq 0$ since $b\neq 0$ and $c\neq 0$.

Let $t=\frac{ad}{bc}$. Then $t\in\mathbb{Q}$ and $f(t)=f(1)t=\left(\frac{c}{d}\right)\left(\frac{ad}{bc}\right)=\frac{a}{b}=x$. Thus, f is onto.

Therefore, f is an isomorphism. This means that every homomorphism $f:\mathbb{Q}\to\mathbb{Q}$ is an isomorphism. Thus, $\mathbb{Q}$ is not isomorphic to any of its proper subgroup. $\square$

Observe that the additive group $\mathbb{Z}$ of integers is isomorphic to some of its proper subgroup but the additive group $\mathbb{Q}$ of rational numbers is not. What can be said about $\mathbb{Q}\oplus\mathbb{Q}$?

Theorem 3.1.4 The additive group $\mathbb{Q}\oplus\mathbb{Q}$ is isomorphic to some if its proper subgroup $\mathbb{Q}\oplus n\mathbb{Q}$, where $n\in\mathbb{Z}\setminus\{0,1,-1\}$.

Proof: Note that $\mathbb{Q}\oplus n\mathbb{Q}$ is a proper subgroup of $\mathbb{Q}\oplus\mathbb{Q}$ since $(1,1)\in\mathbb{Q}\oplus\mathbb{Q}$ but $(1,1)\notin\mathbb{Q}\oplus n\mathbb{Q}$. Let $f:\mathbb{Q}\oplus\mathbb{Q}\to\mathbb{Q}\oplus n\mathbb{Q}$ be defined by $f((s,a))=(s,na)$. Let (s,a) and (t,b) be in $\mathbb{Q}\oplus\mathbb{Q}$ with $(s,a)=(t,b)$. Then $s=t$ and $a=b$. Now $f((s,a))=(s,na)=(t,nb)=f((t,b))$. Thus f is well-defined. Suppose that $f((s,a))=f((t,b))$. Then, $(s,na)=(t,nb)$ implies that $s=t$ and $a=b$. this shows that $(s,a)=(t,b)$ and f is one-to-one. Let $x\in\mathbb{Q}\oplus n\mathbb{Q}$. Then, $x=(s,na)$ for some $s\in\mathbb{Q}$, $n,a\in\mathbb{Q}$. Take $(s,a)\in\mathbb{Q}\oplus\mathbb{Q}$. Then, $f((s,a))=(s,na)\in\mathbb{Q}\oplus n\mathbb{Q}$ implying that f is onto. Therefore, $\mathbb{Q}\oplus\mathbb{Q}$ isomorphic to its proper subgroup $\mathbb{Q}\oplus n\mathbb{Q}$. $\square$

Theorem 3.1.4 is generalized in the following theorem.

Theorem 3.1.5 Suppose that G and H are groups, one of which is isomorphic to some of its proper subgroup. Then $G\oplus H$ is also isomorphic to its proper subgroup.

Proof: Let $G_1 < G$ such that $\exists$ an isomorphism $\phi : G \to G_1$. Since G_1 and H are groups, it follows that the identity elements say $e_{G_1} \in G_1$ and $e_H \in H$ exist. Thus, $(e_G, e_H) \in G_1 \oplus H$ and so $G_1 \oplus H \neq \varnothing$. Let $(g_1, h_1), (g_2, h_2) \in G_1 \oplus H$. Now, $(g_1, h_1) + (g_2, h_2) = (g_1 + g_2, h_1 + h_2) \in G_1 \oplus H$ since G and H are closed under addition. Thus, $G_1 \oplus H$ is also closed under +. Note that

$(g_1, h_1) + (e_{G_1}, e_H) = (g_1 + e_{G_1}, h_1 + e_H) = (g_1, h_1)$.

Thus (e_{G_1}, e_H) is the identity element in $G_1 \oplus H$. Also,

$(e_{G_1}, e_H) = (g_1, h_1) + (g_2, h_2) = (g_1 + g_2, h_1 + h_2)$ implies

that $g_1 + g_2 = e_{G_1}$ and $h_1 + h_2 = e_H$.

Thus $g_2 = e_{G_1} - g_1 = -g_1$ and $h_2 = e_H - h_1 = -h_1$.

Hence $(g_2 h_2) = (-g_1, -h_1) \in G_1 \oplus H$ is the inverse $(g_1, h_1) \in G_1 \oplus H$. Thus, $G_1 \oplus H$ is a subgroup of $G \oplus H$. Consider the function $\varphi : G \oplus H \to G_1 \oplus H$ defined by $\varphi((g,h)) = (\phi(g), h), \forall (g,h) \in G \oplus H$. Let $(g,h), (g',h') \in G \oplus H$. If $(g,h) = (g',h')$, then $g = g'$ and $h = h'$. So, $\varphi((g,h)) = (\phi(g), h) = (\phi(g'), h') = \varphi(g', h')$.

Thus φ well-defined. Observe that,

$$\begin{aligned}\varphi((g,h) + (g',h')) &= \varphi(g + g', h + h') \\ &= (\phi(g + g'), h + h') \\ &= (\phi(g) + \phi(g'), h + h') \\ &= (\phi(g), h) + (\phi(g'), h') \\ &= \varphi((g,h) + \varphi((g',h'))\end{aligned}$$

Thus, φ is a homomorphism. Now, if $\varphi((g,h)) = \varphi((g',h'))$, then $(\phi(g), h) = (\phi(g'), h')$ so that $\phi(g) = \phi(g')$ and $h = h'$. Since ϕ is one-to-one, $g = g'$. Thus, $(g,h) = (g',h')$ and φ is one-to-one. Let $(g_1, h) \in G_1 \oplus H$. Since $g_1 \in G_1$ and ϕ is onto, $\exists g \in G$ such that $\phi(g) = g_1$. Consider $(g,h) \in G \oplus H$. Then, $\varphi((g,h)) = (\phi(g), h) = (g_1, h)$.

Thus, φ is an isomorphism and $G \oplus H$ is isomorphic to its proper subgroup $G_1 \oplus H$. □

Corollary 3.1.6 Let $G_1, G_2, ..., G_n$ be groups. If for some $i \in \{1, 2, \cdots, n\}, G_i$ is isomorphic to some of its proper subgroup, then $G_1 \oplus G_2 \oplus \cdots \oplus G_n$ is also isomorphic to its proper subgroup.

Proof: If one of G_1 or G_2 is isomorphic to its proper subgroup, then by Theorem 3.1.5, $G_1 \oplus G_2$ is isomorphic to its proper subgroup. Assume that $G_1 \oplus G_2 \oplus \cdots \oplus G_k$ is isomorphic to its proper subgroup for all $k > 1$. Then by Theorem 3.1.5,

$$G_1 \oplus G_2 \oplus \cdots \oplus G_{k+1} = (G_1 \oplus G_2 \oplus \cdots \oplus G_k) \oplus G_{k+1}$$

is isomorphic to some of its proper subgroup. Therefore, by *PMI*, $G_1 \oplus G_2 \oplus \cdots \oplus G_n$ is also isomorphic to some of its proper subgroup. □

4. Summary, Conclusion and Recommendations

This chapter summarizes the results being studied in this paper and presents some recommendations for further inquiries.

Summary and Conclusion

This paper obtained the following results on groups which are isomorphic to some of its proper subgroup:

1. The additive group $\mathbb{Z}$ of integers is isomorphic to some of its proper subgroup $n\mathbb{Z}$, where $n \in \mathbb{Z} \setminus \{0, 1, -1\}$. **(Theorem 3.1.1)**

2. Every infinite cyclic group is isomorphic to some of its proper subgroup. **(Corollary 3.1.2)**

3. The additive group $\mathbb{Q}$ of all rational numbers is not isomorphic to any of its proper subgroup. **(Theorem 3.1.3)**

4. The additive group $\mathbb{Q} \oplus \mathbb{Q}$ is isomorphic to some if it's proper subgroup $\mathbb{Q} \oplus n\mathbb{Q}$, where $n \in \mathbb{Q} \setminus \{0,1,-1\}$. **(Theorem 3.1.4)**

5. Suppose that G and H are groups, one of which is isomorphic to some of its proper subgroup. Then $G \oplus H$ is also isomorphic to its proper subgroup. **(Theorem 3.1.5)**

6. Let $G_1, G_2, ..., G_n$ be groups. If for some $i \in \{1, 2, \cdots, n\}, G_i$ is isomorphic to some of its proper subgroup, then $G_1 \oplus G_2 \oplus \cdots \oplus G_n$ is also isomorphic to its proper subgroup. **(Theorem 3.1.6)**

Recommendations

The author recommends the following questions for further investigation.

1. If $G \oplus H$ is isomorphic to some of its proper subgroup, will it follow that G or H is isomorphic to some of its proper subgroup?

2. How many homomorphism and isomorphism exist from the additive group $\mathbb{Q}$ and into itself?

3. One can show that the usual fields and are not isomorphic to proper subfields of themselves but there are fields lying between them and that are isomorphic to proper subfields of themselves. Which fields are field isomorphic to proper subfields of themselves?

List of References

Fraleigh, J.B. *A First Course in Abstract Algebra*. 1994 Addison – Wesley Publishing Company Inc.

Hungerford, T. *Algebra*. 1980. New York: Springer-Verlag.

Maclane, S. and Birkhoff, G. *Algebra.* 1967. New York: Collier-Macmillan.

LIST OF NOTATIONS

$H \leq G$	H is a subgroup of G
$H < G$	H is a proper subgroup of G
$\forall$	for all
$\exists$	there exists
$\varnothing$	empty set
$A \oplus B$	Direct sum of sets A and B
$\mathbb{N}$	set of natural number
$\mathbb{Z}$	group of integers
$2\mathbb{Z}$	group of even integers
$\mathbb{Q}$	group of rational numbers
$\mathbb{R}$	group of real numbers
$\mathbb{Z}_n$	group of integers modulo n
$\cong$	isomorphic to

Lead Determination in Ozamiz City Dumping Site through Flame Atomic Absorption Spectrophotometry

Esmael O. Larubis

Abstract

Lead concentrations in Ozamiz City dumping site located in Bongbong, Ozamiz City were randomly analyzed through Flame Atomic Absorption Spectrometer in USC-TC, Talamban, Cebu City. Along the 100-500 m perimeter of the dumping site, it was found that there was a minimal and acceptable level of Pb in the water, soil and plant material. Specifically, results showed < 0.1000 ppm in deep well water; < 5 mg/kg in plant leaves and roots; and 28.7 mg/kg in soil.

1. Introduction

A dump site has been the most primitive and common method of waste treatment and disposal. It has been temporarily storing, consolidating and processing heaped inorganic and organic waste materials. It is even handling radioactive substances that have been produced from power-generating plants, mining, smelting, semiconductor-related industries and other human activities. However, the accumulated wastes have intensive adverse effects towards marine and terrestrial organisms. Commercial and industrial wastes have been posing abnormalities to plant fertility and groundwater contamination. (Dorfman, 2004)

Lead-containing products and by-products are one of the groups of potential toxic wastes in the dump site. These can be found from a variety of sources such as paint, imported candies (containing chili and tamarind), lead-soldered cans, lead-glazed ceramics, china-leaded crystal glass wares, metallic jewelry, and some colors of ink and crayons. (New York Department of Health, March 2005)

In a three-hectare dump site of Ozamiz City, twenty-five (25) tons of waste materials are being thrown in the area everyday. These wastes are coming from commercial establishments and households within the twenty-three (23) barangays in the city. Most of these wastes are biodegradable materials. These wastes are being processed in a bioreactor to make soil conditioner. Soft and hard plastics, on the other hand, which probably contain lead, are left being dumped in the site. These wastes are heightening the problem of lead contamination in the nearby ecosystems.

In the dump site, the wastes are not segregated accordingly. When it rains, the water from the garbage will run through a canal in a private area. Further, the aforementioned dump site is in its utmost extent but it is still being used as dumping area by the city (Engr. Lambiquit, GSO Officer, Ozamiz City, Dec. 2008). In this manner, waste materials of the site can have a drastic effects to the aquatic and land habitat especially to the public health.

Theoretical Framework

A dumping site for wastes should normally have a tough foundation or base in which the materials will accumulate without being removed by ground waters. This will ensure that contaminants in the dumped waste will not be carried out to the different bodies of water or to the land where they could harm both the aquatic and terrestrial ecosystems. The depth of a dumping site should be over 20 meters. Shallow sites that are important as fishing grounds, spawning grounds and seabed characterized by transport bottoms must not be used for dumping (Colleen, 2008).

Open dumping method of disposal of household and commercial solid wastes is the most common disposal method used by about three-quarters of countries around the world (Rushbrook, 2001). This method is defined as the disposal of abandoned piles of garbage in land disposal site. These wastes are being disposed in a manner that poses health effects to people, wildlife and the environment (FedCenter.gov, 2006). It

occurs when large amount or piles of waste build up in areas not designed to handle such materials and it is illegal (hamiltoncountypublichealth.org). In many Asian countries, this method of waste disposal is mostly done for reasons such as unawareness of the health risks linked with dumping of wastes, acceptance of the present situation due to lack of financial resources to do anything better, and lack of political will to protect and improve public health and the environment (Kurian Joseph, *et al*.; March 2004).

At present, promoting or replacing open dumping sites is highly needed. But there are only limited resources and limited funds to operate and maintain land disposal sites. However, the improvement of this land sites can be achieved through a step-by-step process (Kurian Joseph, *et al*.). Uncontrolled open dumping sites of wastes can be controlled through some practices or steps that municipalities or other agencies must follow. There are four stages of disposal site development that have been given to improve an open dumping site to full sanitary landfill operations. It has been disputed that promoting of land disposal in any country will pass through these four distinct stages. It will take several years for each stage to become the established standard. However, each stage represents a significant improvement in safety and environmental impact over open dumping (Rushbrook, 2001).

