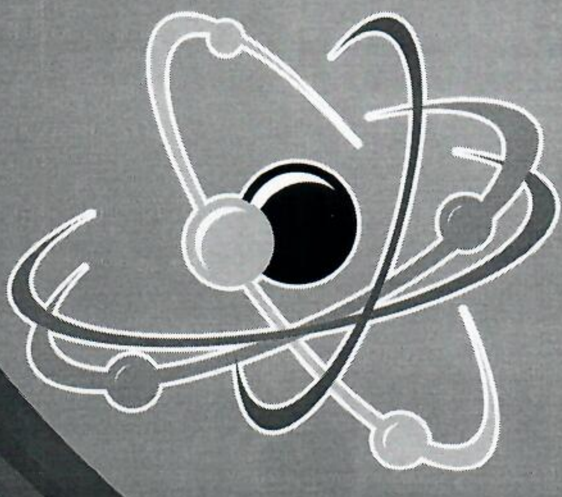
MYANMAR UNIVERSITIES' RESEARCH CONFERENCE 2019

CONFERENCE PROCEEDINGS

Volume 1, Issue 4



Nation Building through Quality Research and Innovation

24th–25th May, 2019, University of Yangon

CONTENT OF PROCEEDINGS

VIII. SCIENCE

		Page
1.	The Significant role of Geological Structure Applicable for Urban Planning: a case study in Taunggyi city, Shan State, Myanmar *(Soe Min)*	1
2.	Petrofabric and Structural Deformation Analyses of Three Pagodas Fault zone along the Thetkaw–Sakangyi area, Southern Myanmar *(Mi Paik)*	6
3.	Sediment Petrography and Sediment Facies Analysis of the Thanlwin Estuary and nearby Shorelines, Mon State, Myanmar *(Tun Tun Zaw)*	16
4.	Purification and Pre-Crystallization Condition of MR1 FKBP22 *(Ohnmar Ye Win)*	28
5.	Carbon Sequestration of Mangrove Forest in Myawyit Coastal Area, Thanintharyi Region, Myanmar *(San Mon Thu)*	34
6.	Two Bioactive Cytochalasins Isolated from an Endophytic Fungus *Phomopsis sp.* *(Yee Yee Thu)*	39
7.	Investigation on Some Pharmaceutical Properties of the Stem Bark Extract of *Millingtonia hortensis* Linn. *(Win Win Khaing)*	45
8.	Molecular Phylogeny of Rucervus *eldii thamin* in Yangon Zoological Garden and Some Wildlife Sanctuaries *(War War Tun)*	50
9.	Nitrogen Fixing Bacteria (Azospirillum strains) from the Rhizosphere of Rice and Tall Reed and their Effect on the Germination Rate of Rice *(Kyaw Myo Naing)*	53
10.	Preparation and Characterization of Natural Hair Dye from Selected Medicinal Herbal Plants for Human Hair *(Thidar Khaing)*	57
11.	Evaluation of Acute Toxicity and Antioxidant Activity of Methanolic Plant Extract and Structure Elucidation of Isolated Compounds from *Dracaena angustifolia* (Medik.) Roxb. *(Aye Mon Thida Nyo)*	63
12.	Preparation and Characterization of Silica Nanoparticles and Iron Oxide Nanoparticles *(Zay Yar Min Min)*	70
13.	Utilization and trade of wild animals in some areas of Tanintharyi Region, Southern Myanmar *(Kyi Thar Khaing)*	75
14.	Synthesis of Superabsorbent Hydrogel from Corn Straw Cellulose and Polyacrylamide for Agricultural Productivity *(Khin San Win)*	82
15.	Investigation on $PM_{2.5}$ Concentration and its Meteorological Effect in Residential Areas of Yangon and Mandalay *(Chit Wityi Oo)*	91
16.	Species Composition, Relative Abundance and Habitat Use of Waterbirds in Minhla Lake, Sintkaing Township *(Than Htwe)*	96
17.	Investigation on Lowering of Glucose Activity, Toxicity and Antioxidant Activity of Bark of *Cinnamomum tamala* F. Nees *(Thida Tin)*	105
18.	Isolation of Some Phytoconstituents and Investigation of Some Bioactivities of the Leaves of *Calotropis gigentea* R. Br. (Mayo) *(Thanda Aung)*	110
19.	The Studies on the Changes of Properties of A Myanmar Lesser–Used Timber Species Following Gamma Irradiation *(Kay Thwe Kywe Aye)*	117

