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Safe and Potable Water for the Community- Science City of Munoz T.U.B.I.G. Project in Focus and the Central Luzon State University Water Potability Testing Activity

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Tap water from deep well is the common source of drinking water in the Science City of Munoz (SCM) and inside the campus of Central Luzon State University (CLSU), water pumped from deep well supplies all colleges and buildings. As part of the Millenium Development Goals set for the Philippines, one of the agenda of the SCM is to ensure that safe water is available for its community.With this on hand; the available water should meet the potability requirements to be rendered safe for drinking, cooking and laboratory use. Water supply is essential for the daily living and activities of the SCM community and inside the CLSU campus , thus clean sources of water must be maintained and analysis must be done regularly in the SCM community and the university. Two kinds of media were used in this test, namely Nutrient Agar (NA) and EMBA. The first medium permitted the growth of all the bacteria that were present in the sample, while the second one detected the presence of *E-coli.* Samples were diluted using the standard serial dilution procedure. After conducting serial dilution for each water sample, the total number of colonies was observed after the first 12 hours of incubation in NA. Average number of colonies was computed by taking the average count. All the water samples tested from the different barangays yield negative result for the presence of enteric bacteria. In CLSU however, the College of Agriculture and College of Home Science and Industry consistently gave the highest and the lowest number of bacterial growth respectively. Moreover, all the water samples collected from the university revealed positive growth of enteric bacteria by showing a metallic green sheen, indicating presence of *E. coli*. **Conclusions:** The available tap water from all the barangay of the Science City of Munoz is potable while the tap water tested from the different colleges tested inside the Central Luzon State University is not potable.

Keywords: potability, tap water, eosin methylene blue agar, nutrient agar, *E-coli*, green metallic sheen, Eosin Methylene Blue Agar (EMBA), Millenium Development Goals (MDG).

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Introduction

Every individual should have access to safe drinking water. It is not only considered essential to sustain and promote of public health but is a basic human right. Diarrheal diseases kill an estimated 1.8 million people each year. Diarrhea accounts for 17% of all deaths among children younger than five years in developing countries (Cairncross *et al.,* 2007). This figure will continue to rise if access to safe and potable water will not be given attention in the future. Flooding is eminent now adays, every year additional towns all over the world becomes flooded for the first time or, after a very long time. This situation poses threat toaccessible safe and potable water for mankind.

In areas where there is no avaialble potable water, the situation is often accompanied by problems in sanitation, such as lack of access to properly built comfort rooms, garbage dumping and sewer problems. Many of these health issues affect primarily the poor. Bacteriological examination offers the most delicate test for the detection of potentially dangerous fecal pollution in a water system (Caoile, J.B. *et al*, 2016)

We usually take the water quality in our daily lives for granted. For example, in performing laboratory activity, we must be cautious in considering the quality of water to be used for activities or experiments to avoid contamination and prevent or reduce the risk of obtaining false experimental data. Human health depends on safe water more than any other thing. Basically the life of human is related to safe water. Most of the problems in developing countries are mainly due to the lack of safe drinking water (Odendaal *et al*., 2015 as cited by Reyes *et. al*. 2017).

Provision of safe water supply prevents the transmission of waterborne pathogens and reduces the exposure of individuals to chemical and physical hazards that could be ingested through drinking contaminated water. Diarrhea and other waterborne diseases still rank among the leading causes of illnesses in the country. It is apparent that continuous development or refinement of policies and programs geared towards minimizing the risk of contracting waterborne diseases should be supported to provide optimal health service for the population (Philippine National Standard for Drinking Water, 2007).

At present we are experiencing scarcity of safe and potable water in many third world countries. As an organism composed of mainly liquid and depends on the presence of water for survival it is but timely for everyone to have knowledge on water conservation and water maintenance for health reasons. Unfortunately, in locations where the available water is known to be not potable, people may use it anyway, this could be due to lack of knowledge on sanitation and maybe be because of out of desperation.

With the given concerns on water quality, this research was performed to routinely check the potability and quality of water available for home and university use in the Science City of Munoz (SCM), Nueva Ecija and in selected colleges of Central Luzon State University.

The Central Luzon State University (CLSU) houses eight degree granting colleges. Students came mostly within the region and a few from neighboring regions and other countries like Africa, China, Japan and Thailand. It serves 3000 students from pre school to graduate studies. With this, the available water must be given attention and importance.

