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The Water Quality Perspective in Universiti Teknologi Malaysia (UTM) River: A Review

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Abstract

Malaysia is a rich country in water resources through rivers, but majority the rivers are continuously increased in contamination. Current status of river water quality are no longer to be consume directly such as outdoor activities of swimming, fishing or recreational activities on the river, due to no longer healthy of water resources and the river water is contaminated which could cause dangerous diseases. At these circumstances, river water pollution is expected and detected caused by point- and non-point source contamination. The point source pollution is originated from central wastewater treatment, manufacturing, agricultural and industrial waste as well as animals farming activities. Meanwhile, the non-point source pollution is reported from agricultural activities and the mechanism of surface runoff. Therefore, based on the standards of the Water Quality Index (WQI) and the Interim National Water Quality Standard (INWQS) designed by DOE Malaysia, the water quality level of UTM River can be determine by examine on six basic water quality parameters, namely ammonia nitrogen, BOD, COD, suspended solid, pH, DO, and temperature. In conclusion, without proper monitoring, the level of river water quality are suspected to continuously decrease and sustainable development will be necessarily required to maintain the biological ecosystem in surrounding environment.

Keywords: UTM River, point and non-point source, sustainable development, Interim National Water Quality Standard

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Introduction

Rivers are crucial to mankind since time immemorial. Clean water is used in various purposes such as drinking water sources and also their daily activities. However, modernity brought by the world's only pursue their passion has led to a very thin stream of interest among the public. In fact, the river water now not only can no longer be taken directly even activities like swimming, fishing or recreational activities on the river was no longer a healthy activity for fear that the river water is contaminated and can carry dangerous diseases (Hua, 2018; Hua, 2017; Ma'arof and Hua, 2015). Malaysia is a country rich in rivers, but most of our rivers are increasingly polluted. In fact there is a river that has been designated as contaminated. Table 1 shows the major rivers in the country.

Table 1: Main River in Malaysia

Location	River Name	Immensity	Length
Peninsular Malaysia	Sungai Pahang	29,300	430

International Journal of Business and Social Development (IJBSD), Volume 1, Issue 1, (page 15 - 24), 2019

	Sungai Perak	14,700	400
	Sungai Kelantan	13,100	355
Sabah and Sarawak	Sungai Rajang	51,315	560
	Sungai Baram	22,325	402
	Sungai Lupar	6,745	210
	Sungai Limbang	3,578	200
	Sungai Kinabatangan	16,581	365

Source: JAS, 2008

The presence of contaminants such as plastic, food scraps, packaging and carcasses and heavy metals in the river water to take up the cause of the water supply cannot be done perfectly. As a result, the water used for daily activities is not entirely clean. Report on the quality of life of Malaysians, 1999 (Fuad, 2007) showed that the water quality of the river water quality computed found the quality to decline from 55.8 percent in 1985 to 27.5 percent in 1998. This indicated a decline in the quality of river water. The problem of pollution has attract the attention of Prime Minister during the present time, and had launched the National Love Our River in Ampang row, Kedah, November 2000. Prime Minister stated that many rivers polluted are due to the people do not appreciate the river as an inheritance to dispose of waste includes materials such as hard plastic to disintegrate in the river. Despite nearly a decade of campaign submitted polluted river in Malaysia remained even worse. The main source of pollution of suspended solids is uncontrolled earthworks. When the soil is disturbed it will cause soil to become loose. This loose soil eroded and washed away happy when there is rain. Surface runoff will carry silt from the land along the river. Silt, making the river water becomes cloudy and also cause sediment in the rivers that will ultimately cause the affected aquatic ecosystems. As a control, intelligent design should be for this land use.

A brief review on the usage of water resources

There are the several categories for water usage (Clarence, 2003);

i. The water supply for public use
ii. The water supply industry use
iii. The water supply for agricultural use such as domestic knives, irrigation and livestock
iv. Recreational such as general purpose, swimming, diving, kayaking, aesthetic
v. Breeding of fish or aquatic life
vi. The supply of hydroelectric power
vii. Shipping industrial
viii. The release of the remaining material

Water Pollution in Malaysia

In Malaysia, water pollution is caused by point source and non-point source. The cause of point source is identified in Malaysia as central wastewater treatment, manufacturing, agricultural and industrial waste and farm animals. Meanwhile, the cause for non-point source is also stems from agricultural activities and also the mechanism of runoff. According to the Malaysia Environmental Quality Report (JAS, 2008), the Department of Environment has recorded 17,991 air pollution occurs from a source point in 2004 and it is due to the central wastewater treatment (54%), manufacturing industry (39%), farm livestock (5 %) and agriculture (3%). The breakdown of the causes of water pollution is shown in Figure 1 below.

