A Case Study: Water Quality Content between Water Supply and Water Vending Machine at Parit Raja, Johor

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Abstract. Water quality study was conducted on water vendor machines with different types of systems that are available around Parit Raja, Batu Pahat such as reverse osmosis systems, systems nanotechnology nano-silver system and water supply pipes. The aim of this study is to distinguish the water quality from the vending machine that follow the standard quality whether authorized or not. Standard water quality parameters such pH, iron concentration experiments, experimental manganese, aluminium and experimental testing ammoniacal nitrogen were computed as comparison. Nanotechnology system water produces better quality when comparing to the pipe water as its pH value shows 6.62. From the experiments the concentration of iron, manganese, aluminium and ammoniacal nitrogen shows 0.08-, 0.07-, 0.05-, and 0.01 mg/L respectively which all the values are in compliance with the National Drinking Water Quality Standards (NDWQS). As for water from reverse osmosis system and pipe water supply both its pH is 6.2 and 6.4 correspondingly which both are not concurrence with National Drinking Water Quality Standards. However, iron content for water from reverse osmosis (0.30 mg/L) is higher than water supply pipe (0.12 mg/L) and both are in the standard range. Iron content of the water supply pipe which is not allowed by 0.14 mg/L. Compared with water from a reverse osmosis system in which the iron content is at a maximum of 0.10mg / L. The parameters of aluminium and ammoniacal nitrogen, the two systems are at acceptable levels. For water from nano-silver system, all parameters are in compliance with the National Drinking Water Quality Standards.

1. Introduction
Water is the most important nutrient in life after air. Water is also one of the natural resources, which play an important role in human life for daily activities directly or indirectly. Now days, all around the world are facing with water crisis due to population growth, global economic and industrial growth rates. Biswas [1] found that population growth of middle class is estimated to have 4.9 billion by 2030 and it expand from 3.2 billion in 2020 and 1.8 billion in 2009. World water demand keep on increasing each year [2-3] and in Malaysia, the demand for agricultural, industrial and domestic purpose has steadily increased started in 1980 until 2000 from 8.9 billion m³ to 15.5 billion m³ [4]. This kind of statistic has emerge an awareness among citizen about water quality for their daily used especially drinking water.
According to the Malaysian Standards, MS 1228 [5] average rate of water use requirements is 225 L/person/day. On average, the volume of water in the human body is 65% of total body weight and volume are highly variable in every person. There are few human organs that contain a lot of water, which is crucial for the water to be clean and quality water. This is because the water is clean and of high quality needed for the body, but it also plays an important role in the growth of the community every day there are about 25,000 people will die from the use of untreated water in everyday life [6].

A research among urban resident in Negeri Sembilan, Malaysia on water issues found that colour, odour and taste were the main problem with their tap water. Due to this matters, 85% respondents has purchased domestic water filters, 41% boiled water and 17% bought bottled water and almost quarter that had water filter clarify it is more convenience for them[7]. The awareness begins when people concern about health, poor water quality and increasing water pollution in the country. The diseases cause by polluted water that attack humans are transmissible and spread through water. Such conditions can cause epidemics of course everywhere.

Based on these concerns, water filter companies have supply many type of water vending machine that easily found in public area. Vending machine is a self-service machine produce purified water dispensing into customer supplied container such as a water bottle [8]. Malaysian citizen perception on vending machine is the water produced by it safe to drink because they on rely on the advertisement by the company provider not from the public health point of view. A good service of water vending machine is when connected to an approved, potable water supply and when they are properly designed, manufactured, installed and maintenance [9].

In Malaysia, several studies have been recorded on the presence of ammonia and manganese in drinking water treatment [10] and minerals content in drinking water [11]. Therefore, through this study, there are two objectives to achieve. The objectives are, (i) identify the contents of water quality based on tests conducted in the laboratory and (ii) determine whether water quality from vending machine follows the standards required.

2. Material and Method
In this study, there are four types of water taken from different water filtration systems. These systems comprises of nano technology, nano silver and reverse osmosis. Water supply pipes, which produced from a water treatment system were also used in the comparison between the other water filtration. Selection of samples according to several parameters involving pH, concentration of iron, manganese, ammoniacal nitrogen and aluminum. Water quality of the content will be either comply with National Drinking Water Quality Standards (NDWQS) or not and this standard issued by the Ministry of Health Malaysia. Table 1 shows the National Drinking Water Quality Standards was used as a standard for this study.