Open dumping is the present stage of disposal site development that is being used widely by many middle and lower-income countries. The location of the dumpsite was chosen such that it is the only economical land available that would not affect interest groups within the municipality. No preparatory operation has taken place. Almost no control is exercised over the site operations or the way in which the waste is dumped. Now, open dumping practice is widely recognized by the government to be brought to an end.

The next stage is the controlled dumping. This is a step higher than the open dumpsite. There are basic control measures for a controlled dumpsite which include authorized persons for the site, regulations of the

wastes being dumped in a single controlled area, controls of vehicles in disposal of waste to the site, prevention of uncontrolled waste burning, construction of a drainage control, and establishment of some rules for the site workers. The purpose and advantage of this improvement is that it can be introduced quickly and can be achieved by most middle and lower-income countries without much additional funds. It will significantly improve the site and will enable to control the waste disposal operation.

The engineered landfill is the third stage. This is characterized as a disposal site where, by planning before construction or by modifications at an existing site, there is a regular and evident application of engineering techniques. These techniques are applied to control surface water from entering the disposed wastes by putting up a well constructed drainage system, to spread soil to cover the wastes, to pack the wastes together into smaller layers, to collect and remove the leachate away from wastes into a pond or similar structures, to expel the landfill gas out of the wastes, to improve the isolation of wastes from the surrounding geology, and to prepare the new parts of the landfill before receiving wastes. This third stage represents the longest transitional period since it involves the gradual accumulation within a municipality of engineering expertise and operational experience.

The last stage in disposal site development is the sanitary landfill. This is an engineered landfill where the processes and controls or use of products and residues are optimal and negative effects on the environment are minimal. The goal of this stage is to treat the waste within a lifetime. This can be achieved when the wastes are stabilized and the stabilized waste is extracted to make the space available for refilling. The realization of this level depends to a large extent upon the factors that control the chemical and biological processes which occur in the landfill wastes. Additional features are found in sanitary landfill such as pre-planned system of landfill gas control and utilization systems, extensive environmental monitoring and environmental protection obligations, an organized and well-qualified work force, detailed record-

keeping, on-site leachate treatment as an additional feature to the leachate collection system, closed circuit television, wide range of specialized mechanical equipment used, and complex, multi-layered lining systems to isolate waste from the nearby surrounding. It is recognized that the development of the sanitary landfill is a long-term process since it requires considerable financial resources. And achieving this standard of waste disposal is likely to be available only in a limited number of places over the next few years. (Kurian Joseph, *et al*., 2004 and Rushbrook, 2001)

Statement of the Problem

The main thrust of this research is to assess the effectivity of soil filtration for extracting toxic lead-containing leachates from Ozamiz City Dumping Site. This can be done by determining the lead-concentration of the soil, deep well water and plant tissues' absorptions. Thus, this research is opted to answer the following questions: "What is the average lead concentration of the water resource, soil and plant tissues within 500-m perimeter from the base of the dumping site?"

Significance of the Study

The results of this study will be helpful to the Local Government Units (LGUs) in monitoring the potential health risks of lead accumulation to water, plants and soil resources. This will give insight on the proper or improper functioning of the dumping site in the city. With this study at hand, it will provide suitable information on the effectivity of soil filtration through the hauled site.

Scope and Limitation

The study focuses on the determination of heavy metals in both the water run-off, plants and soil near the dumping site. The analysis is particular on lead absorption and its accumulation. This study is conducted within the perimeter of Ozamiz City Dumping Site – Bongbong, Ozamiz City. It takes sample from vegetations – including

rootcrops, shrubs, and vines; and also to the surface water located in the private land near the base of the dumping site.

2. Methodology

The plants are collected from 100-500 m perimeter from the base of the dumping site. A total of 20 plant leaves and roots of different species are collected and analyzed. Plant parts, especially roots are washed in fresh running water to eliminate dust, dirt and possible parasites. Then, they are washed with deionized water. Similarly soil samples were collected in plastic bags, dried and stored. Further, water sampling of the run-off water near the base of the dumpsite are manually collected through sterilized polyethylene bottles. During all these steps of sample processing, necessary measures were taken in order to avoid any loss or contamination with lead-containing materials.

A weighed 1 g of air-dried and sieved (< 2mm) soil is taken into a 250-mL erlenmeyer flask. Then, 15 mL of Aqua Regia (1HCl:3HNO_3) is added and swirled to wet the sample. The flask is then heated at 50.0^{0}C for 30 minutes. The temperature is raised to 120.0^{0}C and the heating is continued for 2 h. The flask is then cooled and added with 10 mL of 0.25 M HNO_3. The solution is filtered through a Whatman No. 542 filter paper. The flask and filter paper are washed with small aliquots of 0.25 M HNO_3. The filtrate and washings are transferred to a 50-mL flask and made-up to the mark with 0.25 M HNO_3.

On the otherhand, a weighed 1 g of crushed and powdered plant materials like root, stem, leaves and seeds are placed into a half-covered crucible. They are then heated in the furnace for 4 h keeping the temperature 550^{0}C. The contents of the crucible are then cooled in a dessicator. Then 2.5 mL 6M HNO_3 solution is added to the dish to dissolve its contents. The solution is transferred to a 50-mL flask and is diluted to the mark of 50 mL.

The analysis of heavy metal is performed through flame atomic absorption spectrophotometer (Perkin Elmer Model 3000 Atomic Absorption Spectrometer) using air/acetylene flame. Samples of run-off water were analyzed directly, without pretreatment, by FAAS. For the lead determination, the FAAS apparatus is established with the following sensitivity and detection limits respectively – 0.2 and 1.0 mg/kg. (Hussain, F., et.al, 2006)

3. Results and Discussions

The spectroscopic method used to generate Pb absorptions at UV region obtained the following standard calibration curve at concentration range of 0.0000-1.0000 ppm, as illustrated in Figure 1.0. The result shows a regression constant, r equal to 0.9995. This implies that the data obtained from standard calibration yield high precision and thus, can be precisely used for Pb analysis.

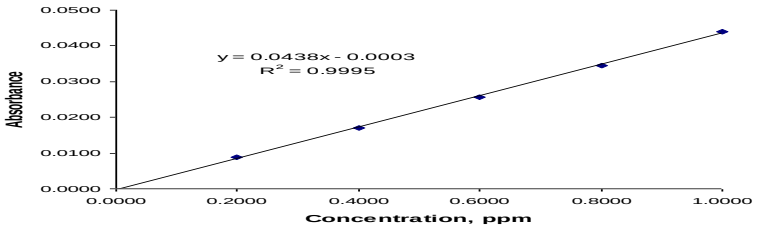


Figure 1.0. Standard Calibration Curve for Pb Absorption

Soil and plant tissues in samples taken from Ozamiz City Dumping Site show considerably higher Pb absorptions than water, as shown in Table 1.0. Further, lead in soil is far much greater than any other two sample types. It yields 23.7 mg/kg more Pb than plant tissues. While deep well water analysis shows a less significant amount of lead. The values reflected in Table 1.0, agrees with the normal values of Pb,

which are below 100 ppm in any sample taken (Impact of Lead-Contaminated Soil on Public Health; 1992).

Table 1.0: Average Lead Concentration of Sample Taken from Ozamiz City Dumping Site

SAMPLE TYPE	CONCENTRATION
Deep Well Water	Less than 0.1000 ppm
Plant Leaves and Roots	Less than 5 mg/kg
Soil	28.7 mg/kg

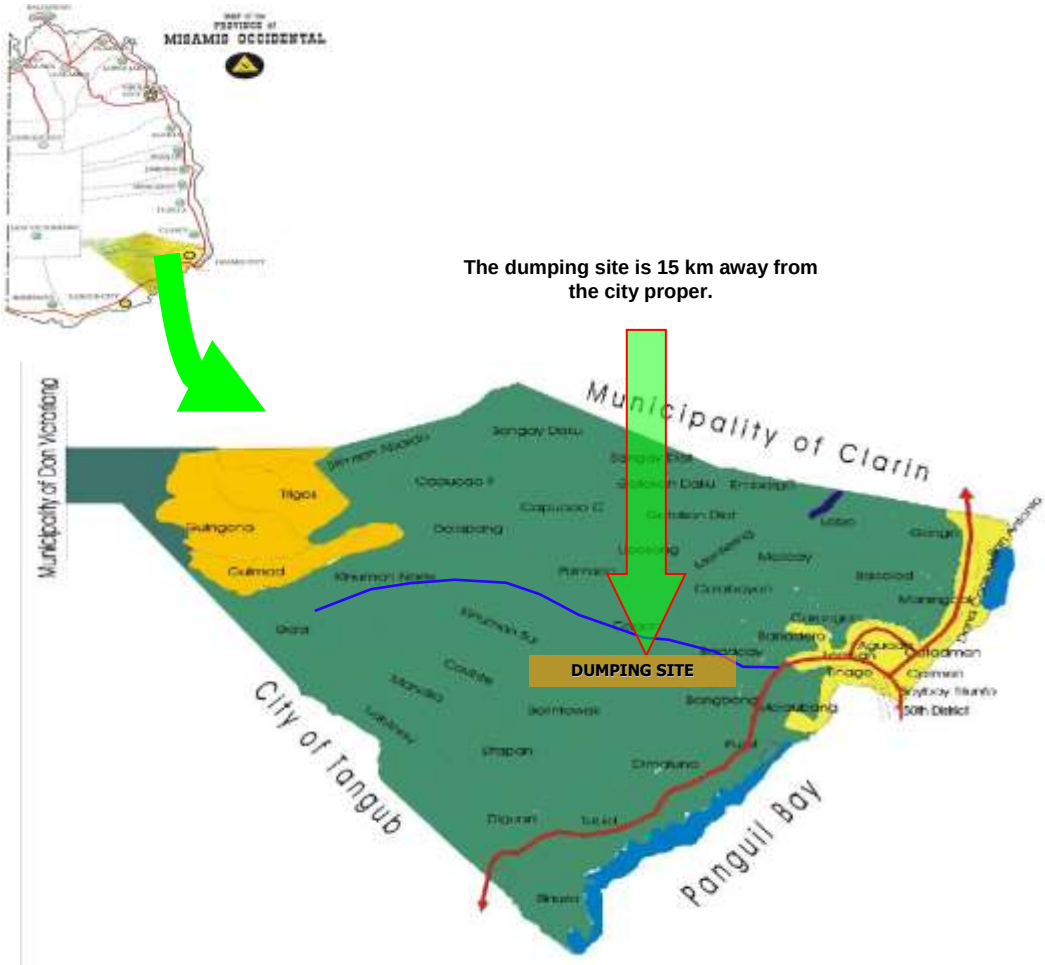
4. Conclusion and Recommendation

Conclusion

Ozamiz City Dumping Site contained negligible amount of lead and lead by-products. Pb absorptions, as reflected in concentrations obtained showed low peaks and acceptable values of Pb in water, soil and plant samples. Results in soil and plant tissues had reflected that the bioaccumulation of lead and lead by-products are minimal in amount. Lead-content in terrestrial surface has greater lead concentration than the plant material. This implies that there is low absorption of the high-molecular weight lead and lead-derivatives. On the other hand, the concentration of lead in deepwell water implies that water leach out from the dumping site yields insignificant amount of lead and lead by-products. Water resources within the 500-m perimeter of the dumping site are lead-free.

Recommendation

Further analysis in tissues and blood of stray animals is required to fully uncover the scope of this research study. The implication will cater towards the distribution of healthy and safe foods in Ozamiz City public market. On the other hand, the researcher still recommends the used of flame atomic absorption spectrophotometry to analyze lead content in the previously said samples.



List of References

Hussain, F. Khan, I. Khan, L. Khan and Wali-Ullah. June 5, 2006 Determination of Heavy Metals in Medicinal Plants; Journal of Chemical Society. Vol 28, No.4,

Kurian Joseph, R. Nagendran, C. Visvanathan. March 2004 Sustainable Approach for Management of Dumpsites in Asia; Centre for Environmental Studies, Anna University, Chennai – 600 025, India, p. 2.

Rushbrook, P. 2001 Guidance on Minimum Approaches for Improvements to Existing Municipal Waste Dumpsites, WHO Regional office for Europe, Copenhagen.

Colleen, Emma (2008). Dumping Waste at Sea.; Uploaded from: emma.colleen(a)naturvardsverket.se. Date retrieved: Sept. 29, 2008.

Dorfman, Marjorie. The Garbage Disposal: What Else Can It Do?; 2004

_____, Sources of Lead; New York Department of Health (March 2005).Uploaded from: http://www.health.state.ny.us/environmental/lead/lead_sources.htm. Date retrieved: December 2008

Engr. Lambiquit, GSO Officer, Ozamiz City: December 2008

Acknowledgement

The author would like to acknowledge the following research assistants who had devote their time and patience for the completion of this research study: **Haidee Patoc**, **Girlie Petiluna** and **Marjon Hisoler**.

Implementation of the Two Probe Method: A Technique in Measuring Electrical Properties

Aldrich T. Caballo
Loremay A. Acebron

Abstract

In this study, the electrical properties, such as resistivity and conductivity are obtained using Ohm's Law and the resistivity equation. Measurements are done under normal lighting conditions and at room temperature. The results show that the carbon rod has higher resistivity than lead and are found to be in the range of conductors. The tool used to implement two-probe measuring technique though it gives values far from the standard value; it is a very useful tool to demonstrate differences on resistivity and conductivity between samples. The two-probe technique which is used to measure near insulator resistivity can also be used to measure resistivities of conductors depending on the availability of the equipment.

1. Introduction

Electrical characterization of certain materials has shown its greatest influence in the field of science and has proven to have important applications. One of these is the discovery of resistors and conducting materials which have brought great development, especially in making electricity safe for home consumption (Acebron, 2008).

The measuring techniques widely known to determine electrical properties of materials are the two-probe method and the four-probe method wherein the former is the most commonly used one because it is simple and inexpensive compared to the four-probe method (Whitaker, 1996). The two-probe and four-probe techniques have been used to characterize almost all semiconductor products available in the world today. These techniques have paved the way in discovering semiconductor materials other than the materials found in the periodic

table of elements. The two probe method is used to measure resistivity of very high resistivity samples – near insulators which is beyond the range of four-probe method.