International Journal of Business and Social Development (IJBSD), Volume 1, Issue 1, (page 15 - 24), 2019

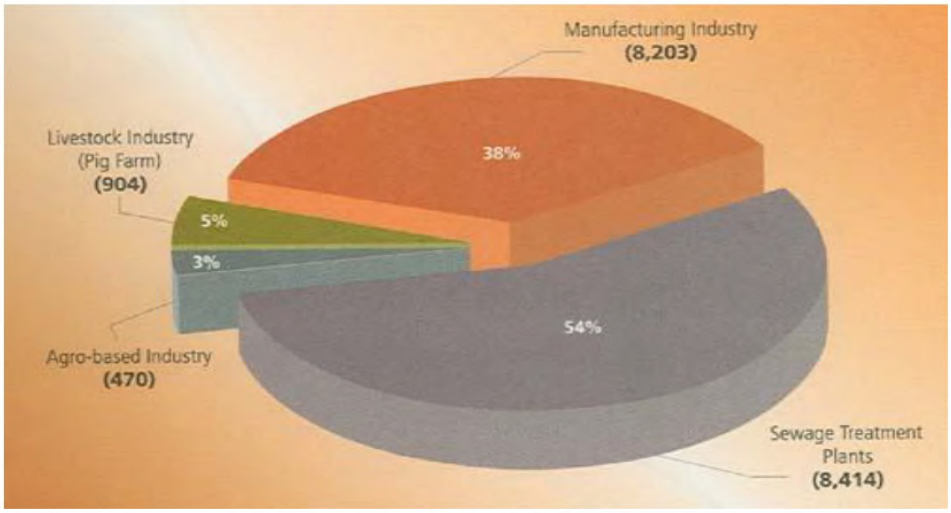

Figure 1: Categories of water pollution from various sectors in 2004
Source: JAS, 2008

River passing through densely populated areas such as towns and housing estates are often polluted by solid waste and soil erosion and can lead to some aquatic life cannot survive and can cause clogging up the drain caused a flash flood. Soil erosion is caused by the development of the land around the river and also of untreated waste water from factories that contribute to high pollution levels in the river water. This will not only destroy aquatic life but also the flora, fauna and vegetation because of high acid levels. In 2008, a major pollutant types are derived from biochemical oxygen demand (BOD), ammonia nitrogen and suspended solids. High BOD levels of pollutants are caused by untreated waste water and waste from industry and manufacturing. While the main causes of ammonia nitrogen is from the animal husbandry and domestic wastewater. Meanwhile, the cause of floating solids and are of earthworks and cleaning activities often associated with the construction industry (JAS, 2008). According to the Environmental Quality Report (JAS, 2008), again, in 2008 a total of 1,063 water quality monitoring stations located around 143 rivers for monitoring purposes. Of these, 612 (58%) found the net, 412 (38%) is highly polluted and 39 (4%) contaminated. Overall, the stations that were in the river are clean and in the downstream river is polluted. While from the river 143 76 (53%) are clean.

Analysis of the solid weight of 5628 water samples were class III, INWQS for arsenic (As), mercury (Hg), cadmium (Cd), chromium (Cr), lead (Pb) and zinc (Zn), except iron (Fe) where the compliance of 86 percent.

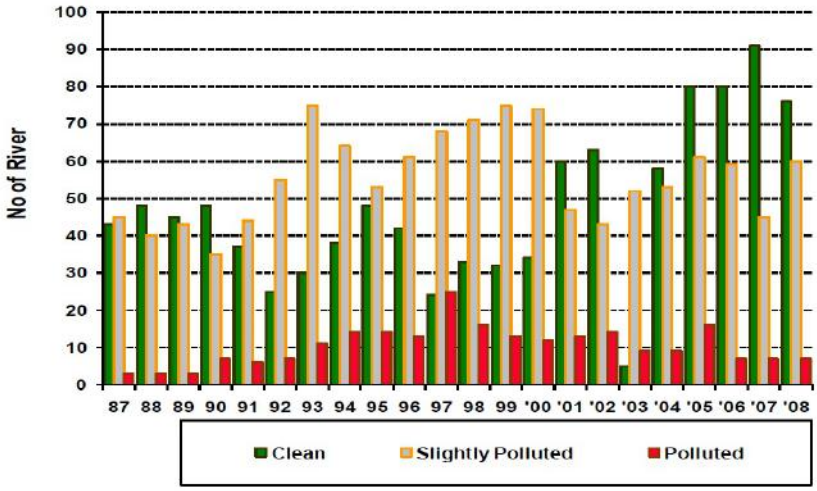

Figure 2: River water quality from 1987 to 2008

International Journal of Business and Social Development (IJBSD), Volume 1, Issue 1, (page 15 - 24), 2019

