The Potential of Waste Water Produced From Split Type Air Conditioner

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Abstract

Water is important for people and ecosystems. Extensive use of water sometimes cause shortage of supply. Therefore various alternatives sought to overcome the shortage of water supply. Among the sources of water that has not extended its use of water resources resulting from the split type air conditioner. Condensation processes that occur in this type of air conditioning split units will produce water. Most of the water produced by the air conditioner of this type would normally discharged directly into the drain. This study focuses on the potential uses of the water produced. The focus is on the amount of water produced per unit, and compares with the total daily water use by domestic activities. Further water samples will be taken and tested for content in accordance with the parameters set by the water quality standard (WQI) of dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, ammonia nitrogen, suspended solids and pH value. The results obtained will be compared with water quality standards issued by the Department of Environment, Malaysia. Based on analysis done, the water produced from air conditioning can be categorized in class III which is suitable used in water supply, requiring intensive care. It also can used for fisheries, according to species that have economic value and can tolerate water quality. During observation, it found that the water produced can reach 300 liter and more at the study area.

Keyword: water quality, condensation process, water produced, domestic activity

1.0 Introduction

Nowadays the use of air conditioning is widely used in Malaysia in order to provide comfortable to the occupants in the building. Typically people used split type air conditioner for house and small offices. This type of air conditioning unit comprises an indoor unit (usually mounted on the wall) and external unit located outside the building. This unit has piping to drain the water produced due condensation process. Condensation is the process of a substance in a gaseous state transforming into a liquid state. This change caused by a change in pressure and temperature substance. Usually people often overlooked the sources of freshwater obtain from condensate process in air conditioner. The water produced from this air conditioner normally will be disposed down to the drain. Indirectly, this alternative source of water is being thrown away. It is such a waste since the water can be reused. According Bob Boulware (2013) condensate is essentially distilled water, low in mineral content, but may contain bacteria. The low mineral content in condensate causes less polluting from mineral

residue in the evaporation process thus making water ideally suited for use in cooling towers and fountains.

Through surveys in the study area, usually the piping used tod rain the water are easily damaged due to trampling or vandalism as it is installed on the floor. Thus, the path becomes slippery and dangerous forpeople passing by. There are also pipe that plucked off as a result of acts of vandalism and wear and tear used. A random survey found that consumers do not even think the water produced from air conditioning unit can be reuse, thinking the water is not safe and contains harmful substances. Therefore, a study should be conducted to identify the potential uses of the water in terms of the capacity of the water produced, tested the water in accordance with set parameters and analysing the appropriateness of the use of water based on standards issued by the Interim National Water Quality Standards For Malaysia (INWQS) shows in table 1.1. The results of this analysis will indirectly give confidence to the user to use the water.

2.0 Methodology

The study only focused on water produced by split type air conditioner installed around the building in Politeknik Kuching Sarawak. The study area was chosen because most of the offices in this area use split type air conditioner. The air conditioner operate for 9 hours from 8.00 am to 5.00 pm. Thus, the total production of water from the air conditioner is in order and can be easily calculated.

For this study, the sampling method to be used is in-situ experiments and laboratory testing methods. Testing in-situ involves three parameters, namely the scale of pH, dissolved oxygen (DO) and turbidity (turbidity). For laboratory experiments, a total of two water samples sent to an outside testing company, namely SP Lab is located at Jalan Sultan Tengah, Petra Jaya, Kuching, Sarawak. Four parameters were tested and analysed. The parameters tested were biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (SS) and ammonia nitrogen (NH3-N). Water Quality Index calculations are made based on the experimental results of samples taken for testing both in-situ and laboratory testing. The results of this analysis will be classified according to the categories given.

