A Study of Industrial Water Pollution at Kawasan Perindustrian Jejawi, Perlis

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Abstract: Hundred and ten water samples were collected for heavy metal and water quality analysis along Sungai Jejawi. Sampling was conducted four times over a period of a month, six times over a period of weekday and weekends and also seven times over a period of a week on December 2009. DR2800 Spectrophotometer and X-Ray Fluorescence (XRF) was used to determine Mn, Cu, Zn and Cr .All the selected heavy metal such as Cu (0.42 mg/L), Mn (0.178 mg/L), Cr (0.091 mg/L) and Zn (0.05 mg/L) had followed the Standard quality. For the XRF determination the trend of heavy metals in water system is Ru> Pd >P> Ca> Hf >Al> Cu >Fe >Os. This river was classified into class III, based on Interim National Water Quality Standards for Malaysia *(INWQS)* which is it can be use as second water supply, but it required conventional treatment.

Keywords: *Heavy Metal's concentration, Water Quality, River*

I. INTRODUCTION

Pollution refers to contamination of the environment by harmful and waste materials, which brings about a significant change in the quality of the surrounding atmosphere. Water pollution is one of the pollution that caused by emission of domestic or urban sewage, agricultural waste, pollutants and industrial effluents into water bodies. Nowadays, one of the main sources of water pollution is the waste material discharged by industrial units, known as industrial water pollution. The biggest sources of industrial water pollution are food and beverage producers, chemical-based industries, paper, palm oil and rubber processing, and textiles(CS Market Research, 2000). From the Report: Malaysian Resources and the Environment (1995) have reported that the major sources of water pollution are agricultural activities and agro-based industries including the processing of palm oil, rubber, sugar and, to some extent, paper and pulp manufacturing. Both the range and complexity of water pollution problems caused by the discharge of industrial effluents have increased. The potential effects of industrial water pollution could grow to catastrophic levels. Not only do the potential for destruction of fish and other water dwelling creatures exist, but the potential for serious human illness also exists. Metal accumulation is potentially one of the most valuable tools for identifying and quantifying the impact of metals in aquatic environments (Borgmann *et al*., 1995). The Department of Environment (DOE) and Interim National Water Quality Standards for Malaysia (INWQS) has been conducting monitoring of river since 1978, primarily to establish the status of water quality, detect changes and identify pollution sources, weather in clean, slightly polluted or polluted category and to classify the rivers in Class I, II, III, IV or V. The Environmental Quality (Sewage and Industrial Effluents) Regulations 1979 applies to all industrial effluents and sewage. However, some industries face difficulties in complying with some of the parameter limits as prescribed in the Third Schedule of the Regulations. These include the pulp and paper industry, distillery, textile and existing sewage treatment plants. In such cases, contravention licenses have been granted.

II SAMPLING AREA

Catchment area is called Sungai Jejawi has been identified and selected as the location of the study. It situated nearby Jejawi Industrial Area (figure 1). It is 2.0 km long. It is continues river that comes from Sungai Ngulang, Sungai Chuping and Sungai Jerneh. Sungai Jejawi is form due to human activities in which it is known as a source of irrigation for paddy field.

Five sampling stations were chosen in order to evaluate the condition of water quality flowing along Sungai Jejawi. Starting from the first sampling point (P1), it is situated nearby the agricultural activities.The second sampling point (P2) was located near to the

scrap metal's shop, where all the recycle metal such as tin, aluminium will be placed there. The third sampling point (P3) were chosen nearby the Shorubber (M) Sdn Bhd, which was the main industries in Jejawi area and fourth sampling point (P4) was continuation from sampling point three (P3). These stations had been chosen because the water that flow from S3 was being use to irrigate the nearest paddy field, which is at P4. Finally, the last station, fifth sampling point (P5) was chosen nearby the residential area. This station was presumed to give less pollution data, due to the location which are far away from industrial area.

III MATERIAL AND METHODS

Five sample bottle of capacity 1 litre, Hydro lab DS5 were used to carry out the in-situ testing. Before the water samples were taken to the laboratory, in-situ testing firstly should be carried out by all those apparatus. The in-situ testing that been carried for the water sample are pH, temperature, turbidity, LDO, salinity, Ammonia (NH4) and Nitrate (NO3). The sensors that are available with this hydro lab were temperature, pH, ORP, NH4, NO3, Depth, LDO, Turbidity, TDS, SRC and Salinity. After site analysis, water sample were taken and placed into the polystyrene box to maintain the pH and temperature. The sample bottle initially should be labeled in order to avoid any error. All of the on-site testing should be established in 2 hours time consumed. This is to avoid any changes in the water parameter for the water sample that had been taken. Laboratory experiments carried out such as Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammonical Nitrogen, Total Suspended Solid (TSS) and also metals parameters (Copper, Manganese, Zinc and Chromium Hexavalent).