Source: JAS, 2008

Figure 2 shows the water quality from 1987 to 2008. Department of Environment (JAS, 2008) uses Water Quality Index (WQI) to assess the water quality status or condition. WQI is used for the evaluation of contamination and pollution while the river is class classification using the Interim National Water Quality Standard (INWQS).

Development of River Corridor

River serves as a passage to drain the water from the watershed to the ocean. Since time immemorial the river and its surroundings are very important in the history of human civilization, which is where development will occur in social or economic. River corridor development plan is needed for work in controlling a wide range of activities that can cause pollution to the river. In addition, it is intended to maintain the river so that the river ecosystem function is not affected. The river corridor can be defined as an opening of land on both sides of the river (Kasan, 2006). The river corridor is very important to maintain and control pollution of the river water for its ability to be able to prevent the movement of sediment and pollutants from entering the various aquatic environments. In addition, it can act as a barrier to erosion of riverbanks and floodplain areas.

Community variety of plants plays an important role in determining the boundaries of the river corridor of the river corridor properties and potential recovery of water quality (Eric, 1997). Factors such as the type, extent and distribution, soil moisture, species composition and depth of the roots are characteristic plant communities are considered in the determination of the river corridor. For example, wetlands in an area intermediate between the aquatic and terrestrial systems where land is usually overwhelmed by floods. It works within the river corridor as a habitat for aquatic organisms and wildlife, water reservoirs, trap sediment, flood barriers and control of water pollution. View of its importance, the river corridor zones must always be kept out of any trouble that it can perform its function as the control of pollutants, natural habitat for aquatic life and wildlife and so to perfection.

There are various ways to determine which is the river corridor as guided by the road, according to land use activities and also based on the quality of water. Determination of the river corridor is done to identifying areas for land use and water quality along the river.

Causes and Effects of Land Use Activities

Land use activities are a very important criterion in determining assessments river corridor. It is done by taking into account as well as identifies land use and socio-economic development of an area, especially an area close to the river corridor itself. A wide range of activities and land use to describe the breadth of the area in order to level the land. The causes of pollution can also be identified through land-use activities that are being carried out along the river corridor as usual they will make the rest of the river as points of departure such as sewage, solid waste disposal from home and many others. Land use activities are one of the activities that contribute to the problem of water pollution.

Agricultural Activity

Normally, agriculture is a contributory factor to the pollution of river water quality in Malaysia due to the use of organic chemicals such as fertilizers and biocides (herbicides and pesticides) to encourage the growth of plants. However, agricultural activities are too close to the river will cause the river is polluted with organic substances such as chemicals and organic manure is used as fertilizer easily slip into a nearby river due to water runoff and also seepage into the ground.

Excessive usage of biocides and uncontrolled agricultural activities can cause a variety of negative consequences for the aquatic environment as this contains carcinogenic substances that are very harmful and toxic to human life (Salam and Mahmood, 1988). Among the active ingredients that have

International Journal of Business and Social Development (IJBSD), Volume 1, Issue 1, (page 15 - 24), 2019

been identified are dangerous in biocides are as axoxystrobin, thionhanate-methyl, chlorothalonil and carbendazim. The wastes from the farm are rich in organic matter and ammonium salts in which the concentration of pollution is higher than what the domestic sewage is drained by the river. Significant impact as a result of this activity is the existence of the plants in the quantity of water in the river bed, or better known as detoxification which also led to the presence of many organisms decomposing organic matter and thus increases the demand for dissolved oxygen (DO). There will contribute negative impact on the ecosystem in the water.