Applicable samples would be insulators of conductivity ranging from 10^{-8} to $10^{-18.}$ Examples are glass, diamond, quartz, etc. Quartz has conductivity in the order of 10^{-16} (Acebron, 2008]· This study implements two probe method in measuring resistivity and conductivity of highly resistive samples.

Statement of the Problem

Measuring techniques for determining the electrical properties of certain materials for the discovery of its application is unavailable. The good thing is, two-probe method is easy to set-up and individual apparatus could be present (Whitaker, 1996). Other universities are now discovering or experimenting on a variety of materials towards determining their application in the real world and maybe sooner they can produce a product out of the results they have acquired (Acebron, 2008). This could be the start of opening the idea of maybe improving the said method and of acquiring better methods towards giving way to the material science laboratory. Though it sounds impossible but obtaining big things always start from something small.

Objectives of the Study

This study utilizes the two-probe method technique of measuring electrical properties using the available apparatuses. Specifically, this study aims to:

1. Fabricate a tool that can be used to fasten a sample for the measuring purposes using a locally available material

2. Test samples using the fabricated tool.

3. Differentiate the resistivity and conductivity of the samples (carbon rod and lead).

Significance of the Study

The two-probe and four-probe techniques have been used to characterize almost all semiconductor products available in the world today. These techniques have paved the way in discovering semiconductor materials. The two probe method is used to measure resistivity of very high resistivity samples – near insulators which is beyond the range of four-probe method (Whitaker, 1996). This study investigates the conductivity and resistivity that can be obtained by utilizing the two probe method using the apparatuses available in the Physics Laboratory of LSU-Ozamiz City.

Scope and Delimitations

This research study presents the measuring technique called the two probe method. It will also determine appropriate materials that should be used and will present a tool that will fasten samples for measuring purposes. This study will utilize available apparatuses in the Physics Laboratory of LSU-Ozamiz. Ranges of available apparatuses in terms of how much they can measure is beyond the researchers' control. This is a research study that represents available measuring technique and in determining the availability of the equipment to be used.

This research study focuses on the representation of the two-probe method. The apparatuses to be used are ammeter, voltmeter and a varying power supply which are from the Physics Laboratory of La Salle University – Ozamiz City. The samples are lead and carbon rod, where the latter can be affected by impurities.

Review of Related Literature

Conductors and Insulators

Table 1: Conductivity and resistivity ranges

	Resistivity(Ωm)	**Conductivity (S/m)**
Insulators	10^{6} to 10^{17}	10^{-18} to 10^{-7}
Semiconductors	10^{-3} to 10^{5}	10^{-6} to 10^{3}
Conductors	10^{-9} to 10^{-2}	10^{2} to 10^{8}

Suppose the researchers were to electrically charge two isolated metal spheres: one with a positive charge, and the other with an equal negative charge. They could then perform a number of simple experiments. For instance, one could connect the spheres together using a length of string. In this case, he would find that the charges residing on the two spheres were unaffected. Next, one could connect the spheres using a copper wire. In this case, he would find that there was no charge remaining on either sphere. Further investigation would reveal that charge must have flowed through the wire, from one sphere to the other, such that the positive charge on the first sphere completely canceled the negative charge on the second, leaving zero charge on either sphere. Substances can be classified into two main groups, depending on whether they allow the free flow of electric charge. Conductors allow charge to pass freely through them, whereas insulators do not. Conductors have a very low resistance to electrical current while insulators have a very high resistance to electrical current. These two factors become very important when one starts to deal with actual electrical circuits. Obviously, string is an insulator, and copper is a conductor. As a general rule, substances which are good conductors of heat are also good conductors of electricity. Thus, all metals are conductors, whereas air, (pure) water, plastics, glasses, and ceramics are insulators. Incidentally, the distinction

between conductors and insulators was first made by the English scientist Stephen Gray in 1729.

Metals are good conductors (both of heat and electricity) because at least one electron per atom is *free*: *i.e.*, it is not tied to any particular atom, but is, instead, able to move freely throughout the metal. In good insulators, such as glass, all of the electrons are tightly bound to atoms (which are fixed), and so there are no free electrons.

Insulators are used to protect people from the dangerous effects of electricity flowing through conductors. Sometimes the voltage in an electrical circuit can be quite high and dangerous. If the voltage is high enough, electric current can be made to flow through even materials that are generally not considered to be good conductors. Our bodies will conduct electricity and you may have experienced this when you received an electrical shock. Generally, electricity flowing through the body is not pleasant and can cause injuries. The function of our heart can be disrupted by a strong electrical shock and the current can cause burns. Therefore, we need to shield our bodies from the conductors that carry electricity. The rubbery coating on wires is an insulating material that shields us from the conductor inside. Look at any lamp cord and you will see the insulator. If you see the conductor, it is probably time to replace the cord (Young et.al., 2004).

Resistivity and Conductivity

The resistivity of a material is the opposing force a material exerts to prevent flow of current when voltage is applied across it and conductivity depends upon the number of free carriers (electrons) and their mobility. If the resistivity of a material is known, the resistance of a rectangular block of material is determined by

$$R = \rho L / w\, t = \rho L / A \qquad (1)$$

Where R is the resistance of the material measured in ohms, ρ is the resistivity of material (ohm.cm), L = length of the material from contact to contact, w = width, t = thickness, A = wt = cross-sectional area. The resistivity can be obtained using this derived formula

$$\rho = RA/L \qquad (2)$$

The conductivity is the reciprocal of resistivity, (Young et.al., 2004)

$$\sigma = 1/\rho \qquad (3)$$

[5]

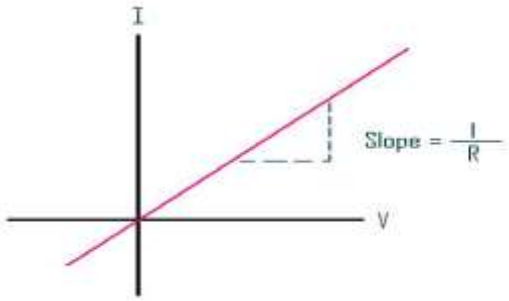


Figure 1. The reciprocal of the slope from the I-V curve is the resistance of the material (Young et.al., 2004).

Batteries The role of carbon in electrochemistry probably started in 1792 with the discovery by Alessandro Volta (Italy) that charcoal could be substituted for metals in galvanic experiments (forerunner to the discovery of batteries). Perhaps the first practical application of carbonaceous materials in batteries was demonstrated in 1866 by Georges Leclanche in cells that bear his name. A more modern version of the Leclanche cell is the alkaline-manganese dioxide (MnO_2) cell.

The outer case is usually made of a thin metal sheet. Coarsely ground manganese dioxide is mixed with an equal volume of carbon to form the cathode (positive electrode). Carbon powders such as acetylene black and graphite are commonly used to enhance the conductivity of the positive electrodes in alkaline batteries. The particle morphology plays a significant role, particularly when carbon blacks are used in batteries as an electrode additive to enhance the electronic conductivity. One of the most common carbon blacks that are used as an additive to enhance the electronic conductivity of electrodes that contain metal oxides is acetylene black. A suitable carbon for this application should have characteristics that include:

(i) low resistivity in the presence of the electrolyte and active electrode material,
(ii) absorb and retain a significant volume of electrolyte without reducing its capability of mixing with the active material;
(iii) exhibit compressibility and resiliency in the cell; and
(iv) contain only low levels of impurities.

Graphite has higher electrical conductivity than acetylene black but it is not capable of retaining the same volume of electrolyte or demonstrating the same mechanical properties in the cell. Acetylene black has a well-developed chain structure, and it is this characteristic which provides the capability to retain a significant amount of electrolyte. Acetylene black is capable of retaining over three times as much electrolyte (cm^3 electrolyte/g carbon) as graphite, which has a very low structure. The capacity of Leclanche cells is dependent on the amount and type of carbon black that is used. Generally about 55 volume % carbon black mixed with manganese dioxide yields the maximum capacity. This composition agrees closely with the minimum in the electrical resistivity of the electrode mixture. The high electronic conductivity, chemical inertness and low cost are beneficial for the use of carbon for electrode materials in these batteries.

A carbon rod is used as a current collector for the positive electrode in cells. The carbon rod is made by heating extruded mixture of carbon (petroleum coke, graphite) and pitch that serves as a binder. A heat-treatment temperature of about 1100°C (2012°F) is used to carbonize the pitch and to produce a solid structure with low resistance. For example, heat treatment reduced the specific resistance from 1 to 0.0036 Ω.cm and the density increased from 1.7 to 2.02 g/cm^3.

Lead Lead is the heaviest member of the **carbon** family. Throughout history, Lead has been used to make water and sewer pipes; roofing; cable coverings; type metal and other alloys; paints; wrappings for food, tobacco, and other products; and as an additive in gasoline. Lead rarely occurs as a pure element in the earth. Its most common ore is galena, or lead sulfide (PbS). Other ores of Lead are anglesite, or lead sulfate ($PbSO_4$); cerussite, or lead carbonate ($PbCO_3$); and mimetite ($PbCL_2 \circ Pb_3(AsO_4)_2$). Lead is a moderately active metal. It dissolves slowly in water and in most cold acids. It reacts more rapidly with hot acids. It does not react with oxygen in the air readily and does not burn.

Lead[1] is a heavy, soft, gray solid. It is both ductile and malleable. Ductile means capable of being drawn into thin wires. Malleable means capable of being hammered into thin sheets. It has a shiny surface when first cut, but it slowly tarnishes (rusts) and becomes dull. Lead is easily worked. "Working" a metal means bending, cutting, shaping, pulling, and otherwise changing the shape of the metal. Lead does not conduct an electric current, sound, or vibrations very well (Kinoshita, 2001).

Impurity By the addition of almost infinitesimal amounts of such other elements called "impurities", the basic electrical properties of pure semiconductor materials can be modified. Consequently, the presence of such excess electrons makes the material a better conductor, i.e., its resistance to current flow is reduced. Impurity elements which are added to silicon crystals to provide excess electrons include arsenic and antimony or a pure material (http://www.eteonline.com/contact.html). Another case is when a semiconductor material will have reduced

conductivity when doped with other material. For example, organic materials doped with basic compound will tend to reduce its conductivity. So an impurity can reduce or increase resistivity of a pure substance (Acebron, 2008).

[1] Conductivity of Lead is shown in Appendix B.

Electrical Characterization Electrical characterization techniques can either be somewhat specialized or can be based on measurements of two and three terminal devices such as diodes and transistors. If a sample has uniform resistivity in a known thickness, the resistivity can be calculated from the measured resistance (Baca, 2005).

In two-probe resistance measurement technique, current is measured as a function of voltage and the resistance will include a contribution from the probes and the probe contact resistance. A four-point probe method is a means of eliminating the extraneous sources of resistance by using two extra probes to measure the voltage across a section of the current path and calculating its resistance across a known distance using a known current, forced by the first two probes.

Two Probe Method for Resistivity Measurement of Insulators The Two Probe Method is one of the standard and most commonly used method for the measurement of resistivity of very high resistivity samples - near insulators. The resistivity measurement of such samples is beyond the range of Four Probe Method (Whitaker, 1996).

2. Methodology

Materials and Equipment

Fabricated glass

This material is an insulator of very low resistance. Its purpose is to have the sample be sandwiched. It must be of much lower resistance

compared to the sample so that no transfer of electrons would occur that would affect the resistivity of the pellet.

Pelletized Sample

A powdered sample is pelletized by using the hydraulic press.

Figure 2.1.1. A picture of two pellets formed using hydraulic press.

Low resistance wires

Low resistance wires are used as the probe in relation to the two probe method.

Low current source

Low current source is used to supply minimal amount of current in the sample.

Digital Multitester & Nanoammeter

The digital multitester can measure current that ranges from 200 mA to 200 µA and voltage from 200 mV to 1000V. While the nanoammeter is used to measure low current level from 100 pA to 200 µA

Electrical Characterization

Figure shows the schematic diagram of the two probe method set-up. The ammeter (symbol ~) is in series with the sample and the voltmeter is placed parallel to the sample.

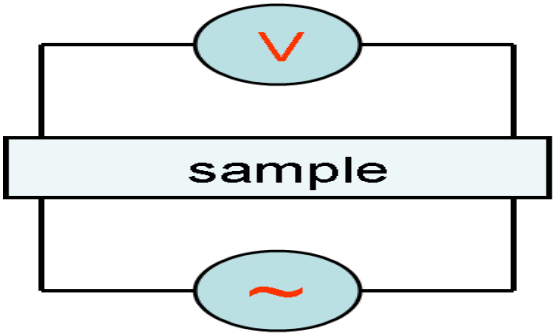


Figure 2.2.1. A schematic diagram of the two probe method set-up where the pictures of equipment be placed.

Making a tool to fasten the sample

Figure 4 shows a sample sandwiched between two rectangularly formed glasses. The low resistance wires act as probes on where voltmeter and ammeter are to be attached. These wires are placed above and below the sample.

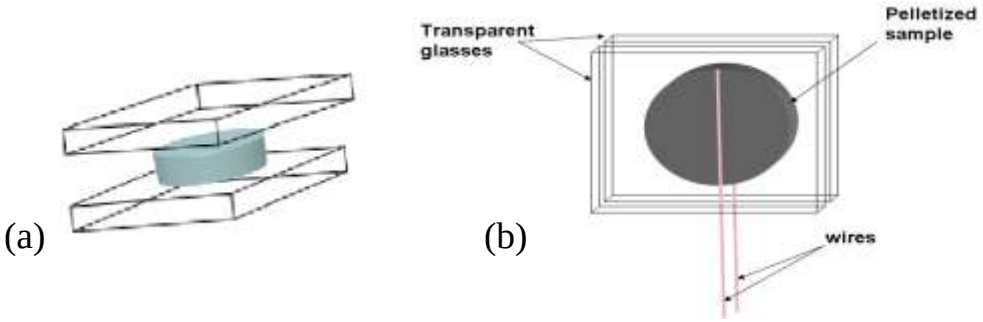


Figure 2.2.2. (a) and (b) show the set-up on which a sample is prepared for characterization purposes

A varying source will supply current to this circuit. Electric potential and current readings are obtained by the voltmeter and ammeter devices. Minimal amount of current is supplied and then incremented until a data of current and its corresponding voltage reading is gathered. These values are then plotted. The slope of the graph corresponds to the reciprocal of the resistance. The resistivity is obtained by using equation (2). The conductivity is taken as the reciprocal of the resistivity ρ.