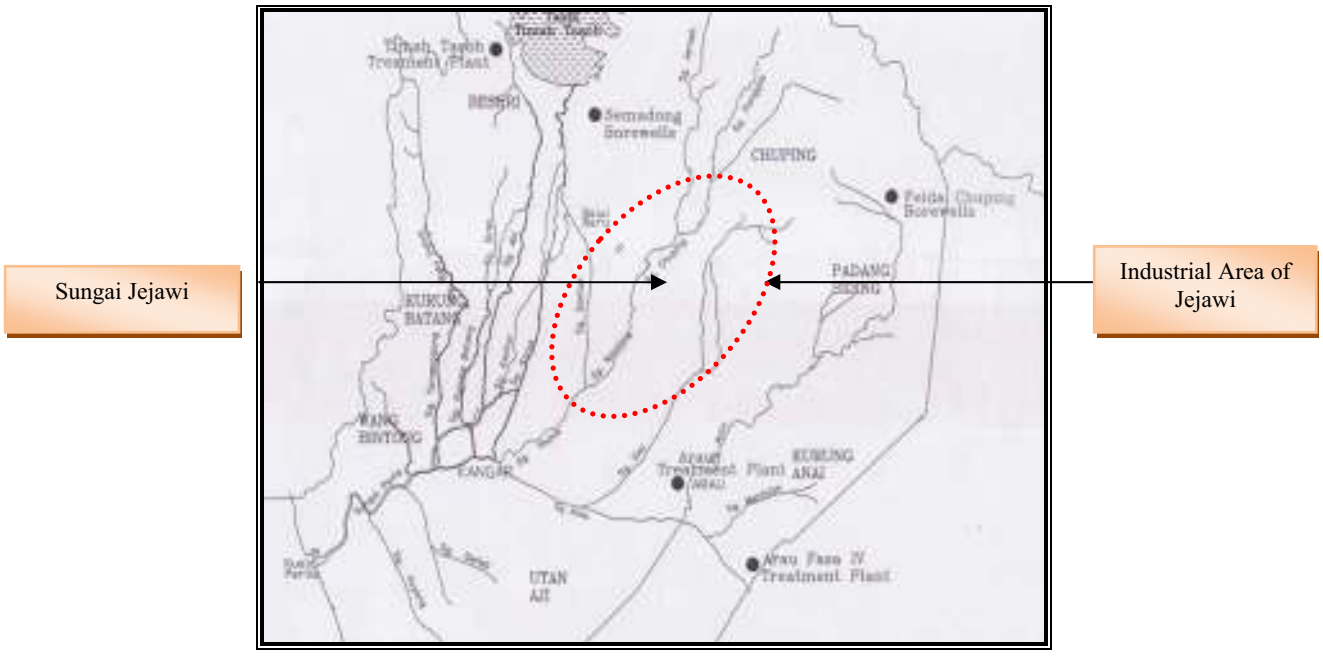

Figure 1: Map of Sungai Jejawi (Source: Department of Irrigation and Drainage Perlis)

IV RESULTS AND DISCUSSIONS

After evaluating all the 6 parameters (pH, Temperature, Mn, Cu, Zn and Cr), all those parameter reading were compared to the Standard B Environmental Quality (Sewage and Industrial Effluents) Regulations 1979. DR2800 Spectrophotometer and X-Ray Fluorescence (XRF) was used to determine Mn, Cu, Zn and Cr . The highest average pH value was indicated on the fifth sampling station (P5) with the average pH value of 7.74, but the lowest average pH value was indicated on the second point (P2) with the average value of 7.16. The pH value was increases at the point 1, and then, slightly drop in point 2 and then start to increase in point 3 until it reached a peak at point 5. This may due to point 1 are located at the upstream of the catchments

and less contamination affecting the water at point 1. For copper, Cu, first sampling point, (P1) was resulting as a higher concentration of copper at 11 am, which is 0.42 mg/L. It is due to the low flow rate of river at that time. The concentration of copper will accumulate and dissolve rapidly into the river. Copper is a natural element that is an essential micronutrient to ensure the well being of all aerobic life forms. Manganese is another heavy metal that was analyzed through DR2800 Spectrophotometer. Manganese had been reported as a highest concentration in a 4th day (17/12/2009) of a week. That means, during the weekdays, Manganese had reached the peak concentration at third sampling point (P3) with 0.178 mg/L at 9.a.m. It is because point 3 was located behind rubber industry (Shorubber (M) Sdn Bhd). Rubber industry will undergo one of the