Residential Activity

Land use for settlement purposes usually consists of residential areas, places of worship, business, transport, schools and so on. The settlements are the areas that produce the most waste. The settlements are located close to the river as a source of contamination for the disposal of food waste, garbage and sewage is discharged directly into the river. UTM River Corridor also has land use areas such as Arcade chengal food shop, Faculty of Civil Engineering, Faculty of Electrical Engineering. The river flows through several laboratories such as the Civil Engineering Laboratory and several other laboratories. Construction of the road is one of the most effective constructions along the river corridor UTM. The second laboratory is a laboratory of the faculty is the Materials Science Laboratory, Laboratory turning and so on, is the third faculty building followed the administration building. Figure 3 shows UTM River that flows near the construction of the new Laboratory of Civil Engineering. This can lead to problems of soil erosion and sedimentation in the river. Figure 4 shows the conditions are met River UTM in the domestic waste such as oil, wash water; food waste from the cafeteria came near Sungai UTM corridor. Figure 5 shows the Materials Laboratory at the Faculty of Mechanical feared manufacture of laboratory waste that can be hazardous to the UTM if material is released lab intentionally or unintentionally.

Activities settlements along river corridors lead to water pollution if they do not have proper planning and supervision by the responsible party. Nowadays, most of the settlements use septic tanks before transporting sewage into the aquatic environment. However, system design and maintenance of septic tank systems can cause poor water quality deterioration (Ismail, 2006).

Figure 3: UTM River flow through construction of new laboratory for civil engineering

International Journal of Business and Social Development (IJBSD), Volume 1, Issue 1, (page 15 - 24), 2019

Figure 4: UTM River being polluted by dumping wastes like oil, wash water and rubbish

Figure 5: Material Laboratory for Faculty of Mechanical that suspected to produce laboratory wastes which would bring dangerous to river and the surrounding

Construction of Road and Bridge

According to Ramali (2000), the road project generally is to improve the economy and convenience of the user. Increasing road capacity and better pavement can reduce travel time and costs but also can improve job opportunities, education and health services and reduce transportation costs. This is a

International Journal of Business and Social Development (IJBSD), Volume 1, Issue 1, (page 15 - 24), 2019

positive aspect in road projects but it should be noted that there is also a negative impact on the community and the natural environment. There is an awareness that road development has a significant impact on the environment. Some of its effects are such as destroying ecosystems that are sensitive to environmental change, soil erosion, changes to streams and groundwater and disrupt the habitat of animals and plants.

Building Construction Activity

Construction activity adjacent to the river could impact badly on the river. Construction activity often leads to soil erosion problems. Construction activities began with the site clearing activities. The work of site clearance and earthworks are often involves clearing land using heavy machinery. The cleared land often becomes unstable and loose. The land makes it easier to erode. Erosion from construction sites has the potential to cause high sedimentation in the rivers. High deposition can be muddying the waters of the river. High turbidity reduces light levels in the water and can cause interference in the process of respiration and food to aquatic life and at the same time changing the original habitat upstream (Samsubaha, 2009). Water resources are also necessary during construction activities undertaken to control dust, dirt, and others. The water must enter the water flow back and will cause water pollution itself.

Figure 6: Construction for Electrical Engineering adjacent to UTM River

Figure 7: New building in Faculty of Electrical Engineering

International Journal of Business and Social Development (IJBSD), Volume 1, Issue 1, (page 15 - 24), 2019

Sedimentation Activity

Untreated effluents from domestic waste and garbage disposal in which discharged directly into the river contain elements of organic and inorganic pollutants are high. It not only can affect water quality even can cause a foul odor and affect the health of nearby communities. The importance of the river should be taken into account in the development of an area. Thus, any proposed development is built outside the boundaries of the reserve of the river (Majid, 2000). Residents are overrepresented in some countries become increasingly serious impact on the environment. The larger a community in an area more land is needed to sustain their daily activities such as residential, farming, animal husbandry. The activities of uncontrolled land use are one of the causes of water pollution.

Tested Parameter

Generally, determining the water quality in UTM River involve with six basic water quality parameters. According to the standards of the Water Quality Index (WQI) and the Interim National Water Quality Standard (INWQS), water quality can be determined according to the respective limits for each parameter as follows:

(a) Temperature

Generally, the importance of temperature is it may effects on other properties such as the speed of chemical reactions, rate management, particularly oxygen gas dissolves, reinforces the smell, taste and so on, life is very sensitive to temperature changes (Tchobanoglus et al, 1985).

(b) Dissolved Oxygen

Dissolved oxygen (DO) it is often regarded as one of the important parameters to measure water quality. Dissolved oxygen is also an important indicator in determining water pollution, showing a biological state, affect the processes occurring in it, the destruction of organic materials and intensity of rehabilitation (self-purification) (Abas, 2007). Dissolved oxygen will only be a little in the water which is at 14 mg / L at 0C and 7.5 mg / L at 30C degrees. DO content in water is less when the water contains salts or there is an increase in temperature.