20. Performance Evaluation of Makeshift Solar Cabinet Dryers by Roselle
(Yin Mar Naing) 124

21. Study on the Properties and Memory Nature of $PbTiO_3$ Films Deposited onto CaF_2 Buffered Si – Substrate of Microcontroller
(Oak Kar Shin) 130

22. Contribution of Point Vortices to the Force on a Moving Body
(Ohn Mar) 135

23. Effect of Silica Aerogel Content on Sound Absorption Property of Rigid Polyurethane Foam
(Ei Shwe Sin Oo) 140

24. Study on TiO_2-MgO Composite Dye-Sensitized Solar Cell with Spinach-derived Natural Dye Extract
(Shwe Yee Win) 145

25. Preparation and Characterization of Ceramic Products from Rice Husk Ash
(Saw Naing) 150

26. Study on Gamma Attenuation Coefficient With Varying Moisture Content of Clay Brick
(Ei Khaing) 154

IX. ENGINEERING AND TECHNOLOGY

27. Pressure Sensitive Paint Application in Low Speed Delta Wing Flow
(Aung Myo Thu) 160

28. Spatial and Form Compositions of Significant Wooden Monasteries in Central Myanmar
(Zin Mar Phyo) 165

29. Keep the Spirit of the Bridge: Concept for the Restoration of the U Bein Bridge in Amarapura
(Zar Chi Min) 173

30. Extraction and Characterization of Gum from *Cactaceae* (*Opuntiaficus-indica*) as Value Added Additive for Cement
(Yaminn Lwin) 181

31. Observation on Ionospheric Plasma Variation Over Myanmar Using Single Frequency Measurement of GPS Receiver
(Win Zaw Hein) 187

32. Modelling and Control ofDifferential Drive Wheeled Mobile Vehicle
(Hsu Myat Thein Lwin) 191

33. Reliability Enhancement and Loss Reduction of Active Distribution Network Considering Different Types of Network Topologies
(Kyaw Myo Lin) 198

34. Watermark Extraction System for Copyright Protection Using Hybrid DCT and DWT Watermarking Technique
(Moe Moe Myint) 204

35. Investigation of the Changes of Letkokkon Sandy Beach Using Geospatial Technology
(Khin Nawarat) 209

36. Study On The Effectiveness of Floating Breakwater's Geometries for Harbour Protection on Wave Transmission Parameter
(Soe Pyae Aung) 216

37. Experimental Investigation of Single Cylinder S.I Engine's Performance Characteristics and Emission Analysis by Using RON-92 and 15% Blended Ethanol
(Myo Zaw Minn) 227

38. Applications of Multi-Walled Carbon Nanotubes Conductive Ink and Dye Removal
(Hsu Pyae Sone Lwin) 233

39. Effect of Sintering Temperature on Microstructure and Mechanical Properties of Sintered ZnO to Produce ZnO Varistor
(Myo Theint Theint Htun) 237

40. Synthesis of hydrogel from Peanut Shells Cellulose-Acrylamide Monomer By Gamma Radiation for Application in Waste Water Treatment
(Myo Khaing) 241

41. Salt Water Intrusion into Coastal Aquifer: A Case from Gulf of Cambay, Gujarat, India
(Paing Nyo Nyo Thinn) 246

Myanmar Universities'
RESEARCH CONFERENCE 2019

VIII. SCIENCE

Nation Building through
Quality Research and Innovation

24-25 May, 2019

University of Yangon

Yangon, Myanmar

Study on Gamma Attenuation Coefficient with Varying Moisture Content of Clay Brick

[1] Ei Khaing*, [2] Myo Myo Aung, [2] Lay Thi Tar Oo
[1] Myanmar Institute of Information Technology, Mandalay, Myanmar
[2] University of Kalay, Saggaing, Myanmar
*Corresponding Author: ei-khaing@miit.edu.mm

