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# Determination Of Water Quality By Sampling And Analysis

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The present study was intended to determine the quality of water by sampling and analysis in School of Science and Engineering, Lumut campus. This location was selected in this study because the water quality in the said campus have not been tested since it was first established in 2015. Three trials were done for this project and three water samples were taken for each trial from different locations within the campus and. Water quality was determined by measuring the physical, chemical and microbiological parameters of the samples. The water quality in Negara Brunei Darussalam follows the standard guidelines set by World Health Organization (WHO) which the results obtained were compared to for this analysis. The results indicated that the temperature of the water within the campus is higher than the WHO standard state temperature. However, the colour and pH of the water samples were found to be in accordance to the guidelines except a certain water sample collected from the campus' canteen where it was slightly higher than the WHO standard. The results also indicated that there were no presence of the common bacteria which are usually found in water in all of the water samples collected. There are various water parameters that were not able to be tested in this project due to the lack of equipment and chemicals and so, it can be concluded that it cannot be decided whether or not the water quality in the campus is 100 % of a quality.

## INTRODUCTION

### Background

Water became a vital concern for many living organisms because of its significant roles and functions. People uses water for purposes such as drinking, cleaning, washing, and many more, and for this reason, is why there is a need to do experiments which involve determining the quality of water. Water quality is the physical, chemical and microbiological characteristics of water (Practical Tools on Water Monitoring Methods and Instrumentation, 2010). It is a very important matter thus people who are in charge to ensure the water to be used is safe and clean have to monitor the water quality very closely. In Negara Brunei Darussalam, the Department of Water Services hold the said responsibilities (Department of Water Services - Brunei Darussalam, 2007). Water Sampling and Analysis ensures water is of a quality and standard appropriate to its use and determines the treatment processes required to ensure the

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supply of water is safe. These standards are defined by legislation and guidelines that govern acceptable levels of components in water that can cause health or aesthetic problems ("Water Sampling and Analysis", n. d. ).

According to Borneo Bulletin (2018), there were some water colour complaints by people in Brunei Darussalam recently and the Public Works Department (JKR) have been continuously undertaking efforts on ensuring the status of the water quality. The department assured that although some areas have been experienced receiving 'yellowish water', the critical parameters for safe potable water as recommended by the World Health Organization (WHO) are still being met. During rainy seasons, the state of the raw water extracted from rivers are very high in organic material, which contributed to a very high hazen or water colour level which is difficult to treat. The department assured the public that steps are taken to ensure the water colour returns to normal (Borneo Bulletin, 2018).

Moreover, water quality has become an increasingly important issue during the past several decades as it provides a window to the health and vitality of hundreds of local ecosystems (Water Quality, n. d. ). The health effects caused by potential waterborne pathogens in water which include bacteria, viruses, protozoa and helminthes can vary in severity from mild gastroenteritis to severe and sometimes fatal diarrhoea, dysentery, hepatitis and typhoid fever. Contaminated water can be the source of large outbreaks of disease, such as cholera, and it can be infected through person-to-person contact and consumption of food. Most waterborne pathogens that are introduced into drinking-water supplies in human or animal faeces, do not grow in water and initiate infection in the gastrointestinal tract following ingestion (Practical Tools on Water Monitoring Methods and Instrumentation, 2010).

There are many ways to monitor water conditions. Monitoring specialists sample the chemical conditions of water, and sediments to determine levels of key constituents such as dissolved oxygen, nutrients, metals, oils, and pesticides. They also monitor the physical conditions such as temperature, flow, sediments, and the erosion potential of stream banks and lake shores and microbiological conditions and parameters such as *Escherichia coli* and *Shigella* which may be present in water (Practical Tools on Water Monitoring Methods and Instrumentation, 2010). Determination of water quality by sampling and analysis involves numerous techniques which include collecting water samples at various locations from the selected area, which for this project, is within the School of Science and Engineering. Moreover, it involves the measuring of parameters for physical, chemical and microbiological characteristics of water. Physical tests are done to indicate properties that can be detected by senses such as temperature and colour. Chemical tests involves determining the pH of the water and lastly, microbiological tests are to show if there are any presence of bacteria and characteristic of faeces contamination.