Table 1.1: Water Quality Index by Department of Environment

No	***Parameter***	***unit***	***Class***					
			I	***IIA***	***IIB***	***III***	***IV***	***V***
1.	Ammoniac Nitrogen	mg/l	<0.1	0.3	0.3	0.3-0.9	0.9-2.7	>2.7
2.	Biochemical Oxygen Demand	mg/l	<1	3	3	3-6	6-12	>12
3.	Chemical Oxygen Demand	mg/l	<10	25	25	25-50	50-100	>100
4.	Dissolved Oxygen	mg/l	>7	5-7	5-7	3-5	1-3	<1
5.	pH	-	>7	6-9	6-9	5-6	< 5	>5
6.	Total Suspended Solid	mg/l	<25	50	50	50-150	150-300	>300
7.	Turbidity	NTU	5	50	50	150	300	300
	Water Quality Index, WQI	-	>92.7	76.5-92.7		51.9 - 76.5	31.0-51.9	<31.0

Sources:Interim National Water Quality Standards for Malaysia - WEPA

Dissolved oxygen (DO) is a measure of water quality is paramount. This is because oxygen is a requirement for aquatic to life. Dissolved oxygen is inversely proportional to temperature. This means an increase in water temperature will reduce the dissolved oxygen content and vice versa. Thus, the solubility of oxygen was also affected by the weather, time either morning, afternoon or evening, and the ambient temperature.

Biochemical oxygen demand (BOD) is the total oxygen requirements needed by microorganisms to decompose the organic pollutants naturally. It is important to control the water quality and pollution. Biochemical oxygen demand clues to the degree of contamination of water. The testing methods usually practiced in Malaysia is storing the samples of water to be tested in a bottle and sealed. After that, the sample is placed in a dark place for 5 days is to avoid the production of oxygen by photosynthetic microorganisms such as algae. It is practiced at a temperature of 30°c.

Chemical Oxygen Demand (COD) is a parameter used to indicate the amount of oxygen required for the oxidation of organic chemical materials and produce carbon dioxide and water during the process. This value also reflects the degree of contamination of the water samples tested.

Ammonia Nitrogen (NH3-N) is a parameter that is used to detect contamination caused by humans and animals. Algae growth is attributed to the presence of excess nitrogen and water quality will deteriorate. The high concentration showed that the presence of organic matter is high.

The pH scale is a measure or index that indicates the acidity and alkalinity of a water source. The rate of pH value is between 0 and 14. It will

measure the concentration of hydrogen ions (H ^ +) contained therein. Air concentrations of ions (H ^ +) high is acidic in nature and has a low pH of less than 7. The water has the concentration of ions (H ^ +) which is low alkaline pH where readings greater than 7. Water is neutral if its pH reading is equal to 7.

Suspended solids in water comprising inorganic or organic particles or substances that are not soluble in water. Inorganic solids are soil, silt and other particles in the soil and organic matter are as fiber plants and microorganisms (biological suspended solids), such as algae and bacteria. The presence of suspended solids can significantly reduce the aesthetic value of water and suspended solids can cause biological outbreak by bacteria and the production of toxic algae.

Turbidity is a test used to gauge the relative clarity of water. The more turbid the water indicates the water is contaminated. Determination of this index is based on a formula published by INWQS.

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Table 1.2 shows the classification of water use by 'Interim National Water Quality Standards for Malaysia'. This table has classified five types of water use according to its quality. The classification system of the level of pollution can be categorized into five stages, namely very good, good, fair, polluted and heavily polluted according to the Air Quality Index is calculated.

Table 1.2: Water Classes and Uses

Class	Use
I	• Water conditions maintained in the state of the natural environment. • Use as water supply, it does not require treatment unless the eradication of river or by boiling only. • For highly sensitive aquatic life.
IIA	• For use in water supply, it requires conventional treatment. • For fishing, suitable for sensitive aquatic life.
IIB	• Can use for bath.
III	• For use in water supply, requiring intensive care. • For fisheries, according to species that have economic value and can tolerate water quality.
IV	• Suitable for crop irrigation.
V	• Other than those mentioned above is not

suitable.