Abstract— In the history of professional construction practices, brick is one of the oldest of all building materials. Today, bricks are most often used for wall construction, especially as an ornamental outer wall surface. In modern construction practices, common bricks are categorized according to their component materials and method of manufacture. Under this classification, there are five common types such as burnt clay brick, sand lime bricks (calcium silicate bricks), concrete bricks, fly ash clay bricks and firebrick. Burnt clay bricks are the classic form of brick, created by pressing wet clay into molds, then drying and firing them in kilns. The gamma ray transmission technique is a non- destructive technique in which there is no need of direct contact between material under study and detector assembly. This type of experiment can be used to find the moisture content as the important consideration in the radiation shielding construction of houses, buildings and industries. This paper presents the experimental work of understanding the variation of gamma attenuation coefficient on moisture of clay brick using Gamma radiations. In this research, the Cs-137 radioactive source with 662 keV Gamma ray beam and Gamma ray Spectroscopy system consisting of 3×3 NaI (Tl) detector and MCA were used for determination of linear attenuation coefficient of the clay brick. The clays were collected from Nabuaing village and Kattipar village in Mandalay region. The spectral analysis was made using Gamma Vision 32 software and MCA Emulator for Microsoft. In this research, the variation of linear attenuation coefficient with moisture content of the clay bricks were studied. The experimental results confirmed that the gamma linear attenuation coefficient varies with moisture content of the clay bricks. The very important result obtained by this experimental work is that percentage of fractional change in linear attenuation coefficient is very close to the moisture content of the clay brick.

Keywords—**Attenuation Coefficient, clay brick, Cs-137 radioactive source, Gamma ray spectroscopy, moisture, NaI(TL) detector**

I. Introduction

The earth's crust is made up of largely igneous rock, which, as nature breaks it down, becomes clay. The main ingredients in clay are alumina, silica and water. Naturally occurring clay exists in many areas of the world. With curiosity and ingenuity one can find out where nature has deposited it for our use. In the history of professional construction practices, brick is one of the oldest of all building materials. Today, bricks are most often used for wall construction, especially as an ornamental outer wall surface. In modern construction practices, common bricks are categorized according to their component materials and method of manufacture. Under this classification, there are five common types such as burnt clay brick, sand lime bricks (calcium silicate bricks), concrete bricks, fly ash clay bricks and firebrick. Burnt clay bricks are the classic form of brick, created by pressing wet clay into molds, then drying and firing them in kilns. Clay bricks have been common building materials for a long time. Most buildings are constructed of bricks. Thus, clay bricks provide excellent durability, unsurpassed life cycle and low maintenance.

Moisture is a common cause of brick delaminating. Porosity is an important characteristic of brick; the porosity of brick is attributed to its fine capillaries. Porous materials are susceptible to chemical attacks and liable to contamination from weathering agents like rain, running water and polluted air. The most constructional defects, eg. movement, cracking, fungal attack, chemical reaction, are initiated and aggravated by the presence of moisture. Therefore estimation of moisture is very important. The moisture content of soil (also referred to as water content) is an indicator of the amount of water present in soil.

Gamma radiation, also known as gamma rays or hyphenated as gamma-rays and denoted as, is electromagnetic radiation of high frequency and therefore high energy. Gamma rays are ionizing radiation and are thus biologically hazardous. They are classically produced by the decay from high energy states of atomic nuclei (gamma decay), but are also created by other processes. Paul Villard, a French chemist and physicist, discovered gamma radiation in 1900, while studying radiation emitted from radium during its gamma decay Villard's radiation was named "gamma rays" by Ernest Rutherford in 1903[3].

Gamma Radiation and X-rays are electromagnetic radiation like visible light, radio waves, and ultraviolet light. Gamma rays and X-rays are the most energetic of these. Gamma radiation is able to travel many meters in air and many centimeters in human tissue. It readily penetrates most materials and is sometimes called "penetrating radiation"[3].