3. Results and Discussion

Carbon Rod Characterization Results

Table 2: The results obtained for each carbon rod sample show slight differences

Sample #	Area,m2	thick,cm	resistance,Ω	resistivity,Ω m
1	4.83983E-05	0.2	0.786790757	0.019039672
2	4.83983E-05	0.33	1.566653242	0.022976779
4	4.83983E-05	0.315	1.227052023	0.018853094
average resistivity				0.020289848

Table 2 shows the resistivity and conductivity of the carbon rod using the fabricated two probe method. Resistivity of the carbon rod in a battery is 3.6×10^{-5} Ωm ($\sigma = 2.7778 \times 10^{4}$) while the resistivity obtained using the fabricated two-probe method is in the order of 10^{-2}

The results could be due to the following factors:

ii. impurities affecting the sample;
iii. incapacity of the fabricated tool to generate or support correct data.

2 I-V curves of the Lead samples for obtaining the resistance are shown Appendix A.

Lead Characterization Result

Table 3: The results obtained for each sample are almost the same

Sample #	**Area,m2**	**thick,cm**	**resistance,Ω**	**resistivity,Ω m**
1	0.00005852	0.2	0.438480548	0.012829941
2	0.000033	0.18	0.675909761	0.012391679
3	0.00004686	0.18	0.580687729	0.015117237
average resistivity				0.013446286

Table 3[1] shows the results obtained in characterizing the lead sample. The results could mean that the lead sample has constancy in the order of $10^{-2.}$ Such that these samples could not be easily affected by impurities because of its compact surface. This would also imply that gathering data using the fabricated two-probe technique needs revision and could also be used to determine whether a material is more conductive or resistive than the other material.

[3] I-V curves of the Lead samples for obtaining the resistance are shown Appendix A.

4. Conclusion and Recommendations

After the experimentation we come up with the following conclusions: The fabricated tool can be used to compare whether a material is more conductive or resistive than the other material.

The carbon rod and lead samples are successfully formed into its desired shape. Characterization is also done by using the fabricated tool which shows that these two samples are both electrical conductors.

Also, carbon rod is found to be more resistive than lead. Meaning, lead is more conductive than the carbon rod.

With the result of the experiment the researchers would like to recommend the following:

Since there is no procedure to determine impurities of the samples or way to secure standard samples it is observed that the tool used gives a value for resistivity for each type of material which is incomparable with the standard value for each type. For this, it is recommended to secure and test standard samples where their resistivity are known.

With the procurement of the standard samples it is recommended to conduct experiment to validate the accuracy of the two probe method in determining the resistivity of a material.

It is also recommended to use highly resistive samples to validate the capability of the tool.

List of References

Acebron, Lorimay. (2008). Characterization of KOH Doped Polyaniline Pellets. Department of Physics, MSU-IIT

Whitaker, J.C. (1996) Electronics Handbook pages 470-472

Young, Hugh; Freedman, Roger. (2004), University Physics with Modern Physics, 11th Edition. Pearson Education, Inc.

Baca, A.G.; Ashby C.I. (2005). Fabrication of Gas Devices Institution of Electrical Engineers

Rinoshita, Kim (2001), Electrochemical Uses of Carbon. Lawrence Berkeley National Laboratory. Berkeley, CA 94720, USA

Electronic Technical Enterprises. Uploaded from: http://www.eteonline.com/contact.html. Date retrieved: March 28, 2009

Determination of Solvent System for the Separation of the Components of Selected Plants Using Paper Chromatography

Lito A. Real
Maria Cristina M. Llauder
Engr. Josephine H. Lomusad

Abstract

This study aims to determine the most suitable solvent system for the separation of the components of selected plant leaves using paper chromatography. The UV lamp is the visualizing instrument of the components of the plants. The results showed that toluene:2-propanol is better in terms of separating the components of plant sample one (1). None of the solvent systems is able to separate each components of the second plant sample. Both solvent systems can separate the components of the third plant sample, but chloroform:ethanol shows more components extracted than the toluene:2-propanol.

1. Introduction

People in all corners of the world have been using plants for many purposes. In the Philippines, plants are still popularly used to cure various kinds of ailments. Researchers in the field of natural products chemistry are seeking for novel compounds and possible active components that can cure specific disorders in several organisms most specially in humans. Nowadays, certain methods are developed to monitor the quality of medicinal plants used by many people. In fact the Department of Health (DOH) provides a list of common plants that are known to cure or at least alleviate certain abnormal conditions experienced by humans.

In the analysis of plants, one indispensable way of separating its components is through the use of chromatography. The method plays a

vital role in the isolation, purification, assay, elucidation, and synthesis of target compounds. Chromatography, though simple and basic, is the key analytical tool in the discovery of new active substances. Without it, research on herbal medicines would be impossible (Dayrit, 2002) (Paano, 2000) (Quisumbing, 1981).

Research on bioactive components in plants is very important because it would pave the way to the verification of the common and popular notion that plants, when used in treating diseases, is totally safe. Many believe that because it is "natural" then there would be no overdose. Meaning, it can be taken anytime of the day without concern on how much is supposed to be taken in. The more you take it in higher doses, the better.

Because the Philippines is a third world country and many of its citizens don't have the access to effective and costly medicines, people resort to what is available in nature. Not only that, even those who can afford high cost drugs would resort to it because many plants are scientifically proven to cure various illnesses and are safe to use (Quisumbing, 1981).

Objective

In this study, the researchers aim to find the solvent systems that could separate the possible UV and bioactive components of three selected plant samples. Also, the study aims to find how many UV active components do the plant samples have according to the chosen solvent system specified in table 1 below.

Table 1: Solvent System

Solvent System 1		**Solvent System 2**	
Toluene (mL)	2-propanol (mL)	Chloroform (mL)	Ethyl alcohol (mL)
10.0	0.0	10.0	0.0
9.0	1.0	9.0	1.0
8.0	2.0	8.0	2.0
7.0	3.0	7.0	3.0
6.0	4.0	6.0	4.0

Significance of the study

In the chemistry of natural products, the search of suitable solvent system is the very first step before one could screen for a specific compound that is active. Before isolating the pure form of an active compound, it is essential to establish the right mixture of an array of solvents that would do the job. After which the isolation, purification, assay, and elucidation of the compound can be done.

This study would also serve as a baseline for future search of possible novel compounds and bioactive substances found in the selected plant samples.

The technique can be used as a guide for introductory organic chemistry students on how to go on with natural products research. In the future, LSU chemistry majors can use the method in teaching high school chemistry on its role in medicinal research.

Scope and limitation

The study focuses on the search for the most suitable solvent system that can resolve the components of the plant samples. Solvent choice is limited to what is available in La Salle University Chemistry

Laboratory. The visualizing agent used in this research is the UV lamp because it is the only available visualizing material. The result of this research is mainly due to the purity of the available reagent that the school's science laboratories have.

2. Methodology

The Plant Samples

Plant sample one (1) is locally known as Gmelina. Its leaves is usually placed in contact with the skin at the back and allowed to stay for at least twenty four hours. Users claim that it can alleviate arthritis and remove back pains.

The second sample is normally heated before applying to the wound of a diabetic person.

When the juice starts to come out of the plant, it is squeezed and allowed to drip on the open wound. Locals call it "espada" because of its shape and appearance.

At present, the third plant sample has no known medicinal value. The researchers include it in the study in the hope that a profile of the plant is established and biologically active compounds may be isolated and synthesized in the future.

Chromatographic Method of Analysis

Several chromatographic techniques are widely used in natural products chemistry and medicinal science. It includes paper chromatography, which is used in this research, *thin layer chromatography* (TLC), *column chromatography*, *gas chromatography* (GC) and *high performance/pressure chromatography* (HPLC). All of these techniques have two (2) components namely the stationary phase

and the mobile phase. The stationary phase is usually polar which include the chromatography paper, silica, and alumina.

The mobile phase varies from highly polar to non polar depending on the choice of the researcher. In many cases, researchers employ paper and TLC to screen an array of solvent systems until the most number of spots is separated or resolved. When the appropriate solvent system is determined, column chromatography is used to separate the components of the sample. Once the components are separated, GC is used to confirm the purity of the components separated from the column. When the separated components are confirmed to be pure, bioassay and structure elucidation using the combination of infrared spectroscopy (IR), carbon and hydrogen nuclear magnetic resonance (C and HNMR), and mass spectrometry (MS) (Scott, 2008).

III. Experimental

Approximately 50.0 grams of two fresh plant leaves is macerated with 20.0 mL of 2-propanol for at least 30 minutes. It is then squeezed using cheesecloth to remove the liquid. The filtrate is evaporated in steam bath to approximately one-fourth (1/4) its original volume. The concentrate is then applied to a chromatography paper as shown in figure 1. It is then dried, carefully placed in a solvent system, and covered as shown in figure 2. When the solvent almost reached the top of the paper, it is removed and allowed to dry. Before the chromatogram is visualized under a UV lamp, the distance traveled by the solvent is measured. The distance traveled by the spot is measured and marked after seeing it under the UV lamp as shown in figures 3 and 4. The retention factor or R_f value of the spot is calculated using the formula

$$R_f = \frac{\text{Distance traveled by spot}}{\text{Distance traveled by solvent}}$$

The entire process is performed twice to verify the results obtained in the first run.

A different mode of extraction is employed on the second plant sample. It is heated in an open flame until the juice starts to come out of the sample. The plant is then squeezed and set aside for chromatographic determination. Solvent extraction is no longer applied in the initial separation because the sample gave a considerable amount of liquid when squeezed.

Figure 1. Spotting the chromatography paper with extract

Figure 2. Placing the sample in the chamber with solvent system

Figure 3. Marking the distance traveled by solvent and the spots (Scott, 2008)

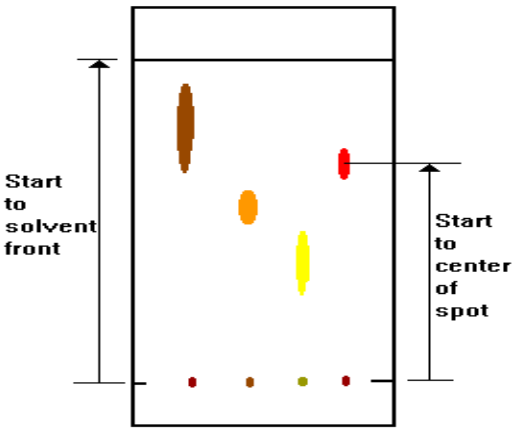
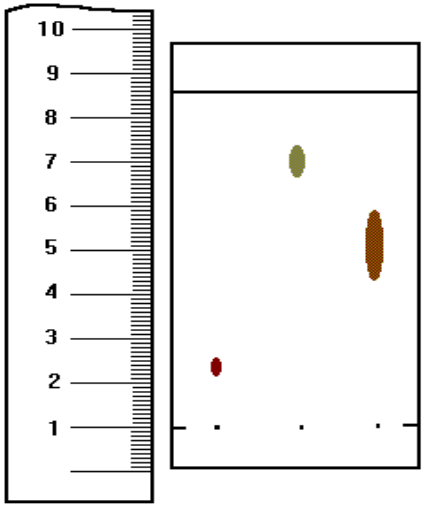


Figure 4. Measuring the distance traveled by solvent and the spots (Scott, 2008)



3. Results and Discussion

Table 2: Solvent System 1-Plant Sample 1 (Gmelina)

Solvent (mL)		Run 1			Run 2			Average R_f
		Distance Traveled (mm)		R_f	Distance Traveled (mm)		R_f	
Toluene	2-propanol	Solvent	Spot		Solvent	Spot		
10.0	0.0	50.0	13.0	0.260	46.0	11.8	0.257	0.258
			22.0	0.440		20.0	0.435	0.437
			35.0	0.700		32.1	0.698	0.699

Table 2, continued								
9.0	1.0	49.0	9.0	0.184	52.0	9.8	0.188	0.186
			19.0	0.388		20.0	0.385	0.386
			40.0	0.816		42.8	0.823	0.820
8.0	2.0	53.0	19.0	0.358	46.0	16.8	0.365	0.362
			35.0	0.660		30.6	0.665	0.663
			44.0	0.830		38.0	0.826	0.828
7.0	3.0	45.0	43.0	0.956	38.0	36.0	0.947	0.951
6.0	4.0	50.0	9.0	0.180	39.0	6.9	0.177	0.178
			44.0	0.880		34.0	0.872	0.876

Table 2 shows that the spots using the pure toluene, 9:1, 8:2, and 6:4 solvent systems have varying polarity. The spot with R_f value 0.285 indicates that the component adhered more to the stationary phase. This simply implies that its polarity is closer to that of the paper than the solvent. An R_f value of 0.951 indicates that the compound have high affinity to the 7:3 toluene:2-propanol solvent system. The spots with R_f value ranging from 0.437- 0.699 have polarity somewhere between that of the stationary and mobile phase. The rest of the R_f values indicate that the polarity is higher because it traveled together with solvent system with increasing polarity.

The results further show that there are at least twelve (12) components of the sample. Five (5) of which are affinite to the stationary phase, three (3) are intermediate and four (4) have high affinity to the mobile phase.