Five experiments were conducted including pH test [13], experiment concentrations of iron [12], manganese experiment [13], experiment aluminum and experiment ammoniacal nitrogen [13] based on several studies have done [10-11]. In carrying these experiments, equipment and materials used should be determined properly in order to reduce the error.
Table 1. National Drinking Water Quality Standard (NDWQS) [12]

| Parameter                  | Group | Raw Water | Treated Water |
|----------------------------|-------|-----------|---------------|
|                            |       | Minimum   | Maximum       | Minimum | Maximum |
| Total coliform(TC)         | 1     | 0.00      | 5000.00       | 0.00    | 0.00    |
| e-coli (E-Coli)            | 1     | 0.00      | 5000.00       | 0.00    | 0.00    |
| Turbidity (NTU)            | 1     | 0.00      | 1000.00       | 0.00    | 5.00    |
| Color                      | 1     | 0.00      | 300.90        | 0.00    | 15.00   |
| pH                         | 1     | 9.00      | 6.50          | 9.00    | 9.00    |
| Chlorine (Cl)              | 1     | -         | -             | 0.20    | 5.00    |
| Ammoniacal nitrogen(NH$_3$-N) | 2   | 0.00      | 1.50          | 0.00    | 1.50    |
| Fluoride (Fl)              | 2     | 0.00      | 1.50          | 0.40    | 0.60    |
| Ferum (Fe)                 | 2     | 0.00      | 1.00          | 0.00    | 0.30    |
| Aluminium(Al)              | 2     | -         | -             | 0.00    | 0.20    |
| Mangan (Mn)                | 2     | 0.00      | 0.20          | 0.00    | 0.10    |
| Chemical Oxygen Demand (COD)| 2  | 0.00      | 10.00         | -       | -       |
| Biochemical Oxygen Demand (BOD)| 2| 0.00  | 6.00         | 0.00    | 0.00    |

3. Results and Discussion

Figure 1 to Figure 5 shows the average value for each water filtration system for pH, iron, manganese, aluminium and ammonical nitrogen concentration, respectively. According to National Drinking Water Quality Standards, the value allowable pH range is 6.5 to 9.0. The data shows in Figure 1 indicate that, pH value for water produced from reverse osmosis system and pipe supply is less than 6.5. Figure 2 shows the data for iron concentration. Reverse osmosis system has recorded the highest value of 0.30mg / L of iron concentration value. Meanwhile, pipe water supply has the second highest value of 0.12mg / L and nano technology system with the lowest value, 0.08mg/L. According to the National Water Quality Standards (KKM, 2009), the permissible value of iron for treated water is between 0.00mg / L to 0.30mg / L. From Figure 3, shows the supply pipe for the highest value for manganese with 0.14mg/L. The allowable value is between 0.00mg/L to 0.10mg/L. It is may be caused the pipes were not well maintained. Nano technology has the lowest value. Figure 4 shows the analysis of aluminium. According To National Drinking Water Quality Standards[12], the value allowable aluminium range is 0.00mg/L to 0.20 mg/L. In the study, all of the water has allowed value. Figure 5 shows the analysis of ammoniacal nitrogen. According To National Drinking Water Quality Standards (Table 1), the value allowable ammoniacal nitrogen ranged from 0.00 mg/L to 0.15 mg/L. In the study, all of the water has allowed value.

Based on the laboratory results, the values for all four water supply system are acceptable as according to the National Drinking Water Quality Standards. There are few types of metal that are allow in water due to some of it are naturally exists while others are from pollution. Natural metal like aluminum exists in tap water as a result of its use as a coagulant in water treatment such as excessive aluminum sulfate. Ammoniacal this nitrogen results from microbiological activity and usually exists in surface water and underground water.
Figure 1. Analysis of pH

Figure 2. Analysis Concentration of Iron

Figure 3. Analysis of Manganese

Figure 4. Analysis of Aluminium

Figure 5. Analysis of Ammoniacal Nitrogen

4. Conclusion
As a conclusion, based on analysis result obtained, it shows that nano-technology system produced better water quality compared to the others different system. This can be seen when all the selected parameters, the water system using nano-technology are comply with the values in the National Drinking Water Quality Standards. Meanwhile, reverse osmosis system is categories as the worst water filtration system compared to the other three system in water vendor machine. Among all the parameters that has been tested it shows that pH parameter has the unfavourable value. Besides that, there are two parameters that have the maximum permitted concentrations of iron and manganese. These two parameters are sourced from the pipes that are not maintained due to the presence of iron
and manganese can be detected if there are on the pipe. Other that pipe water supply, water filtration machine system or water vending machine also not properly maintained. Water sources from the pipe water supply has low water quality because there are some parameters that do not follow the National Drinking Water Quality Standards such as pH and manganese parameters. Water quality is also affected due to the pipes that are not properly maintained.

5. References

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