The scintillation detector is one of the most widely used particle detection devices in nuclear and particle physics today. In 1944, the scintillation detector was invented by Sir Samuel Curran whilst he was working on the Manhattan Project at the University of California at Berkeley, and it is based on the earlier work of Antoine Henri Becquerel[3].

The general description of a scintillator is material that emits low-energy photons when it struck by a high-energy charged particle. When used as a gamma-ray detector, the scintillator does not directly the gamma-rays. Instead, the gamma-rays produce charged particles in the scintillator crystals which interact with the crystal and emit photons. These lower energy photons are subsequently collected by photomultiplier tubes.

When gamma-rays pass through the matter, they can undergo three basic processes: Compton scattering, photoelectric absorption, or pair production. Each of these processes can create high-energy electrons or positrons which interact in the scintillator as charged particles. By adding up the energy collected in the surrounding photomultiplier tubes, the energy of detected gamma-ray can be determined.

Generally, a scintillation detector consists of two parts, the scintillation detector and photomultiplier tube (PMT) and they are coupling with together. When coupled to a photomultiplier, these scintillations can be converted into electrical pulses which can then be analyzed and counted electronically to give information conserving the incident radiation[1].

Since the scintillation detector is widely used to obtain information about the energies of the radiation emitted from a radioactive source it is frequently referred to as a scintillation spectrometer. Two types of spectrometer are the Single Channel Analyzer (SCA) and the Multi-Channel Analyzer (MCA). The multichannel analyzer output is sent to a computer, which stores, displays, and analyzes the data[1].

Four types of scintillators are (i) Organic Scintillators (including organic crystals, organic liquids and plastic) (ii) Inorganic Scintillators (iii) Gaseous Scintillators and (iv) Glasses. Most of the inorganic scintillators are crystals of alkali halides containing small activator impurity, eg. NaI (Tl), CsI (Tl), CaI (Na), where Thallium (TL) and sodium (Na) are the impurity activators. Among them, NaI (Tl) scintillation detector is the most widely used to detect gamma radiation. In this work, NaI detector was used to attenuate the gamma ray by using the various thicknesses of clay brick.

Gamma spectroscopy is the science (or art) of identification and/or quantification of radionuclides by analysis of the gamma ray energy spectrum produced in a gamma-ray spectrometer. Most radioactive sources produce gamma rays which are of the various energies and intensities. When these emissions are detected and analyzed with a spectroscopy system, a gamma ray energy spectrum can be produced. In this experimental work, gamma ray spectroscopy used as Gamma ray spectroscopy system consisting of NaI (TL) crystal detector of size 3" × 3" photomultiplier tube, pre amplifier, amplifier, and MCA. In this present work calibration was done using Cs-137 (662 kev) and 60Co (1173 keV and 1332 keV).

II. Experimental Work

A. Theory

The moisture in the clay brick is calculated using the following relation:

$$\textbf{Moisture content} = \frac{(M_{wet} = M_{dry})}{M_{wet}} \times 100\% \qquad (1)$$

Where M_{wet} is the weight of wet sample and M_{dry} is the weight of the sample on completely drying. Previous to this experimental work preliminary experiments have done to understand the variation of linear attenuation coefficient with moisture content of material. It was found that the percentage of fractional change in linear attenuation coefficient due to presence of water is very nearly equal to moisture content of the sample. Therefore, this experimental work was intended to study the dependence of linear attenuation coefficient on moisture content of sample and to verify the relation:

$$\frac{(\mu_{wet} - \mu_{dry})}{\mu_{wet}} \times 100\% = \left(\frac{M_{wet} - M_{dry}}{M_{wet}} \right) \times 100\% \qquad (2)$$

Where μ_{wet} is the linear attenuation coefficient of wet and μ_{dry} is the linear attenuation coefficient of the sample under dry condition.

B. The Gamma Ray Spectrometry

In this experimental work gamma ray spectroscopy system used was a high efficiency consisting of NaI(TL) detector of size 3"×3" and MCA, GSPEC is a pc based Gamma Ray Spectroscopy system, which communicates with PC through USB port. In this present work calibration was done using Co-60 (1173Mev, 1332MeV), and Cs-137 (662keV). The gamma spectrometry system was initially tested for resolution[5].