As humans need oxygen to breathe, and so also with fish and other aquatic life need oxygen for his life. The content of oxygen in the water depends on physical processes, biology, and microbiology. Air is saturated dissolved oxygen level of the water in contact with air in the atmosphere containing a quantity of oxygen which depends on air pressure, temperature and concentration of dissolved salts.

(c) pH

The pH value is an index of alkalinity or acidity important. It is an acid or base effect of the minerals and organic matter. It is used to identify whether the water in acidic or alkaline conditions by measuring the concentration of hydrogen ions present in the water. PH range is between 0 to 14, where neutral will be pH 7. For a low pH value of 7 is acidic and while more than 7 is showing an alkaline condition. Aquatic organisms and bacteria will be threatened if the pH value of the water is low and too high. Tool measuring the pH value is pH meter.

(d) Suspended Solid

Suspended solids (SS) are usually composed of inorganic particles sized larger than 0.001 mm. Most of the suspended solids in domestic waste consist of organic matter while the rest of the industry is also subject to the types of industries for each region. Total suspended solids are filtered solid amount in filtration processes which subsequently heated at 103. It is measured by the concentration in mg / L (Tchobanoglous et al, 1985).

International Journal of Business and Social Development (IJBSD), Volume 1, Issue 1, (page 15 - 24), 2019

(e) Chemical Oxygen Demand

Chemical Oxygen Demand (COD) is a commonly used method for measuring water contaminated by chemicals result of human activity; it can be defined as the amount of oxygen required in the oxidation of a compound. COD is an equality of oxygen to some organic materials such as permanganate, dichromate and the like in an acidic solution. Advantages COD test compared BOD test is shorter oxidation time of about three hours and almost all organic matter can be oxidized by the COD test. Generally, the COD value is higher than the BOD.

(f) Biochemical Oxygen Demand

Biochemical Oxygen Demand (BOD) is a measure of the quantity of oxygen required for microorganisms to oxidize organic materials in aerated conditions. BOD test was conducted to determine the quantity of oxygen used in the decomposition of organic matter in sewage that occurs naturally. BOD test results that provide high value indicates the sample is contaminated water.

The level of pollution caused by effluent to have high BOD depends entirely on the nature of its receipt system which is a reference to water resources or polluted river. Theoretically, an imbalance occurs if the effluent to have high BOD discharged into receiving system which is in the stage production of low oxygen. This situation resulted in anoxic conditions, namely a state in which the oxygen deficiency. Thereby making the river more polluted.

However, the balance occurs when the BOD effluent stream flowed and the ability to supply oxygen have the same magnitude. The condition occurs when oxygen demand in the receiving system does not exceed the concentration of organic matter is passed, the effluent flowed not leave any negative effects on the environment and the river (Davis and Cornwell, 1991).

(g) Ammonia Nitrogen

Nitrogen ammonia (NH_3N) can be used to detect the teeth of pollution caused by agricultural fertilizers, manure or domestic sewage. Ammonia is a compound that typically resulting from degradation of nitrogenous organic materials. Unionized ammonia is toxic to aquatic life. When dissolved in water, NH_3 will react with water to form ammonia NH_4 ion with the balance remains as NH_3. NH_3 can be oxidized to nitrite and then to nitrate NO_2 and NO_3 by bacteria Nitrosomonas and nitrobacter. NH_3 to NO_3 oxidation process also uses oxygen in large quantities.

NH_3N content in the air is measured by the total ammonia concentration. NH_3 concentrations of NO3 bit and also are an important resource for the growth of algae. Water for aquatic life criteria for NH3 content is 0.02 mg / L (Davis and Cornwell, 1991).

Conclusion

In overall, this study indicates that the water quality of the UTM River is suspected to have been affected by land use activities along the corridor. Land use activities have changed the real situation on the river corridors and buffer areas circumstance also the river itself and has caused problems such as surface runoff erosion and sedimentation River UTM. At the same time UTM River water quality is affected by the discharge of wash water from a food shop in the area around the River UTM.

Water quality index (WQI) and the Interim National Water Quality Standard (INWQS) become main reference to assess and monitor the water quality of the River UTM. This includes the ammonia nitrogen, BOD, COD, suspended solid, pH, DO, and temperature. Without proper monitoring, the level of river water quality are suspected to continuously decrease and sustainable development will be necessarily required to maintain the biological ecosystem in surrounding environment.

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