## **Significance of study**

The significant of water quality is that the standards can differ in different environment conditions, ecosystems, and intended human uses. Contaminants that are present in untreated water may contain microorganisms such as viruses and bacteria, organic and inorganic substances, and radioactive contaminants. This can be a possible danger to the economy, and also environment as it may cause health effects when consumed or have direct contact with the water. Water serve purposes such as for drinking and also non-drinking purposes. For example, although some people can filter water contaminants away by using water purification, others

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may have their water sources coming from a local stream or lake which is not filtered. The health effects of drinking contaminated water can vary from no physical impact to severe illness or even death. Some examples of the effects are nausea, vomiting, cramps, and diarrhea. The lack of research on this area of study in Brunei Darussalam is one of the reason there is a need to perform this project. In addition, since the establishment of the School of Science and Engineering in 2015, the water sources at various locations on campus have not been tested for water quality and so, with this project, it can let the people gain knowledge of the quality of water used inside the campus. This project can also help in developing and optimizing protocols to improve the water quality of the water using any practical sources available in the campus. This chapter includes the review from researches and previous studies that are related to the study of this final year project, which is on the determination of water quality by sampling and analysis. There are some previous researches on water quality by sampling and analysis from many different locations, testing a number of physical, chemical and microbiological parameters, which some of it are reviewed and discussed in detail whereas some are only referred to as appropriate in this chapter.

## **Physico-chemical characteristics**

In a study by Harichandan, Sekhar Patra & Mohan Sethy (2017) which focused on the determination of water quality by using water quality index (WQI) to assess the suitability of water for domestic and drinking purpose. The research analyzed water samples collected from streams surrounding an iron ore mine for Physico-Chemical parameters which includes pH, colour, total dissolved solids (TDS), dissolve oxygen (DO), biochemical oxygen demand (BOD), total hardness (TH), chloride (Cl-), nitrate (NO<sub>3</sub>-), oil and grease (O&G), sulphate (SO<sub>4</sub><sup>2-</sup>), iron (Fe), manganese (Mn), fluoride (F-), and arsenic (As). From this study, it is observed that high values of these parameters present in the water can leads to poor water quality even though there are other factors that might contributes to the poor quality of water (Harichandan, Sekhar Patra & Mohan Sethy, 2017).

In another research work, Physico-Chemical characteristics of water were determined in five blocks from a selected area which is urban and rural locations of Bangalore. Four water samples were taken for each of the blocks to be analyzed for Physico-Chemical parameters like pH, Specific conductivity (SP), total dissolved solids (TDS) and total hardness (TH). It was concluded that the pH of all water samples were found neutral and the SP, TDS and TH were all increased towards water coming from the urban areas compared to the rural areas. However, all parameters were within the WHO standard limits (Physico-chemical analysis of water samples, 2015). A research work by Khalid, Malik, Waseem, Zahra & Murtaza (2011) was conducted to analyze the qualitative and quantitative analysis of drinking water samples from different locations in Abbottabad district, Pakistan. The analysis include many parameters analyzed but two examples of parameters included were temperature and pH.

A total of fifteen water samples were analyzed to determine the presence of different amount of pollutants in the water. The results in this study showed that the average temperature of the water samples was 14.9 °C which is quite below the WHO standard limits (25°C) and the pH values was between 7.26 – 8.84 which is within the WHO standards (6.5 - 8.5). A research work was carried out to evaluate the microbial and chemical characteristics of potable water in public-water supply within Lagos University, Nigeria. Water samples collected were from four different locations in the campus and it was discovered that the level of Coliform contamination

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exceeded the WHO standard limits which further proved the high occurrence of student populations obtaining water-borne diseases such as Dysentery, Diarrhea and Typhoid fever. There are also other microorganisms discovered in the water samples which include *E. coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, yeasts and moulds.

A study carried on the microbiological quality assessment of drinking water in Lalo Commune, Benin, West Africa. Thirty-five water samples were taken in the Ahomadégbé district to assess the microbiological parameters and from this study, it is observed that the presence of microbiological pollution in the drinking water exceeded the WHO standard limits, especially the faecal contamination. This was what caused a health concern among the public though the drinking water was readily available in Benin (Johnson et al. , 2016).

Another study by Jayalakshmi & Lakshmi (2014) was aimed to analyze water samples for microbiological parameters of water and waste waters from seven different locations in and around Vijayawada from January to December 2012. The results showed that in all of the locations, except site II, the fungal colonies did not exceeded the standard limits but the microbiological tests showed that there are also presence of *E. coli*, *Salmonella typhi*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Vibrio cholera*.

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