C. Spectral Analysis

Firstly, the gamma ray spectrometer was be calibrated by using the standard sources 137Cs source (1 µCi, 662 keV) and 60Co (1 µCi, 1173 keV and 1332 keV). The structure of a sealed source and chart of sealed gamma source were shown in table (1) and (2). Coarse gain and fine gain was adjusted until to get the well-defined peak. In this present work, coarse gain is 20 and fine gain is 13. Real time is 800s and live time is 600s and conversion gain is 1024. The distance between the source and detector was fixed 10 cm in the whole of research. To reduce a possible background radiation that comes from the environment, lead (Pb) shielding was used in this experiment. Firstly, the Cs-137 radioactive source and plastic container were placed in front of NaI (TL) detector to measure the gamma radiation before it passes through the absorber. Then, the wet clay brick sample 1cm (S-1) was kept into the plastic container. The overview and side view of this experimental setup and the measurement arrangement for detection system were shown in figures (1), (2) and (3). The spectrum of Cs-137 source was acquired and recorded for 600 seconds. Then, the wet clay brick samples were measured continuously by varying the various thicknesses. Next, with the same source and detector geometry, wet clay brick samples (S-2) with various thicknesses were placed between the source and detector and the obtained spectrum was recorded.

The wet samples (S-1) and (S-2) were taken out from the experimental position and allowed to evaporate. Due to evaporation using an oven, the weight of the clay sample decreases at the same temperature (100°C). The dry samples were allowed to cool and weight this cooled samples again and again. The wet samples must completely dry to a constant weight using drying equipment and recorded these dry weights. After evaporation, this experiment was repeated for different weights of the dry clay sample (S-1) and (S-2) as the same procedure of wet sample. So, the second section of this experiment works deals the determination of linear attenuation coefficients for dry clay brick.

TABLE I. STRUCTURAL OF A SEALED SOURCE

Overall Dimension		
Overall Diameter	Activate Diameter	Height
1"	0.197"	0.250"

TABLE II. CHART OF SEALED GAMMA SOURCE

Type of Element	Standard Activity (μCi)	Manfucture Date	Half-life (yr)	Energy(keV)
Cs-137	1	2013 May	30.07	662
Co-60	1	2013 May	5.27	1173, 1332

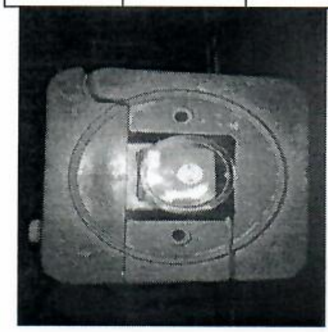


Figure 1 Overview of Sample

Figure 2. Side View of Sample

Figure 3. The Measurement Arrangement of The Clay Brick Sample

III. RESULTS AND DISCUSSION

The linear attenuation coefficients (μ) for two different clay brick samples were calculated from the measured data at 661.6 keV photon energy. Firstly, from the recorded wet weight and dry weight data, the moisture contents of clay brick sample (S-1) and sample (S-2) were calculated by using the equation (1). The calculated data for (S-1) and (S-2) were shown in tables (3) and (4).

Next, the measured spectra of wet and dry samples were analyzed by using Gamma Vision 32 software. The linear attenuation coefficients were calculated from these analyzed data by using the equation (2). The variation of these calculated result data of wet and dry samples (S-1) and (S-2) for energy 662keV were shown in tables (5) and (6).

The percentage of fractional changes linear attenuation coefficient of clay bricks under wet and dry conditions were calculated by using the equation (2). The comparison data between the calculated fractional change linear attenuation coefficient and the moisture content of clay sample for 662keV (S-1) and (S-2) were shown in tables (7) and (8).

The comparison of the moisture contents and linear attenuation coefficient data of wet and dry samples for (S-1) and (S-2) were shown in table (9).

The comparison of the linear attenuation coefficient data of wet and dry samples for (S-1) and (S-2) were illustrated in figure (4) and (5).