processes called drying. Chromium is another heavy metal that had been evaluate and one of an industrially important metal, which has the potential to contaminate drinking water sources. The highest average concentrations of chromium were indicated at first week of sampling. It might occur due to the Chromium as a common constituent of surface waters but in low concentrations because of its low solubility and its ready adsorption onto particulate and sedimentary materials. Second sampling point (P2) was indicated as a highest chromium concentration, with 0.091 mg/L. It is because point 2 is located behind the scrap metal's shops. Zinc was one of the metal was tested using DR2800 Spectrophotometer. The highest average concentrations of Zinc can be indicated within a month was at the second week. It is due to increasing of human activities such as farming, fishing, steel production, coal burning, and burning of wastes. The human activity was slow starting from the third week (28/12/2009) because at that week, the weather was not good. The lower the concentration of zinc in river (source of irrigation), the plants will grow well without containing excessive heavy metal. For the XRF determination the trend of heavy metals in water system is Ru> Pd >P> Ca> Hf >Al> Cu >Fe >Os. The WQI for Sungai Jejawi was 56.77. It was in range 45-75 which is in a moderate condition.This river was classified into class III, based on Interim National Water Quality Standards for Malaysia (INWQS) which is it can be use as second water supply, but it required conventional treatment.

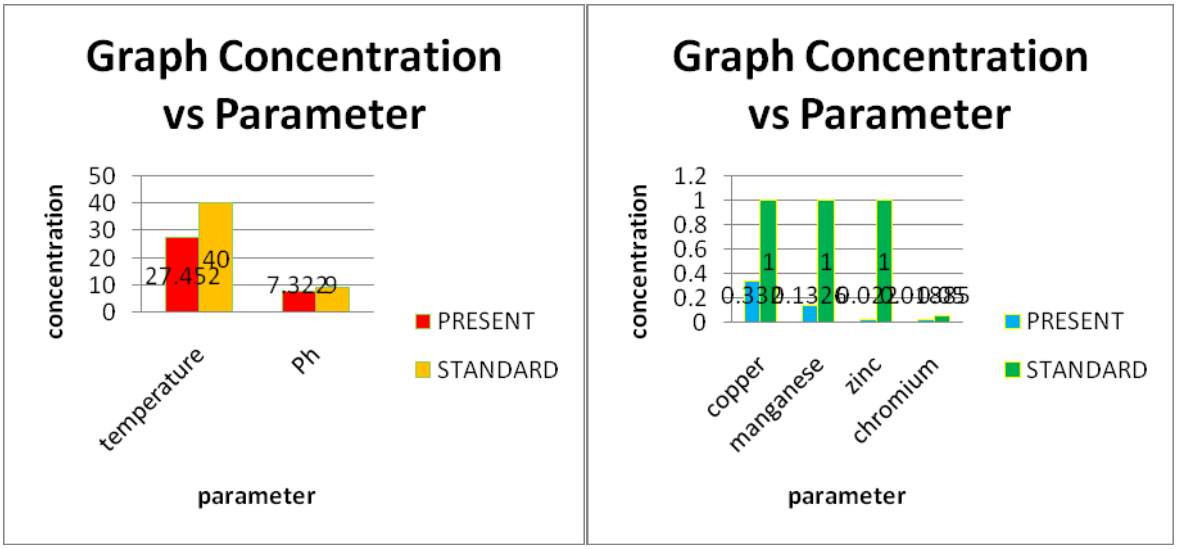

Figure 2: Selected Parameter compared to the Standard Parameter Limit

V CONCLUSION

Concentration of heavy metal in the river that analyzed based on Standard B Environmental Quality (Sewage and Industrial Effluents) Regulations 1979 [Regulations 8(1), 8(2), 8(3)], found that river quality at Sungai Jejawi consistent from sampling point 1 towards sampling point 5. Overall ph value which is 7.42 was in the actual standard which in range 6.0-9.0, concentration of both manganese and copper was in their standard range which is below 1.0 mg/L, concentration of zinc below 2.0 mg/L and concentration of chromium hexavalent is also below 0.05 mg/L. Although the river is used for various water-based activities, it still receives minimum anthropogenic metals and can be considered as free from any heavy metal pollution problem. Water quality was analyzed by using DOE-WQI and was found that, water quality at Sungai Jejawi can be grouped in Classes III, which is it can be use as second water supply, but it required

conventional treatment and fishing activities. Sungai Jejawi is a source of irrigation for the nearest paddy field.

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