Sources:Interim National Water Quality Standards for Malaysia - WEPA

3.0 Results and discussion

Observation result

The study area is an office building that uses split type 3HP air conditioner. Observation method has been used in order to calculate the amount of water produced in one day of operation. Six location were selected in order to obtain the result. Based on observation, it's found that the average water produced in study area is 377.865 litter per day. Table 1.3 shows the rate of domestic water consumption by activity issued by the Syarikat Bekalan Air Terengganu and sugesstion the number of uses when using this result. By reffering the table, if the water is suggest to use for flushing the toilet, it will used 25 time flushing.

Table 1.3: The rate of water consumption by activity (Estimated rate of water flow is 6 litters per minute)

No.	Activity	Water consumption (Litter)	No of uses
1.	Brushing (using pipe for 2 minutes)	12	31
2.	Wash hands (using pipe for 2 minutes)	12	31
3.	Bath (with tub)	110	3
4.	Using the tap water (shower) for 2 minutes	12	31
5.	Wash your face (using pipe for 2 minutes)	12	31
6.	Dish wash (Using tap water for 15 min	90	4
7.	Flushing the toilet	9 – 15	25
8.	Watering the plants (Using the water from the pipes and hoses for 3 min)	18	21
9.	Watering the plants (using a 5 litter bucket)	5	75
10.	Car wash (use a hose for 10 minutes)	60	6
11.	Wash the floor (use a hose for 3 minutes)	18	21

In-situ experiment
The in-situ experiment used two sample. First sample taken direct from air conditining unit and second sample taken from waste water tank. The parameter tested were Dissolved Oxygen (DO), pH and Turbidity.

Laboratory test
Two samples taken and four parameters were tested and analysed in the laboratory. The sample also taken Similar with in-situ experiment. The parameters tested were biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (SS) and ammonia nitrogen (NH3-N).Table 1.4 shows the results obtained from both experiment.. Sample 1 is a sample water taken directly from the air conditioning while sample 2 is water from the air conditioner collected in the storage tank.

Table 1.4: *In-situ and laboratory test results*

Parameter	***Sample 1***	***Sample 2***
Dissolved Oxygen (DO)	5.79	10.18
pH	6.38	7.79
Turbidity	0.28	1.04
biochemical oxygen demand (BOD	1.1	2.6
chemical oxygen demand (COD)	<10	14
total suspended solids (SS)	<5.0	<5.0
ammonia nitrogen (NH3-N)	1.0	4.35

3.4 Water Quality Index result

The calculation of "Water Quality Index "(WQI) is conduct by using the following formula.

WQI = (0.22 * SIDO) + (0.19 * SIBOD) + (0.16 * SICOD) + (0.15 * SIAN) + (0.16 * SISS) + (0.12 * SipH)

Sample 1 is calculation of WQI for water that taken directly from air conditioner and sample 2 is calculation water from air conditioner that taken from waste water tank.Result obtain from both results shows in table 1.5.

Table 1.5: Sub-index calculation result

Sub-Index	WQI	
	waste water directed from air conditioning (sample 1)	**water from air conditioning waste water's tank (sample 2)**
SIBO	0	2.50
SIBOD	95.75	89.40
SICOD	85.8	80.48
SIAN	48.00	0
SISS	94.51	94.51
SLPH	95.79	93.76
WQI	65.74	56.79
Class	**III**	**III**

4.0 Conclusion

As a result of the accumulation of water, the total amount of the water produced by air conditioner in the study area is of 377 865 millimetres or 377.865 litters per day. It is a large amount of water sources as Politeknik Kuching Sarawak always experienced water shortage. Result fromin-situ experiments and laboratory tests found that the water produced by air conditioning is in categories class III. Sample 1 is greater than sample2 due to water pollution in the storage tank. From observation, it found that the storage tank contain algae due to weather and lack of care. According category to data issued by the Interim National Water Quality Standards for Malaysia, this water is suitable used in water supply, requiring intensive care. It can also be used for fisheries, according to species that have economic value and can tolerate water quality. However, further studies should be carried out if the water is to be used other than the use of which has been proposed in Table 1.3.

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