Objectives: This research generally aimed to analyse water potability by detecting the presence of enteric bacteria from the Science city of Munoz and the selected colleges of Central Luzon State University.

This research specifically aims to:

1. Enumerate the bacteria present in tap water from the different pumping stations and households in the Science city of Munoz
2. Enumerate the bacteria present in tap water from the different colleges of Central Luzon State University
3. Detect the presence of enteric bacteria in tap water from the different collection sites

Materials and methods

Collection of the Samples

Water samples from different faucets were collected from each sampling area and placed in a single bottle and labelled. Each bottle was filled with first flow of water and after 5 minutes of opening the water inlet. A 100 mL composite sample was collected from each site. This composite sample was used for the serial dilution (MPN and CFU) and detection of *Escherechia coli*.

Determination of Most Probable Number

To count the estimated number of bacteria by MPN procedure , Multiple Tube Fermentation Technique (MTFT) was used. One mililiter from each diluted sample was transferred into sterile lactose broth on durnham tubes and incubated for 48 hours. Change in color of the broth and gas formation was noted. As a rule, for the water source to be classified as potable, MPN value should be zero or less (Reyes *et al*, 2016). MPN Index for five-replicate design from FDA's Bacteriological Analytical Method was used as basis in data gathering of this research.

Determination of Colony Forming Units (CFU)

From the collected samples, one millilitre was aseptically transferred on sterile petridish, approximate 20 mL of pre cooled Nutrient Agar was poured and mixed with the water sample. After the media solidifies, the plates were incubated and bacterial growth were counted after 24 hours.

Detection of Escherechia coli as confirmatory test

From MPN dilution tubes, one ml was aseptically transferred on top of hardened Eosine Methylene Blue agar. The plates were swirled to distribute the water evenly. The plates were incubated for 24 hours and growths of metallic green sheen colonies were determined. The metallic green sheen colonies indicate the presence of the faecal organism *Escherechia coli*. Presence of this organism regardless of the number of colonies indicates non potability of the tested water samples.

Results

Microbial Potability of Science City of Munoz

There are thirty seven barangay in the SCM and out of this, twenty two barangays are being supplied with deep well water that are community managed. These pumping stations supplies water to approximately 4,500 households. Potability of the water system is constantly monitored to prevent desease outbreak. It was fortunate that for the span of three years, with four potability testings conducted annually, the water system yield negative result for the presence of bacteria by testing using MPN and CFU procedures for enumeration.

Consistently, the water quality by confirmatory test also yield negative for the presence of the indicator organism *Escherechia coli*.

Microbial Potability on Selected Colleges of CLSU

As preliminary investigation to test for water potability available in the different colleges of CLSU, enumeration of bacteria was conducted by MPN procedures. Result of the analyses after 24 hours of incubation is presented in Table 1 below.

Table 1. MPN result after 24 hours of incubation using 100ml composite sample

Colleges*	10ml	1ml	0.01ml	MPN/100mL
CAS	3	2	0	14
CVSM	2	1	0	7
CBAA	2	1	0	7
CED	2	1	0	7
CEN	2	1	0	7
CAG	3	1	1	14
CHSI	2	0	0	4
CF	2	1	0	7

*CAS- College of Arts and Sciences, CVSM- College of Veterinary Science and Medicine, CBAA- College of Business Administration and Accountancy,CED- College of Education,CEN- College of Engineering, CAG- College of Agriculture, CHSI- College of Home Science and Industry, CF- College of Fisheries.

The highest MPN of bacteria was obtained from the CAG followed by CAS and the lowest MPN was obtained from CHSI. This data obtained is alarming since most of the students are enrolled in the CAG while freshmen students of the University held classes in CAS. In like manner, interview on CAG and CAS students revealed that incidence of gastro-intestinal problems like stomach ache were common on the first few weeks of class. In other colleges, incidences of stomach aches were also present but in minimal numbers averaging to two (2) incidences per year, mostly during rainy season.

Enumeration of bacteria by CFU after 24 hours of incubation revealed values that are too numerous to count (TNTC) for the CLSU sampling sites.On the otherhand, no growth were observed from SCM water system tested using CFU method for bacterial enumration.