The gamma attenuation coefficient of wet and dry samples and moisture content for gamma energy 662 keV was compared with a plot by the base on these result tables. These figure was shown in (6) for (S-1) and (7) for (S-2).

TABLE III. THE VARIATION OF THE MOISTURE CONTENT OF CLAY SAMPLE (S-1)

Thickness of clay sample (cm)	Wet Weight of Clay Brick (g)	Dry Weight of Clay (g)	Moisture Content (%)
1	125	105	16.00
2	245	200	18.36
3	340	270	20.58
4	445	350	21.34
5	560	440	21.42
6	690	540	21.73
7	780	610	21.79
8	880	680	22.73

TABLE IV. THE VARIATION OF THE MOISTURE CONTENT OF CLAY SAMPLE (S-2)

Thickness of clay sample (cm)	Wet Weight of Clay Brick (g)	Dry Weight of Clay (g)	Moisture Content (%)
1	115	100	13.04
2	240	200	16.66
3	320	260	18.75
4	430	340	20.93
5	540	425	21.29
6	650	510	21.53
7	740	580	21.62
8	860	670	22.09

TABLE V. THE VARIATION OF THE LINEAR ATTENUATION COEFFICIENT OF WET AND DRY CLAY SAMPLE (S-1) FOR 662 KEV

Thickness of clay sample (cm)	Moisture Content (%)	Linear Attenuation Coefficient μwet (cm^{-1})	Linear Attenuation Coefficient μdry(cm^{-1})
1	16.00	0.1692	0.1406
2	18.36	0.1683	0.1405
3	20.58	0.1663	0.1365
4	21.34	0.1609	0.1310
5	21.42	0.1598	0.13.9
.6	21.73	0.1557	0.1302
7	21.79	0.1529	0.1286
8	22.73	0.1519	0.1269
Mean Value	20.49	0.1620	0.1325

TABLE VI. THE VARIATION OF THE LINEAR ATTENUATION COEFFICIENT OF WET AND DRY CLAY SAMPLE (S-2) FOR 662 KEV

Thickness of clay sample (cm)	Moisture Content (%)	Linear Attenuation Coefficient μwet (cm^{-1})	Linear Attenuation Coefficient μdry(cm^{-1})
1	13.04	0.1567	0.1364
2	16.66	0.1564	0.1354
3	18.75	0.1560	0.1321
4	20.93	0.1516	0.1289
5	21.29	0.1513	0.1256
6	21.53	0.1491	0.1245
7	21.62	0.1474	0.1220
8	22.09	0.1437	0.1178
Mean Value	19.48	0.1515	0.1279

TABLE VII. THE COMPARISON BETWEEN THE FRACTIONAL CHANGE LINEAR ATTENUATION COEFFICIENT AND THE MOISTURE CONTENT OF CLAY SAMPLE (S-1) FOR 662KEV

Thickness of clay sample (cm)	Moisture Content (%)	Linear Attenuation Coefficient μwet (cm^{-1})	% of Fractional Change in Linear Attenuation Coefficient (%)
1	16.00	0.1692	16.92
2	18.36	0.1683	16.51
3	20.58	0.1663	20.76
4	21.34	0.1609	20.92
5	21.42	0.1598	19.12
6	21.73	0.1557	16.40
7	21.79	0.1529	17.01
8	22.73	0.1519	17.95

TABLE VIII. THE COMPARISON BETWEEN THE FRACTIONAL CHANGE LINEAR ATTENUATION COEFFICIENT AND THE MOISTURE CONTENT OF CLAY SAMPLE (S-2) FOR 662KEV

Thickness of clay sample (cm)	Moisture Content (%)	Linear Attenuation Coefficient μwet (cm^{-1})	% of Fractional Change in Linear Attenuation Coefficient (%)
1	13.04	0.1567	12.96
2	16.66	0.1564	13.41
3	18.75	0.1560	15.34
4	20.93	0.1516	14.96
5	21.29	0.1513	16.97
6	21.53	0.1491	16.48
7	21.62	0.1474	17.22
8	22.09	0.1437	17.98