Table 3: Solvent System 2-Plant Sample 1
(Gmelina)

Solvent (mL)		Run 1			Run 2			Average R_f
		Distance Traveled (mm)		R_f	Distance Traveled (mm)		R_f	
Chloroform	Ethanol	Solvent	Spot		Solvent	Spot		
10.0	0.0	50.0	8.7	0.174	46.0	6.2	0.177	0.176
9.0	1.0	53.0	19.0	0.358	52.0	18.8	0.362	0.360
			40.1	0.757		39.5	0.760	0.758
8.0	2.0	49.0	11.0	0.208	46.0	9.4	0.204	0.206
			46.0	0.868		40.0	0.870	0.869
7.0	3.0	48.0	20.0	0.377	38.0	14.5	0.382	0.379
			41.0	0.854		32.3	0.850	0.852
6.0	4.0	44.0	19.1	0.382	39.0	14.7	0.387	0.384
			35.2	0.704		26.5	0.679	0.692

The data show that the polarity of many of its components is polar. Five (5) out of nine (9) the spots have R_f value that are less than five (5) which means that it adheres more to the polar stationary phase.

The toluene: 2-propanol solvent system is more effective in separating the non polar components because half of the separated components has R_f values greater than five (5). The components with R_f value ranging from 0.176 – 384 can be increased by reversing the ratio between chloroform:ethanol mixture.

Plant sample three (3) gave no visible results to the analysis. The chromatogram has shown that no spots are present when viewed under the UV lamp. The spots present may be made visible using other visualizing agents like iodine chamber, vanillin-sulfuric acid, and chromic acid solution.

Table 4: Solvent System 1-Plant Sample 3

Solvent (mL)		**Run 1**			**Run 2**			**Average R_f**
		Distance Traveled (mm)		**R_f**	**Distance Traveled (mm)**		**R_f**	
Toluene	**2-propanol**	**Solvent**	**Spot**		**Solvent**	**Spot**		
10.0	0.0	45.0	10.0	0.222	52.0	11.4	0.219	0.221
			32.0	0.711		36.1	0.694	0.703
			39.0	0.867		45.3	0.871	0.869
9.0	1.00	50.0	10.0	0.200	53.0	10.4	0.196	0.198
			19.0	0.380		19.6	0.377	0.378
			40.0	0.800		41.4	0.796	0.798

Table 4 shows that at least three 3 of the component are polar and adhere more to the paper due to the low R_f value ranging from 0.198 - 0.378. The other three components are more non polar because they travel together with the solvent. Furthermore, the solvent system is able to separate six (6) components.

Table 5: Solvent System 2-Plant Sample 3

Solvent (mL)		Run 1			Run 2			Average R_f
		Distance Traveled (mm)		R_f	Distance Traveled (mm)		R_f	
Chloroform	Ethanol	Solvent	Spot		Solvent	Spot		
10.0	0.0	46.0	38.0	0.826	38.0	31.2	0.821	0.824
			40.0	0.870		33.4	0.879	0.874
9.0	1.00	48.0	44.0	0.917	45.0	42.0	0.933	0.925
8.0	2.0	45.0	30.0	0.667	42.0	27.5	0.655	0.661
			35.0	0.778		32.2	0.767	0.772
7.0	3.0	40.0	20.0	0.500	45.0	22.1	0.491	0.496
			29.0	0.725		32.4	0.720	0.723
6.0	4.0	20.0	16.0	0.800	32.0	25.9	0.809	0.805

Tables 4 and 5 show that chloroform: ethanol system is more promising in terms of separating the components of the sample. From the number of spots separated, the second solvent system separated at least 8 components of the sample.

The first solvent system is more effective in separating varying polarity of the components based on the R_f values obtained. The non polar components are more resolved in the second solvent.

4. Conclusion and Recommendation

From the results, it can be concluded that in separating the components of the samples, it is essential to use an array of solvent systems because it is possible that the components separated by one solvent can not be separated by the other systems. It would be good to analyze the samples using gas chromatography to verify how many compounds are there in the extract.

It is also advisable to use other visualizing agents like iodine chamber, vanillin-sulfuric acid, and chromic acid solution so that components that are invisible in UV lamp can be seen.

List of References

Dayrit and Pasuelo (May 2002). Development of Quality Assurance Methods for Medicinal Plants Using Thin Layer Chromatography. Journal of Multidisciplinary Studies**.** Volume II Number 1.

Paano et al (May 2000). Pandanus Alkaloids as Potential Key to Pandanaceae Systematics. Proceedings of the 16th Annual Philippine Chemistry Congress.

Quisumbing, Eduardo (1981). Medicinal Plants of the Philippines. Bureau of Printing. Manila.

Scott, Raymond P. (March 2008) . Thin Layer Chromatography. http://www.chromatography-online.org/TLC/History.html. Retrieved on: February 2009

_____,Thin Layer Chromatography. http://www.chemguide.co.uk/analysis/chromatography/thinlayer.l Retrieved on: February 2009

Microbiological Assessment of the Springwater of Barangay Bagakay, Ozamiz City

Leo Ritche C. Gumera
Mary Lizbeth M. Caballo
Alma Ligaya I. Alegre

Abstract

This study aims to microbiologically assess the spring water sourced from Brgy. Bagakay Spring, Ozamiz City using *E. coli* as indicator of fecal contamination. Samples were taken from two different pipes and assigned as sample A and B. Water samples were subjected to presumptive, confirmed, completed tests. The three kinds of tests determine whether there is a total coliform contamination specifically *E. coli*. Water testing did not proceed to the completed tests because of the absence of *E. coli* colonies in the EMB agar during the confirmed test. The water samples were negative for E. coli contamination. Therefore, there is absence of any fecal contamination. The water supply sourced from Brgy. Bagakay Spring is safe for drinking.

1. Introduction

According to DENR Administrative Order no. 26A, water for drinking must be free from pathogenic organisms like bacteria, viruses, protozoans and helminthes. These pathogens can cause diseases like cholera, dysentery, and typhoid fever. These diseases are of great considerations to the livelihood of Filipinos who only depend on the supply of water provided by the government. To prevent such problems, it is important to determine bacteriological quality of water in particular sample

The primary objective of bacterial examination of drinking water is the detection of fecal contamination. The total count is of little significance in judging the sanitary quality of water. K. L. Burdon states that it is not so much of the number as the kinds of bacteria present that

are important in water analysis (Burdon, 1964). The DENR added that although it is now possible to detect the presence of many pathogens in water, the methods of isolation and detection are often complicated and lengthy. It is therefore impossible and impractical to identify every disease causing organism present in water. The approach is to use normal enteric organisms which belong to the coliform group especially *Escherichia coli* as the essential indicator to fecal pollution. These organisms are easy to detect and their presence in a sample indicates that water may be contaminated with organisms that can cause disease (DENR A.O. no 26A, 1994).

Weissfeld explains that *E. coli* bacteria is a member of a very vast family of Enterobacteriaceae which is a gram-negative, non-spore-forming bacilli that are oxidase negative and, with few exceptions, catalase positive, ferment glucose with the production of acid and often gas, reduce nitrate to nitrite, and peritrichously flagellated if motile. In addition, *E. coli* is a normal microflora of the intestinal tract of humans and other animals (Weissfeld, et. al., 1994). For the reason, when *E. coli* is detected to be present in water samples, this indicates fecal contamination.

In the UNICEF's 1990 Progress Assessment on Drinking Water and Sanitation Target, 7% of the Philippine urban population does not have access to an improved water source. Urban areas typically have a population between 2,000-10,000 people and improved water source includes household connection, public standpipes, boreholes, protected dug well, protected springs, rainwater collection. The report further explains that a poor water supply and sanitation system can lead to a number of diseases, including diarrhea, intestinal worms, trachoma, schistosomiasis, and cholera (Gumera, 2006).

Gumera (2006) was able to identify presence of E. coli in two sampling points in Brgy. Bongbong, Ozamiz City. Brgy. Bongbong is a neighboring place of Bagakay. Gumera suspected of a contamination of the drinking water supply of his sampling sites for they are near the city's

dumping site. The result of this study can be used to assess the effects of the dumping site to the areas' aquifer. Comparing the sampling site of the researchers to the sampling site of Gumera (2006), the latter is much nearer to the dumping site noting a possible relation between distance of sampling site to the dumping site and the presence of *E. coli*.

Significance of the Study

This study would be of great help for the long-term health and well-being of the families in the community. It will provide information whether the water which they have utilized for a long time is still potable as before. This study will also assist the decision-making of the law-makers of the city to act on any problem that may arise which threatens not only the health of the families in Bagakay but also of the city as a whole. In addition, follow-up research on spring water quality analysis would be substantiated for there is already a store of information to be used for comparisons and generalizations. To conclude, this will provide a partial insight of the microorganisms that might be present in Bagakay Spring which are pathogenic.

Statement of the Problem

General Objective

This study aims to assess the microbial flora of the spring water sourced from Brgy. Bagakay Spring, Ozamiz City.

Specific Objectives

1. What is the **Most Probable Number of Coliform bacteria of** the water sample collected from Bagakay Spring?
2. Is there a presence of *E. coli* **using Presumptive, Confirmed, and Completed Tests?**

Scope and Limitation of the Study

The study was conducted with only one trial on March 3, 2009. Laboratory analysis of the water samples was performed in the air-conditioned microbiology room of La Salle University, Ozamiz City which is equipped with UV light. The water samples were collected from the spring of Bagakay, Ozamiz City, stored in sterilized containers inside an icebox while transported to the laboratory. This study focused on the microbiological assessment of the quality of the spring water.

In this study, *E. coli* was used as an indicator organism to determine fecal contamination. Determination of the kind of strains of *E. coli* was not included in the study. Furthermore, other genera of Family Enterobacteriaceae including known pathogens such as *Salmonella, Shigella, and Yersinia* were not identified. This investigation was limited only to a one- time collection and analysis of the spring water as specified in the methodology.

2. Methodology

Research Locale

One of the major sources of drinking water in Baranggay Bagakay, Ozamiz City is an existing spring. The spring served as the main source of not only drinking water but also for other household uses. Water from this spring is distributed to the whole community through gather-in-pail method. Located at an elevated part of the barangay is the city dump site which has already operated for ten years and covers 10 hectares. It is possible that it might affect the quality of the spring water being supplied to the barangay.

The spring in the community of Bagakay, Ozamiz City has the potential to contamination by pathogens for it is near a dumping site. This dumping site does not have the sanitary facility to collect harmful fluids that would percolate to the groundwater. With these conditions, in one way or another, the dumping site may already have an effect on these springs. Therefore, it is important to determine presence of *E. coli* in the water sourced from these springs to serve as precautions to the residents of the community.

Sampling Procedure

Sampling was done once on March 3, 2009. Sample was sourced from two different pipes (labeled A and B) in Bagakay Spring, Ozamiz City. The researchers collected water samples only once due to time constraints.

Sampling Materials

Cooler or icebox, alcohol lamp, detergent, alcohol, Lysol, face mask, laboratory gown, surgical gloves and autoclaved water containers for the samples

Materials for Presumptive, Confirmed, and Completed Tests

Autoclave, alcohol lamp or Bunsen burner, inoculating loop, cotton plugs, Durham tubes, Petri dishes, formulated media and Lysol

Presumptive and Most Probable Number Test

A series of fermentation tubes with lactose broth as medium was inoculated with appropriate graduated quantities (0.1, 1.0, 10 ml) of the water to be tested. A total of fifteen tubes were used for a sample. Five tubes inoculated with 0.1 ml of water to be tested was used, another five for 1.0 ml of inoculum, and additional five tubes with 10 ml of inoculum. Tubes were incubated at 37 °C for forty-eight hours. Coliform

positive tubes will show gas formation in the inverted Durham tubes. Positive tubes were noted and analyzed using Most Probable Number table (Appendix 3).

The Confirmed Test

Samples were obtained from the tubes showing positive result using inoculating loop. A loopful of were streaked into plates with Eosin Methylene Blue (EMB) agar. The plates were incubated at 35 °C for twenty-four hours. On the course of the experiment, no plates that are found positive with *E. coli* that shows colony with green metallic sheen.

The procedure that follows is applicable only for positive results in the confirmed test. It is included in this paper to report the standardized way of microbial assessment of water.

The Completed Test

Colony with green metallic sheen will be fished and transferred to agar slants for storage. Completion of the test requires another positive result in lactose fermentation and the presence of gram negative bacteria. Therefore, samples for the completed test will be sourced either from the fresh colony of the EMB agar or from the colony on agar slants.

3. Results and Discussions

Considering the research locale, it was hypothesized that water sourced from Brgy. Bagakay Spring is contaminated with enteric microorganisms. However, the microbial assessment presents positive, presumably with this type of microorganisms from the family *Enterobacteriocеae* (Table 1)

Table 1: Number of Tubes Positive for Acid and Gas Formation in every Five Tubes of the Desired Volume of Inoculum

Water Source	**Volume of Inoculum**			**MPN**
	0.1 ml	1.0 ml	10.0 ml	
A	3/5	1/5	2/5	**110**
B	2/5	2/5	2/5	**≤12**

Table 1 shows that during the initial test which is the Presumptive and Most Probable Number (MPN) Test, 6 out of 15 tubes revealed positive for acid and gas formation for each water source. Nester (2004) affirms that MPN method is a statistical assay of cell numbers. It employs successive dilutions of a water sample in tubes of lactose-containing broth that have a vial to trap gas. Tubes in which gas is produced are tested to confirm presence of coliforms (Nester, et. al., 2004). Based on the table of MPN (Appendix 5), water from sample A has 110 most probable numbers of lactose-fermenting bacteria, presumably E. coli, while sample B is suspected with 12 or lesser number of coliform.

The Confirmatory Test which uses Eosin Methylene Blue Agar (EMB) showed the absence of *Escherichia coli. E. coli* produces colonies with a metallic sheen which can be presumptively identified by simply observing the colonial growth on the EMB agar (Weissfeld, et. al., 1994). Thus, water sourced from Brgy. Bagakay Spring is positive with lactose-fermenters but not with *E. coli*, because a positive test for lactose fermentation does necessarily indicate the presence of *E. coli*. By means of the negative confirmatory test for *E. coli*, the Completed Test was not carried out.