Detection of Indicator Organism (Escherechia coli)

The presence of *Escherechia coli* and other enteric bacteria in a water system clearly indicates that the water is not safe for human consumption. The test conducted on the water from the different colleges yield presence of *Escherechia coli* (Table 2) on differential plates after 24 hours of incubation. With the growth of metallic green sheen colonies on EMBA it leads to the conclusion that the water is not potable.

Table 2. Detection of indicator organisms on the water samples collected from the different colleges of CLSU.

Colleges	Enteric bacteria (presence of *E. coli*)	
	Present	Absent
CAS MAIN	⁄	
CAS ANNEX	⁄	
CBAA	⁄	
CVSM	⁄	
CED	⁄	
CEN	⁄	
CAG	⁄	
CF	⁄	
CHSI	⁄	

Abiotic factors (pH and Temperature)

Abiotic factors like water pH and temperature were gathered during water collection, result is presented in Table 3. The lowest pH of water was obtained from CAS (7.37) and the highest pH was from CBAA (8.54). Average water temperature is 26.˚C**.** Lowest temperature recorded was 25˚C from CAS ANNEX building and the hottest was from CF (27.05˚C). Temperature and pH of this range suggest suitability for the growth of mesophyllic bacteria.

Table 3. Average temperature and pH reading of water samples.

Colleges	Abiotic Factors	
	pH	Temperature (˚C)
CAS MAIN	7.37	26.57
CAS ANNEX	7.42	25.00
CBAA	7.44	26.40
CVSM	8.54	26.97
CED	7.48	26.22
CEN	7.41	26.36
CAG	7.53	26.81
CF	7.39	27.05
CHSI	7.58	25.44

Discussion

Water quality that is clean and safe for human consumption has been a constant concern of the Philippine administration, as reported from the 2011 Annual Poverty Indicators Survey (APIS) conducted by NSO, there is an increase of 78.1 percent from 1988 to 84.4 percent in 2011 of the family that

has access to clean water from community water systems and covered deep wells (NEDA, 2014). Morover, as mandated by the World Health Organization out of the eight MDG, water quality should be given attention in compliance to MDG 7 (Ensure Environmental Sustainability). Water quality affects not only human lives but the whole living population of organisms as well. (http://www.un.org/millenniumgoals/environ.shtml). This study initially tried to take baseline information on provisions for safe and potable water system and resources for the SCM community and CLSU students. From this, initial endevours can be taken to assess and mitigate problems on water potability. Water quality from SCM is on the monitoring stage for sustainability since it yields to be potable based on water test conducted. The CLSU water system however needs much action to promote safe and potable water for its academic constituents.

In the Philippines fifth progress report on MDG issues (NEDA, 2014), the agenda on providing potable and safe water and access to sanitary toilet facilities to the Filipino people is rated high (MDG 7) in terms of atainability. By duplicating this research and the program established by SCM, it is not far that all Filipinos will have access to safe and potable water. Human health depends on safe water more than anything else (Miranzadeh *et al*, 2011). It is life giving and life providing and it should be made available for everybody.

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References

Caoile, J.B, Pineda, F.G. and Valentino, M (2016). Microbial potability Testing of tap water fro m selected colleges of Central Luzon State University. Undergraduate thesis {unpublis hed), Central Luzon State University.

Duque, F.T. (2007). Philippine National Standards for Drinking Water 2007. ADMINISTRATIVE ORDER No. 2007- 0012

Cairncross, S., Clasen, T., Schmidt, W. P., Rabie, T., and Roberts, I. (2007). Interventions to improve water quality for preventing diarrhea: systematic review and meta-analysis. *British Medical Journal*, *334*(7597), 782.

Miranzadeh, M.B., Hassanzadeh, M, Dehqan, S (2011). Determination of Total Dissolved Solids (TDD), Nitrate and Flouride in 24 brands of Iranian bottled water. International Journal of Physical Sciences. 5128-5132. http//doi.org/10.5897/IJPSII.582

National Economic and Development Authority (NEDA) and United Nations Development Program (2014). Fifth Progree Report- Millenium Development Goals. Published by NEDA, online publication at www.neda.gov.ph.

Duque, F.T. (2007). Philippine National Standards for Drinking Water. Department of Health. Office of the Secretary. Administrative Order No. 2007-0012. Philippines.

Reyes, A.P., Pineda, F.G., and Valentino, V.V. (2017). Microbial potabitiy testing of tap water from different colleges in Central Luzon State University. Undergraduate thesis {unpublished), Central Luzon State University. ENV-BIO-02-17-008.

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