TABLE VI. THE COMPARISON BETWEEN THE LINEAR ATTENUATION COEFFICIENT AND THE MOISTURE CONTENT OF WET AND DRY CLAY SAMPLE (S-1) AND (S-2)

Sample	Linear Attenuation Coefficient μ_{wet}(cm$_{-1}$)	Moisture Content(%)	Linear Attenuation Coefficient μ_{dry} (cm$_{-1}$)
S-1	0.162	20.49	0.1325
S-2	0.1515	19.48	0.1279

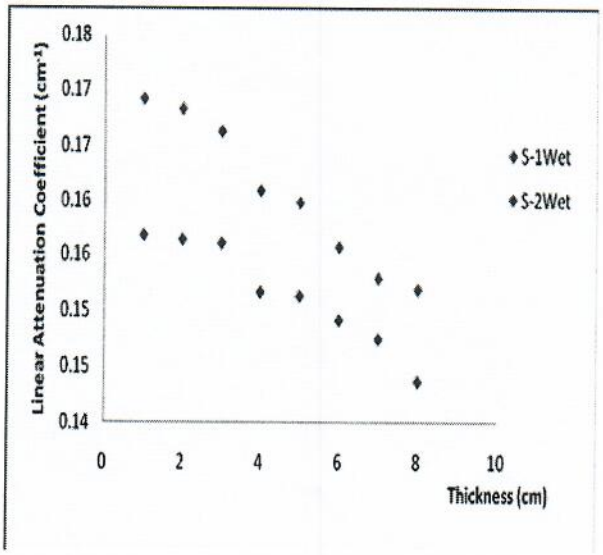


Figure 4. The comparison of linear attenuation coefficient of wet sample (S-1) and (S-2) for 662 keV

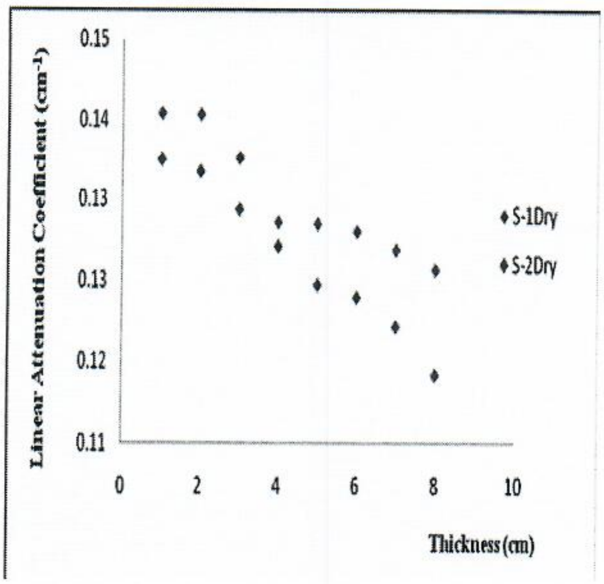


Figure 5. The comparison of linear attenuation coefficient of dry sample (S-1) and (S-2) for 662 keV

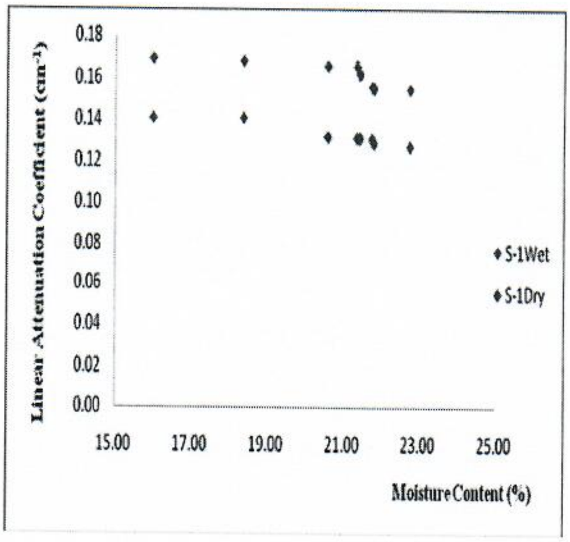


Figure 6. The comparison between the linear attenuation coefficient and the moisture content of wet and dry clay sample (S-1) for 662 keV