Although this study is limited in the determination of the presence of *E. coli*, certain factors were considered which can probably affect the accuracy of results. One of the circumstances regarded as important is the availability of clean bench. Clean bench can provide a sterile

environment for a microbiological testing. Therefore, it can prevent contamination during isolation of the desired microorganism. Particularly, this study used selective media, therefore, lactose-fermenters are the only microorganisms that can tolerate to grow in the medium and only the desired bacteria are isolated. Another factor that is considered is the efficiency of the media used during the isolation of *E. coli*. It is noted that the media used is inconsistent to the formula given. The media did not solidify as intended in the preparation written in the label. These said cases are carefully considered to acquire results that can provide firm conclusions.

4. Summary, Conclusion and Recommendation

Summary

Springs are one of the most important sources of clean drinking water. However, freshwater sources can be easily contaminated with pathogens like *Escherichia coli, Salmonella, Giardia,* and *Cryptosporidium s*p. which are responsible for waterborne diseases. This study aimed to investigate the presence of *E. coli* in the spring water sourced at Baranggay Bagakay, Ozamiz City. The presence of *E. coli* was used as an indicator organism to determine fecal contamination.

Sampling was done once on March 3, 2009. Sample was sourced from two different pipes in Bagakay Spring, Ozamiz City. There was a prescribed frequency of sampling considering the population of Baranggay Bagakay, but for this study, used one trial only.

The Confirmatory Test which uses Eosin Methylene Blue Agar (EMB) showed the absence of *Escherichia coli. E. coli* produces colonies with a metallic sheen which can be presumptively identified by simply observing the colonial growth on the EMB agar (Weissfeld, et. al., 1994). Thus, water sourced from Brgy. Bagakay Spring is positive with lactose-fermenters but not with *E. coli,* because a positive test for lactose

fermentation does necessarily indicate the presence of *E. coli*. By means of the negative confirmatory test for E. coli, the Completed Test was not carried out.

Conclusion

This study employed the MPN Method and the Confirmatory Test to determine the presence of *E. coli*. Based on the table of MPN (Appendix 5), water from sample A has 110 most probable numbers of lactose-fermenting bacteria, presumably E. coli, while sample B is suspected with 12 or lesser number of coliforms. The Confirmatory Test which uses Eosin Methylene Blue Agar (EMB) showed the absence of *Escherichia coli.* Thus, water sourced from Brgy. Bagakay Spring is positive with lactose-fermenters but not with *E. coli.*

Recommendations

To closely monitor the quality of water in Baranggay Bagakay Spring, the researchers recommend the following:

1. Monthly monitoring of the microbial flora by collecting samples once every month.

2. Extensively employ biochemical tests to determine the genera of the microbes present in the water samples.

3. A preliminary survey on the prevalence of gastro-intestinal related diseases in that area.

List of References

Burdon, K. L. et. al. 1964. Microbiology. 5th ed. The Macmillan ompany. USA.

Department of Environment and Natural Resources. 1994 Administrative Order no 26 A. Philippine Standards of Drinking Water. DENR.

Gumera, Leo Ritche. 2006. Bateriological Analysis of Water from Selected Springs in Bongbong, Ozamiz City, An Undergraduate Thesis. MSU Biology Department. Marawi City.

Nester, Eugene W., et. al., 2004. Microbiology: A Human Perspective, 4th Edition, MacGraw-Hill, New York,.

Weissfeld, Alice. 1994. Clinical and Pathogenic Microbiology, 2nd Edition edited by Barbara, Howard Mosby-Year Book, Inc., USA

APPENDICES

Appendix 1.
Minimum Frequency of Sampling for Drinking Water Supply Systems

Source and Mode of Supply	Population Served	Minimum Frequency of Sampling
Level 1	90-150	Once in every three months
Level 2	600	Once every two months
Level 3	Less than 5,000	1 sample monthly
	5,000-100,000	1 sample per 5,000 population monthly
	More than 100,000	20 samples plus 1 sample per 10, 000 population
Bottled Drinking water		Once every two months
Emergency supplies of drinking water		Before delivery to users

Appendix 2

General Sterility and Cleanliness

1. The countertops are wiped down with surface disinfectants.
2. Antimicrobial soap is available at the laboratory sinks to facilitate hand washing before and after laboratory work.
3. Glass wares should be thoroughly washed with detergent to remove oil and other substances.
4. Glass wares should be completely dried before autoclaving.
5. Petri dishes and glass pipettes are wrapped with foil or with paper and sealed in bag before autoclaving.
6. Test tubes and flasks should be secured with cotton plugs when autoclaving.
7. Media are also sterilized by autoclaving before use.

8. Autoclaves are operated in 15 lb/in^2 in steam pressure, producing an inside temperature of 121 to 124 degrees Celsius. When 15 psi is reached wait for 15 minutes before turning off the autoclave. Do not overload the autoclave. Open autoclave when pressure reading reaches 0 psi.

Appendix 3
Some Examples of the Most Probable Numbers when dilutions are 10, 1, and 0.1 ml.

Combination of Positives	Most Probable Number per 100 ml
1:0:0	2
2:3:1	12
4:1:0	17
4:3:1	33
5:0:2	43
5:3:1	110
5:4:3	280
5:5:1	350
5:5:4	1600

Appendix 4
Location of Bagakay, Ozamiz City

The Gain Scores of the Mixed Grade Computation Method

Emma O. Suana

Abstract

The performance or grade of every student in any course or subject is usually expressed in numerical figures. The student's grade is based not only on the final exam but in every kind of evidence upon which the faculty member can depend in coming to a decision such as recitation, term papers, book report, written and oral tests or quizzes, and other projects. It is the responsibility of the faculty members to compute the grade of the students enrolled in their classes based upon the officially approved grading system.

LSU followed the cumulative system of grading for a good number of years. However, in the school year 2006-2007, this grading system was changed after the criteria for academic honors were revised. The cumulative system was replaced with the mixed computation method for this was chosen by the majority without any empirical study to back up or explain that this method is better than the other. After a year of implementation, some the teachers commented that the new grade computation method seemed not good since there were so many who failed. On the other hand, many students claimed that the new grading system is tougher than the old one. As observed, they could hardly get 75 in the final rating especially when their midterm grades were low since the weight of the midterm grade in the final rating is 50%. It is in this light that the researcher decided to conduct a study to find out whether the mixed grade computation method is better or not, or just the same with the former method known as cumulative.

Findings revealed that the average grade of the students using the mixed computation method is lower than the students' average grade using the cumulative system or the old method. This implies that students got better grades in the final rating when cumulative system of grading is used. Moreover, there is a significant difference between the mixed computation method and cumulative system in terms of students' grades. The cumulative system gives higher average grade of students compared to the mixed computation method. Though cumulative system provides high numerical rating to students, this grading system is not very much reflective of the whole semester's performance of the students in a particular course since the weight of the prelim in the final rating is only 1/27. The weight of the midterm is 2/27 and the weight of the pre-final is 2/9. This means that the final grade using the cumulative system is very much dependent of the student's performance in the final period. This further implies that a

student has still a big chance to pass the course or subject even if he/she is failed in the prelim or midterm so long as he/she will work hard in the pre-final or final period. Whereas the mixed computation method is more reflective in terms of students' performance in the whole semester since the midterm grade and the temporary final grade have given equal weight which ½ each or 50%.

With the above mentioned findings, a qualitative study should be made with students and teachers as respondents to verify and check their ideas or insights regarding the two methods of grade computation. Academic administrators need to review and discuss further the advantages and disadvantages of the new grade computation and come up with recommendation whether to continue using it or not.

1. Introduction

The performance or grade of every student in any course or subject is usually expressed in numerical figures. The student's grade is based not only on the final exam but in every kind of evidence upon which the faculty member can depend in coming to a decision such as recitation, term papers, book report, written and oral tests or quizzes, and other projects. It is the responsibility of the faculty members to compute the grade of the students enrolled in their classes based upon the officially approved grading system.

The grading system of La Salle University (LSU) is as follows:

1.00	---------	97-100
1.25	---------	94-96
1.50	---------	91-93
1.75	---------	88-90
2.00	---------	85-87
2.25	---------	83-84
2.50	---------	81-82
2.75	---------	78-80
3.00	---------	75-77
5.00	---------	74-65
INC	---------	Incomplete

DR	---------	Dropped
FA	---------	Failure due to excessive absences

In terms of grade computation, every school has its own standard way of doing it.Some are following the cumulative system; while others are following the averaging. In cumulative grading, the final grade is obtained by getting more weight in the present periodic grade than the previous periodic grade; say 1/3 of the mid-term grade plus 2/3 of the end-term grade will constitute the final grade. De La Salle Lipa (DLSL) is one of the schools following the cumulative system of grading. The student's scholastic achievement is evaluated using the formula below:

Periodic (mid-term and end-term) grades are computed as follows

Component	***Weight***	***Comment***
Quizzes	1/3	
Class Standing	1/3	Recitation, seatwork, oral reports, compositions, term papers, and other course requirements
Periodic Examination	1/3	

Final grade is obtained by getting 1/3 of the Mid-term grade plus 2/3 of the End-term grade. (DLSL College Handbook, p.23).

There are schools also which use the averaging system of getting the final grade. Elementary and high schools both in public and private get the average of the four periodic grades to obtain the final rating of the student or pupil in every subject or course. The average or the final rating is being arrived at by adding the grades the student got from the first grading period up to the fourth grading period and dividing the total by four since there are four grading periods in the school year. Averaging is used not only in basic education but also in college. San

Juan de Letran (SJDL) is one that follows the averaging in computing the final grade of the students. The final grade is computed as follows:

(Midterm + Pre-final grades) ÷ 2 = Final Grade.

Quizzes	30%	30%
Class standing	30%	30%
Midterm Exam	40%	
Final Exam		40%
	100%	100%

Class standing includes recitations, assignments, seat works, research works, and projects (SJDL Student Handbook, p. 17).

LSU followed the cumulative system of grading for a good number of years. Prelim grade as well as initial grade of every grading period comprised 2/3 of the quiz grade and 1/3 of the exam grade. Midterm grade is obtained by getting 2/3 of the initial midterm and 1/3 of the prelim grade. 2/3 of the initial pre-final grade and 1/3 of the midterm grade constitutes the pre-final grade and the final grade is 2/3 of the initial final and 1/3 of the pre-final grade.

However, in the school year 2006-2007, when the criteria for academic honors were revised the council of deans also proposed to have a review on the cumulative system of grading. Four computation methods including the one that had been practiced were presented in the council. These proposed computation methods of grades were presented without any empirical study to back up or explain that one method is better than the other. The deans were held responsible for the consultation with their respective groups of teachers about the proposed methods. Finally, the mixed computation method was chosen by the majority of teachers.

In the mixed computation method, prelim and midterm grades are computed in the same way as of the cumulative system. The semi-final grade is computed just like the prelim grade. The final grade is obtained by getting the average of the midterm and temporary final grades. 2/3 of

the initial final grade and 1/3 of the pre-final grade constitutes the temporary final grade. The initial final grade is computed just like the prelim grade.

After a year of implementation, some teachers commented that the new grade computation method is not good since there were so many who failed in their classes. For some of them, the new method is not helpful to the students. They noticed that once the student failed in the midterm, he or she would likely to fail in the final term. Others said it is not "student friendly." In fact, during the mid-year evaluation last October 2008, one college requested that a study should be made about the two grading systems. On the other hand, there were also students who commented that the new grading system is tougher than the old one. They said they could hardly get 75 in the final rating especially when their midterm grades were low since the weight of the midterm grade in the final rating is 50%.

Upon knowing this issue, the researcher who is an academic administrator was convinced that something must be done in order to satisfy the queries of the teachers. It is in this light that the researcher decided to conduct a study to find out whether the mixed grade computation method is better or not, or just the same with the former method known as cumulative.

Statement of the Problem

This study aimed to determine if the mixed grade computation method is significantly different from the cumulative system. Specifically, the study sought answers to the following questions:

1. What is the average grade of the students using the mixed computation method?
2. What is the average grade of the students using the cumulative grading system?

3. Is there a significant difference between the two methods in terms of students' grades?

s Null Hypothesis

There is no significant difference between the mixed grade computation method and the cumulative system of grading in terms of students' grades.

Scope and Limitations

This research dealt primarily on the determination whether the two methods of computing the students' grades are significantly different from each other. The data were obtained from the class records of the teachers from the different colleges and school who were included in the sample during the first semester of school year 2008-2009. These data were the grades of the students using the mixed computation method. To test the significant difference between the two methods of grade computation, the researcher did the computation of grades using the cumulative system.

Significance of the Study

The results of the study will provide valuable information to the following groups of people in the education milieu:

School Administrators. The result of the study may help school administrators in making a decision regarding students' grade computation.

College Faculty. The results of this study may give teachers enough information and insights that would answer their query about the mixed grade computation method as a replacement of cumulative system which had been practised in the past years.

Students. This study may help students understand and appreciate the mixed grade computation method.

Future Researchers. Findings of this study may be used as springboard for future researchers conducting a similar study.

2. Methodology

The descriptive research method was used in the study. It included the description, recording, analysis, and interpretation of the conditions that exist between the two-grade computation methods. This study determined the average of the students using cumulative system and the mixed grade computation methods. It also attempted to establish difference between the two grade computation methods.

Respondents

The respondents of the study were the college teachers of La Salle University who taught in the first semester of school year 2008-2009. These teachers came from the seven colleges and one school who were randomly selected by the researcher, the seven colleges were College of Arts and Sciences (CAS), College of Education (CED), College of Computer Studies (CCS), College of Accountancy (COA), College of Business and Economics (CBE), College of Engineering (COE), and College of Nursing (CON). The school was the School of Hospitality Management (SHM). For the purpose of convenience, the researcher randomly selected two teachers per college or school except for the College of Arts and Sciences because the researcher got one teacher from every department. The departments under CAS were Mathematics, Science, Languages, Social Science, Religious Education, and Physical Education and Music.

Source of Data

This study used the class records of the twenty teachers who were randomly selected by the researcher to gather data which were the students' grades using the mixed grade computation method. The class records were taken out from the Registrar's office with permission. Based on the data on the class records, the researcher computed the students' grades using the cumulative system.

Statistical Treatment

Mean and t-test were used to treat the data in this study. Results were obtained using the Microsoft excel.

1. *Mean*. The mean was computed to describe the general magnitude of the students' grades using the cumulative system of grading and using the mixed grade computation method.

2. *t-test*. The t-test for paired two samples for means was used to determine if the mixed grade computation method is significantly different from the cumulative system.

3. Results and Discussion

Average Grade of the Students

Table 1 presents the average grade of the students using the mixed grade computation method and cumulative system.

Table 1: Average Grade of Students

Mixed Computation Method	Cumulative System
81.00907258	81.39768145

The average grade of the students using the mixed computation method is lower than the students' average grade using the cumulative system or the old method. This implies that students got better grades in the final rating when cumulative system of grading is used. This result would confirm the belief of some teachers and students that the mixed computation method would tend to pull down the final rating of the students especially when their midterm grades are already low. The average grade which is 81 when rounded also implies that there is still a big room for improvement in terms of students' scholastic achievement. If all students are focused in their studies and hard worked to achieve excellence, the average grade which is 81 could have become higher.

Difference between Cumulative System and Mixed Grade Computation Method

Table 2 presents the result of the t-test which is used to test the difference between the mixed grade computation method and the cumulative system.

Table 2: Difference between Mixed Computation Method and Cumulative System

	Critical Value (two-tail)	**t-stat**	**Interpretation**
t-Test: Paired Two Sample for Means ; $\alpha = 0.05$	- 1.961160957	- 6.930600897	significant

The t-stat absolute value, 6.930600897, is greater than the absolute critical value at 0.05 level of significance. This means the null hypothesis should be rejected. This means that there is a significant difference between the mixed computation method and cumulative system in terms of students' grades. As seen in Table 1, the cumulative system gives the higher average grade of students compared to the mixed computation method. This implies that the cumulative system is better

compared to the mixed computation method in terms students' grades. However, the cumulative system is not very much reflective of the whole semester's performance of the students in a particular course since the weight of the prelim in the final rating is only 1/27. The weight of the midterm is 2/27 and the weight of the pre-final is 2/9. This means that the final grade using the cumulative system is very much dependent of the student's performance in the final period. This further implies that a student has still a big chance to pass the course or subject even if he/she is failed in the prelim or midterm so long as he/she will work hard in the pre-final or final period. Whereas the mixed computation method is more reflective in terms of students' performance in the whole semester since the midterm grade and the temporary final grade have given equal weight which ½ each or 50%. For complete statistical test results please refer to Appendix A.

4. Findings, Conclusion, and Recommendation

Finding

The following are the findings of the study:

1. The average grade of the mixed computation method is 81.00907258 while the average grade of the cumulative system is 81.39768145.

2. There is a significant difference between the mixed computation method and the cumulative system in terms of students' grades.

Conclusion

The mixed computation method tends to pull down the final rating of the students compared to the cumulative system.

Recommendation

Based on the findings, the researcher recommends the following:

1. A qualitative study should be made with students and teachers as respondents to verify and check their ideas or insights regarding the two methods of grade computation.

2. Academic administrators need to review and discuss further the advantages and disadvantages of the new grade computation and come up with recommendation whether to continue using it or not.

List of References

"Standard Grade Components and Weight." Uploaded from http://www.dlsl.edu.ph/downloads/pdf/college handbook.pdf
Date Retrieved: March 25, 2009

"Grading System". Uploaded from http://www.letran.edu/pdf/student handbook.pdf
Date Retrieved: March 25, 2009

On Some Upper Bounds of the Smarandache Function

Jovannie R. Castillo
Ernie O. Capuno

Abstract

Let $n \in \square$. The Smarandache function, denoted by $S(n)$ is defined as $S(n) = \min\{k \in \square : n | k!\}$ This paper will establish and characterize some upper bounds of the Smarandache Function and some useful inequalities in computing the values of $S(n)$.

1. Introduction

Number Theory is one of the oldest mathematical disciplines whose existence can be traced back into antiquity, divisibility being one of its foundations. Problems are often easy to state into lay men terms but surprisingly extremely difficult to solve, which is the origin of much of its charm, the purity of numbers tickles the interest of many mathematicians.

In the early 70's a Romanian mathematician in the name of Florintin Smarandache developed a new function he called "Smarandache function" (Sandor, 1998). This function was first considered by some previous mathematicians in the later part of the 19th century and apparently a thorough study of the behavior of such function was investigated by Smarandache which gives the smallest $k \in Z^+$ relative to some $n \in Z^+$ such that n divides $k!$.

The Study is based on the recommendation of the article "*On Certain Inequalities and Limits for the Smarandache function*" (Sandor, 1998). Basic definitions are presented. The main results are proved in details and "*proof*" and "*qed*" (qoud errata demonstratum) are used to denote the start and end of the proof respectively.

Objectives of the Study

Determining good upper bounds for the Smarandache function is the main concern of the study. Some values of $S(n) = \min\{k \in N : n|k!\}$ are computed to gain some insights of its behavior and properties in relation to some constraints subjected to n. In particular the formulation of some inequalities which serves as upper bound of $S(n)$.

Significance of the Study

The Smarandanche function is often involve in many proposed problems and conjectures in number theory and recreational mathematics, likewise the Smarandache type function are often employed in finding perfect numbers and problems involving congruencies.

2. Methodology

Preliminary Concepts

This section presents some basic definitions needed in the study.

Definition 4.1. An integer is said to be divisible by an integer $a \neq 0$, in symbol $a|b$, if there exists some integer c such that $b = ac$. We write $a \nmid b$ to indicate that *a does* not divide *b* (Niven et. al., 1972).

Example 4.1. Let $4,16 \in Z$, then $4|16$ since there exist $4 \in Z$ such that $4(4)=16$.

Definition 4.2. An integer $p > 1$ is called a prime number, or simply a prime, if it is divisible only by 1 and p. If an integer $a > 1$ is not prime, then it is called a *composite number* (Niven et. al., 1972).

Example 4.1. The integers 5 and 7 are primes, while 6 and 8 are composites.

Definition 4.3. Any integer $a > 1$ which can be expressed in the form,

$$a = p_1^{a_1} p_2^{a_2} ... p_r^{a_r}$$

Is called the canonical form factorization of a, where the primes $p_1 < p_2 < ... p_r$ are distinct and the exponents a_i are positive (Niven et. al., 1972).

Example 4.2. Suppose $a = 540$, then the canonical factorization of a is $540 = 2^2 \bullet 3^3 \bullet 5$.

Definition 4.4. The product of the positive integers from 1 to n, inclusive, is called "*n **factorial"*** and is usually denoted by *n!* (Chong et. al., 1992), that is,

$$n! = 1 \bullet 2 \bullet 3(n-2)(n-1)n.$$

Define 0! = 1

Example 4.3. $5! = 1 \bullet 2 \bullet 3 \bullet 4 \bullet 5 = 120$.

Definition 4.5. For any non- negative integers *n* and *r* where $n \geq r$, the ***binomial coefficient*** , denoted by $\binom{n}{r}$ is defined as, (Chong et. al., 1992)

$$\binom{n}{r} = {}_nC_r = \frac{n!}{r!(n-r)!}.$$

Example 4.4. Let *n= 10* and *r = 6*. Then $\binom{10}{6} = \frac{10!}{6!(10-6)!} = \frac{10!}{6!4!} = 210$

Definition 4.6. Let S be a finite subset of R. The number α is called the maximum of S if $\alpha \in S$ and $\alpha \geq x$ for all $x \in S$ (Niven et. al., 1972).

Definition 4.7. Let *S* be a finite subset of R. The number β is called the minimum of S if $\beta \in S$ and $\beta \leq x$ for all $x \in S$ (Niven et. al., 1972).

3. Results and Discussions

This section presents the results generated in this study.

Definition 4.8. Let $n \in \mathbb{Z}$. The Smarandache function, denoted by $S(n)$ is defined as

$$S(n) = \min\{k \in \mathbb{Z} : n \mid k!\}$$

Theorem 1. For all $m, n \in \mathbb{Z}$ $S\left((n!)^m\right) \leq mn$.

Proof: To show that $(n!)^m \mid (mn)!$, we need to show that $\frac{(mn)!}{(n!)^m} \in \square$. Now

$$\frac{(mn)!}{(n!)^m} = \frac{(mn)!}{\underbrace{(n!)(n!)\square\square\square(n!)}_{m\ factors}}$$

$$= \frac{(mn)!}{n!(nm-n)!} \square \frac{(nm-n)!}{(n!)(nm-2n)!} \square \frac{(nm-2n)}{(n!)(nm-3n)!} \square\square\square \frac{(nm-in)}{(n!)\left[nm-(i+1)n\right]!},$$

where $i = 1, 2, ..., n.$

$$= \left({}_{nm}C_n\right)\left({}_{nm-n}C_n\right)\left({}_{nm-2n}C_n\right)\square\square\square\left({}_{nm-in}C_n\right)$$

$$= \prod_{i=0}^{m}\left({}_{nm-in}C_n\right)$$

Now, for $i = 1, 2, ..., m$, ${}_{nm-in}C_n \in \square$. So, $\prod_{i=0}^{m}\left({}_{nm-in}C_n\right) \in \square$. This implies that $(n!)^m \mid (mn)!$. Therefore by definition, $S\left((n!)^m\right) \le (mn)$

q.e.d.

Theorem 2. For all $m, n \in \square$, $S(nm) \le S(n) + S(m)$.

Proof: Suppose $S(n) = N \,\&\, S(m) = \mathrm{M}$. By definition $n \mid N!$ and $m \mid M!$.

Now Suppose that $r \in \square$ where $r > N$ and $t \in \square$ such that $t \mid N!$, since $r > N$ implies that $t \mid r!$ thus, $t \mid \mathrm{r}(\mathrm{r}\text{-}1)(\mathrm{r}\text{-}2)\square\square\square(r-N+1)$.

Now,

$$\binom{r}{N} = \frac{r!}{N!(r-N)!} = \frac{r(r-1)(r-2)\,\square\square\square\,(r-N+1)(r-N)!}{N!(r-N)!}$$

$$= \frac{r(r-1)(r-2)\,\square\square\square\,(r-N+1)}{N!} \in \square$$

Therefore, $N!\,|\,r(r-1)(r-2)\,\square\square\square\,(r-N+1)$.

Since $t\,|\,N!$ implies $t!\,|\,r(r-1)(r-2)\,\square\square\square\,(r-N+1)$. Also $r > N$ so let $r = M + N > N$, meaning

$$t!\,|\,(M+N)(M+N-1)\,\square\square\square\,(M!)\,\square\square\square 3\cdot 2\cdot 1 = (M+N)!$$

Let $t = m$ thus, $m\,|\,(M+N)!$ and $n\,|\,(M+N)!$. Therefore $mn\,|\,(M+N)!$ that is

$$S(nm) < M + N = S(n) + S(m)$$

q.e.d.

Corollary 1. If $m\,|\,n$ then $S\left(\frac{n}{m}\right) \geq S(n) - S(m)$.

Proof: Since $m\,|\,n$, there exist $k \in \square$ such that $n = mk$.

By Theorem 2, $S(n) = S(mk) \leq S(m) + S(k)$

$\Rightarrow S(n) \leq S(m) + S(k)$

$\Rightarrow S(n) - S(m) \leq S(k)$ but $k = \frac{n}{m}$

Therefore, $\Rightarrow S(n)-S(m)\le S\left(\frac{n}{m}\right)$

q.e.d.

Theorem 3. If $k|n$ such that $n\ge k^2$ then $S(n)\le\left(\frac{n}{k}\right)$ and this bound sharp.

Proof: Let $n,k\in$ such that $n\ge k^2$ then $\frac{n}{k}\ge k$ and since $k|n$, $\frac{n}{k}\in$. Now we form the factorial $\left(\frac{n}{k}\right)!=1\cdot2\cdot3\cdots k\cdots\frac{n}{k}$ meaning to say $\left(\frac{n}{k}\right)!$ contain the factors k and $\frac{n}{k}$ hence $(k)\left(\frac{n}{k}\right)\left|\left(\frac{n}{k}\right)!\right.$ that is $n\left|\left(\frac{n}{k}\right)!\right.$ and therefore by definition $S(n)\le\left(\frac{n}{k}\right)$.

q.e.d.

Example 4.5. Let $n=81$ and $k=3$ clearly $k=9\le81$ and $3|81$ therefore by Theorem 3 $S(81)\le\frac{81}{3}=27$.

Corollary 2. If $n\ge4$ then $S(n)\le\left(\frac{n}{2}\right)$.

Proof: Take $k=2$ and apply Theorem 3.

Remark: This Theorem is relatively important most specially for large values of *n*; since the result will give us a sharp bound on what interval will we pick the value of $S(n)$. In example 5.1 it is clear that the interval for which we pick the value of $S(81)$ is in the set $\{9,10,11,...,27\}$.

4. Recommendations

Henceforth the researchers would like to post the following recommendations for future interested researchers.

1. That the upper bounds generated in this paper be established as equalities.

2. Relate the Smarandache Function to other number theoretic function such as the Euler Phi Function and the Euler Totient Function.

List of References

Chong, C. C. and Meng K. K. (1992) Principles and Techniques in Combinatorics. Department of Mathematics, National University of Singapore.

Niven, I. and Fuckerman H. S. 1972. An Introduction to the Theory of Numbers, Third Edition; New Delhi, Bangalone. Wiley Limited

Sandor, Josef. (1998) On Certain Inequalities and Limits for the Smarandache function. Smarandache Journal. Vol. 9

Electrical Characteristics of Zns and Mn-Doped Zns Pellets

Augustus Hospicio C. Ampong Jr.