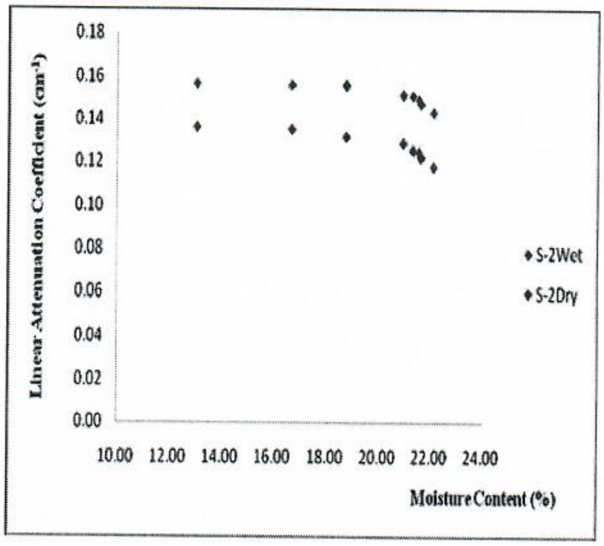


Figure 7. The comparison between the linear attenuation coefficient and the moisture content of wet and dry clay sample (S-2) for 662 keV

IV. CONCLUSION

Buildings are constructed mostly from concretes and clay bricks. In building construction of improved city, the main point has to be considered. This is the resistance against radiation expressed gamma ray attenuation. Since gamma ray is uncharged and has no mass, it can easily penetrate into matter, and thus the shielding against these photons is very difficult. In this paper, the sample (S-1) is better for attenuating gamma ray compared to the sample (S-2) especially for wet and dry conditions. So, sample S-1 (Nabuaing Village) clay brick is more suitable for gamma shielding. But, from the table (9), sample (S-1) is higher than the sample (S-2) on moisture content; this means water was absorbed more in (S-1) than (S-2). More water causes the increasing of the reaction in the elements of the clay brick and the reducing the temperature, which reduce the amount of cracking inside the clay. This important factor should be included for radiation shielding to be used the clay brick as the building materials. The value of the percentage of fractional change in linear attenuation coefficient was found to be very close nearly to the value of moisture content of clay brick sample. This is the very important relationship drawn from this experiment. Moreover, it is found that linear attenuation coefficient varies the moisture content of clay brick sample. From the figure, it is clear that attenuation coefficient is minimum for moisture content 22.73% in (S-1), 22.09% in (S-2) and maximum for moisture content 16.00% in (S-1), 13.04% in (S-2) by varying thicknesses with same dimension of clay samples. So, this type of experiment can be used to find the moisture content as the next important consideration in the radiation shielding construction of houses, buildings and industries.

ACKNOWLEDGMENT

I would like to extend my gratitude to all those who have knowingly or unknowingly help her in preparation of this research. Firstly, the author would like to thank her supervisor Dr Lay Thi Tar Oo for her ever-willing support and guidance.

Special thank many individuals who have given her support in developing some innovative topics, Dr Kay Thwe Kywe Aye, Professor, and other teachers from Department of Natural Science.

Finally, the author would like to thank my family and friends for their encouragement and support and her like elder sister Dr Myo Myo Aung for their support, encouragement, understanding and patience.

REFERENCES

[1] Gamma Vision-32 Gamma Ray Spectrum Analysis and MCA Emulator for Microsoft

[2] Window 95, 98, 2000 and NT", ORTEC Software and Manual, U.S.A.

[3] Glenn F. Knoll, (1979), "Radiation detection and Measurement", New York, John Wiley & Sons,

[4] W.R. Lee, "Techniques for Nuclear and Particle Physics Experiments", Springer-Verlag, Germany, (1994).

[5] N.Tsaulfanidis, "Measurement and Detection of Radiation", Second Edition, University of Missouri-Rolla, Taylor & Francis, (1995)

[6] www.ijesi.org Volume 2 Issue 7 \\July.2013\\PP.35-38

[7] www.kitcornell pottery.