Abstract

Investigation of the electrical properties of ZnS and ZnS:Mn Pellets was done in this study using the Van der Pauw and Two Probe techniques. These pellets were fabricated from powders produced by Sol-gel process, a low cost method in synthesizing semiconductors in powder form as well as in thin films. Results show that the current-voltage properties of the samples behave linearly in both characterization methods. The conductivity of each sample increased when exposed to UV with λ = 365nm = 3.4eV and show sensitive response to gamma radiation using Co60 with E = 1.17MeV. Calculations show that the conductivity of the samples are in the range of 10^{-9} to 10^{-3} S·cm-1. Most samples show expected conductivity type which is n-type for ZnS and p-type for ZnS:Mn.

1. Introduction

Zinc Sulfide is a wide band gap semiconductor, thus is useful in conditions involving high temperature operation. But since natural ZnS mineral is not of good quality in terms of its electrical and other properties, various ways of obtaining a synthetic ZnS were developed. Most of these processes require a vacuum condition and the use of high technology equipment, which means producing one, is very expensive. Nevertheless, ZnS had been synthesized and studied in bulk and thin film for a long time. It has been used all along for its wide and direct band gap by doping it with various elements. Such materials have applications in luminescent devices, light emitters, phosphors, optical sensors etc (Karar et.al, 2004).

Axman (2004) reported that a good Mn-doped ZnS has been successfully produced, enhancing its properties, but excess Mn doping

results to quenching thus lowering the electrical properties due to irregularity of the crystalinity of ZnS.

This study will investigate the electrical properties of ZnS and ZnS:Mn synthesized by a low cost method called the Sol-gel process. This detailed investigation of the produced samples was done using van der Pauw and two probe techniques.

2. Methodology

ZnS and ZnS:Mn semiconductor in powder form were produced by Sol-gel process. Then pellets with 1.305cm diameter were fabricated out of the semiconductor powders using a hydraulic press. The pellets were cut into small squares for characterization and were marked as sample 1 to 12. Thin copper wires were silver pasted into the four corners of each ZnS and ZnS:Mn sample.

The electrical characterization was done under dark condition using van der Pauw technique to get the I-V properties together with the resistivity & conductivity of the samples.

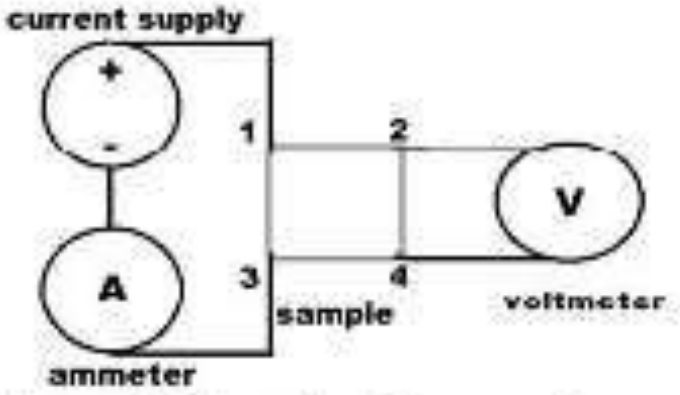


Figure 1: Van der Pauw set up

Van der Pauw technique is commonly used in characterizing semiconductors with or without high symmetry in its geometry as long as the thickness is known and is uniform. In this study it was used to measure the resistivity/conductivity and to observe the I-V properties of the samples under dark condition (BhattacharjeeB et.al, 2002). The Set up is shown in Figure1.

Using Hall effect measurements the conductivity type, charge carrier density, and Hall mobility of each sample were taken.

The Hall Effect principle states that when a current-carrying conductor is placed into a magnetic field, a Lorentz force is exerted on the current. This force disturbs the current distribution, resulting in a potential difference (voltage) across the output. This measured voltage drop is the Hall voltage V_H (Ubale et.al., 2007).

Further investigation was done using the two probe method to observe the I-V behavior of the samples under dark condition, UV illumination and under radiation. This is to qualitatively observe the response of the samples to a given stimulus.

3. Results and Discussions

Resistivity, sheet resistance and the conductivity of the samples are obtained using the Van der Pauw configuration of the four probe method in dark condition at room temperature. Two characteristic resistances are acquired from each of the samples and from these data other electrical properties are calculated. Table 1 shows the calculated electrical properties of the samples.

Using Hall effect measurements, the conductivity type of each sample was obtained. Most samples show expected conductivity type.

Samples 3, 8 and 11 shows an unexpected n-type conductivity which is may be due to Mn interstitial on ZnS.

Through a qualitative test using two probe method, it has been observed that the produced samples are photoconductive since most of the samples show increase of conductivity when exposed to UV (λ = 365nm = 3.4eV). On the other hand Co60 exposure, with energy of 1.17MeV, may enhance or diminish the conductivity of the samples.

Table 1

Sample	produced	ρ	Rs	σ	σ type
1	ZnS	7.07 E02	1.65 E04	1.41 E-03	p
2	ZnS:Mn	1.76 E07	4.87 E08	5.70 E-08	p
3	ZnS:Mn	4.17 E08	5.48 E09	2.40 E-09	n
4	ZnS:Mn	7.90 E05	1.14 E07	1.27 E-06	p
5	ZnS	6.54 E02	1.63 E07	1.53 E-03	n
6	ZnS:Mn	9.63 E05	2.35 E07	1.04 E-06	p
7	ZnS:Mn	2.97 E03	4.87 E04	3.36 E-04	p
8	ZnS:Mn	4.54 E06	8.11 E06	2.20 E-06	n
9	ZnS	4.80 E06	1.09 E06	2.08 E-07	n
10	ZnS:Mn	1.28 E07	1.28 E06	1.82 E-06	p
11	ZnS:Mn	5.30 E07	5.30 E07	3.43 E-07	n
12	ZnS:Mn	3.10 E07	3.10 E07	6.21 E-07	p

This table shows the resistivity in Ω cm (ρ), sheet resistance in Ω (Rs), conductivity in S/cm (σ) and the conductivity type of the samples. The values here are not exact due to the uncertainties in accuracy and precision of the equipment used. These uncertainties are of the same range with the obtained values.

4. Conclusion

ZnS and ZnS:Mn semiconductors in pellets were successfully fabricated with about 1cm diameter. Through a widely accepted characterizing method, the electrical properties of these semiconductor pellets were carefully investigated.

From the results, it is concluded the most samples show a good photoconductive response since their resistances lowered when exposed to UV (λ = 365nm = 3.4eV) and Co60 (E = 1.17MeV) radiation. Thus these samples may be of good use in opto-electronics application and when perfected as phosphors but optical analysis and photoluminescence are suggested for confirmation and to give specific and detailed application of the sample.

A diode may also be created out of the samples since n-type ZnS and p-type ZnS:Mn semiconductors were produced.

List of References

N. Karar, et. Al. (2004) Preperties of nanocrystalline ZnS:Mn, Journal of Crystal Growth 298 585-589, National Physics Laboratory, New Delhi 110012, India

Y. Axman. (2004) Manganese Doped ZnS NanoParticles: Sythesis, Particle Sizing and Optical Properties, These No 3029, Ecole Polytechnique Federale de Lausanne, Deilom chemikerin, Universitat Ulm, Allemagne et de nationalite allemande

BhattacharjeeB., et.al., (2004) Sythesis and Characterization of Sol-Gel derived ZnS:Mn2+Nanocrystallites embedded in a Silica Matrix, Bull. Mater. Sci., Vol 25, No. 3, June 2002, pp 175-180

A.U. Ubale, et., al. (2007) Size Dependent OpTical Characteristics of Chemically Deposited Nanostructured ZnS thinfilms. Bull Mater Sci., Vol. 30, No. 2, April 2007, pp 147-151

*** This paper was accepted and presented in the 11th Samahang Pisika ng Visayas at Mindanao (SPVM) National Physics Conference and Workshop in Father Saturnino Urios University, Butuan City last October 22-24, 2009.*

ERRATUM

Kris Elaine Marcojos' Sources of Clinical Instructors' Stressors of Vol. 14 No. 1 journal. On this article rectifications were made on its Table 1 and Table 2 found on page 118 and page 120 respectively.

Table 1: Work Stressors of the Clinical Instructors

Items	Work Stressors				Weighted Mean
	Never	Occasionally	Frequently	Extremely	
A. Inadequate Role Occupancy					
1. Involved in nursing education & clinical nursing practice	5	11	3	4	2.2609
2. Difficult to facilitate between ideal role expectation and actual reality	6	10	4	3	2.1739
3. Transition from old role to new role in your position	6	11	3	3	2.1304
B. Increasing Work Demands					
1.Perceived too many unpredictable tasks from the workplace	3	3	10	7	2.913

Table 1, continued.					
2. Expected to perform new tasks, finish the amount of work within a limited time frame	0	15	4	4	2.5217
3. Expected to have a master's degree	0	3	17	3	3
C. Insufficient role support					
1. Lack of support from immediate supervisor	4	15	2	2	2.087
2. Inadequate information from supervisor with regards to work delegation	4	4	11	4	2.6522
3.Mentalsupport & suggestions from supervisor in complicated nursing practice	3	10	10	6	3.348

Table 2: Personal Stressors of the Clinical Instructors

PERSONAL Stressors	**Never**	**Occasionally**	**Frequently**	**Extremely**	**Weighted Mean**
A. Peer Relationship					
1. Conflict with the your co-clinical instructor	8	9	0	6	2.1739
2. Lack of opportunity to talk openly with other clinical instructors about problems in the work setting CI-Student Relationship	14	6	3	0	1.5217
B. Clinical Instructor-Student Relationship					
1. Motivation of the students to learn	8	11	2	2	1.913
2. Feedback received from the students	4	17	2	0	1.913

About the Authors

Mr. Merven M. Pailden is a graduate of Bachelor of Science in Physics at Mindanao State University-Marawi City in 2002. He completed the academic requirements for Master in Science in Teaching Physical Science while he earned some units in Statistics. He was able to publish some articles in the journals of Samahang Pisika ng Pilipinas.

Mr. Jaymar T. Balihon is a graduate of Bachelor of Science in Mathematics at Mindanao State University-Iligan Institute of Technology (MSU-IIT) in 2008. He is pursuing his Master of Education major in Mathematics at La Salle University, Ozamiz City. At present, he teaches Mathematics in the College of Arts and Sciences. He is also a member of CFC-Singles for Christ, Iligan City Chapter.

Mr. Esmael O. Larubis graduated from MSU-Iligan Institute of Technology last March 2005 with the degree of BS in Chemical Engineering. He is currently taking up Masters in Chemistry in USC-TC, Talamban, City. He is mostly inclined to environmental researches with the application of instrumental techniques.

Engr. Aldrich Caballo finished BS Mechanical Engineering at Xavier University, Cagayan de Oro City in

1990. He passed the licensure examination for Mechanical Engineers in 1991. At present, he is taking his Master in Physics at MSU-Iligan Institute of Technology. He is presently handling Engineering Subjects at La Salle University, Ozamiz City.

Ms. Lorimay M. Acebron is a graduate of Bachelor of Science in Physics at MSU-Iligan Institute of Technology in 2008. She is currently taking her Master of Education major in Physics degree and is also teaching Physics at La Salle University, Ozamiz City.

Mr. Lito A. Real is a graduate of Bachelor of Science in Chemistry (BS-Chem) at Xavier University, Cagayan de Oro City. Currently he is taking his Master of Education major in Chemistry at La Salle University, Ozamiz City. At present, he is handling Biology subjects at La Salle University.

Ms. Maria Cristina M. Llauder is a graduate of Bachelor of Science in Education major in Chemistry at MSU-IIT, Iligan City. She finished her Master in Teaching Chemisty at La Salle University, Ozamiz City in 2007. At present, she is a faculty member in Science Department of the College of Arts and Sciences.

Engr. Josephine H. Lumosad is a graduate of Bachelor of Science in Chemical Engineering at University of San Carlos. She finished the Master of Management Major in

Management Engineering (MMMME) at Liceo de Cagayan University and currently on – going the Master of Education in Chemistry at La Salle University. Presently, she is a chemistry teacher in the College of Arts and Sciences at La Salle University.

Mr. Leo Ritche C. Gumera is a BS Biology graduate of Mindanao State University in Marawi City. He is interested in pursuing studies in medical microbiology.

Ms. Mary Lizbeth M. Caballo finished BS Zoology from MSU-IIT with the academic distinction of Cum Laude. She finished her M. Ed. in Biology from DLSU (Manila). She is a nurturing mother to her one and only apple of the eye, Allison. Mrs. Caballo is currently the Coordinator of the Science Department.

Ms. Alma Ligaya I. Alegre finished BS Zoology from MSU Marawi City with the academic distinction of Cum Laude. She is currently enrolled in Master of Science in Biology in MSU-IIT. She is a scientist by heart, a friend in nature.

Dr. Emma O. Suana is presently the Vice-Chancellor for Academics at La Salle University. She earned her Doctor of Philosophy in Education major in Educational Management in March 2008 with her dissertation entitled "Affective Behavior Dimension and Achievement of Students in Six Colleges of LSU: Basis for Holistic Student Development Program", Master in Education major in Mathematics at Immaculate Conception College-La Salle in October 2002 with

Figure 3b. The trajectory of a projectile with $V_o = 0.0005 \frac{m}{s}$

thesis entitled "Performance of College Algebra Students: Basis for osed Mathematics Modules" and Master in Teaching Mathematics at Immaculate Conception College-La Salle in October 1997.

Mr. Ernie O. Capuno is a graduate of Bachelor of Science in Mathematics at Mindanao State University, Marawi City, and teaches Mathematics in the College of Arts and Sciences at La Salle University (LSU). He is currently finishing his Master's degree.

Mr. Jovannie R. Castillo is a graduate of Bachelor of Science in Mathematics at MSU-IIT with the distinction of Cum Laude in 2005. He is also taking his Master of Mathematics at same school at present. Mr. Castillo is a full time probationary faculty of the College of Arts and Sciences under Mathematics department.

Mr. Augustus Hospicio C. Ampong Jr. is a graduate of Bachelor of Science in Physics at Mindanao State University-Iligan Institute of Technology, Iligan City in 2008. He is currently teaching Physics subjects under the College of Arts and Sciences at La Salle University, Ozamiz City.