



Faculty of Engineering

**ANALYSIS OF TOTAL SUSPENDED SOLIDS IN SUNGAI
MAONG KIRI**

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Dedicated to my beloved family, lectures and friends

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ABSTRACT

This study is about suspended solids analysis in Sungai Maong Kiri. This area is chosen because it has high population density. This analysis is to observe changing of trend experienced by suspended solids. High suspended solids content in water would result river to become cloudy and polluted. The suspended solid main source is from erosion because of development and also from man-made pollution, discharge waste water into the river. Apart from that, this study also tries to simulate water quality model by using suspended solids parameter. That simulation will use 'Water Analysis Simulation Programme 7 (WASP7) software. Besides WASP7 software, this analysis could also be done by using 'Microsoft Excel'. At the same time, this study is also to compare the suspended solids trend with the standard value. From comparison, river classification can be determined. Based from the result, it is found in certain years that suspended solids in Sungai Maong's upstream are higher than the downstream of the river. Suspended solids' concentration values are high during early and end of the year while lowest concentration value is recorded in the middle of the year. This scenario probably is affected by the rain. Rain will cause the land to be eroded and rain will carry the sediment into the river. As a conclusion, Sungai Maong is classified as 11B class and unpolluted in term of total suspended solids.

ABSTRAK

Kajian ini adalah tentang analisis pepejal terampai di Sungai Maong Kiri. Kawasan ini dikaji kerana jumlah kepadatan penduduknya yang tinggi. Analisis ini adalah untuk memerhatikan tren perubahan yang dialami oleh pepejal terampai. Kandungan pepejal terampai yang tinggi akan menyebabkan sungai menjadi keruh dan tercemar. Punca utama pepejal terampai ini adalah daripada hakisan yang disebabkan oleh pembangunan. Selain itu, kajian ini adalah untuk mencuba simulasi model kualiti air menggunakan parameter pepejal terampai. Simulasi tersebut menggunakan perisian 'Water Analysis Simulation Programme 7' (WASP). Selain menggunakan perisian WASP7, analisis ini boleh juga menggunakan 'Microsoft Excel'. Di samping itu juga, kajian ini adalah untuk membandingkan tren pepejal terampai dengan nilai piawai. Daripada perbandingan, pengelasan sungai dapat ditentukan. Hasil daripada kajian, didapati bahawa pepejal terampai di kawasan hulu Sungai Maong adalah lebih tinggi daripada di hilir sungai. Nilai kepekatan pepejal terampai adalah tinggi pada awal dan akhir tahun. manakala nilai kepekatan paling rendah adalah pada pertengahan tahun. Hal ini berkemungkinan berkaitan dengan faktor hujan. Hujan menyebabkan tanah akan terhakis lalu membawa sedimen itu ke dalam sungai. Setelah kajian dijalankan, dapat disimpulkan Sungai Maong adalah kelas 11B dan masih tidak tercemar dalam istilah pepejal terampai.

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LIST OF ABBREVIATIONS AND NOTATIONS

BOD	Biochemical Oxygen Demand
CAIS	Centre for Academic Information Service
cm, m, km	Centimeter, Meter, Kilometer
COD	Chemical Oxygen Demand
DID	Department of Irrigation & Drainage
DLL	Dynamic Link Library
DOE	Department of Environment
DO	Dissolved Oxygen
FC	Faecal Coliforms
INWQS	Interim National Water Quality Standards
mg/l	milligram per litre
NH ₃ N	Ammoniacal Nitrogen
NREB	Natural Resources & Environment Board
NWQSM	National Water Quality Standards for Malaysia
RWQMP	River Water Quality Monitoring Program
SRB	Sarawak Rivers Board
TCC	Total Coliforms Counts
TSS	Total suspended solids
US EPA	United States of America Environmental Protection Agency
UNIMAS	University Malaysia Sarawak
WASP7	Water Analysis Simulation Programme 7
WASP	Water Analysis Simulation Programme

WEPA	Water Environment Partnership in Asia
WQI	The Water Quality Index
WWF	World Wildlife Federation

CHAPTER 1

INTRODUCTION

1.0 Introduction of Study

Wikipedia webpage (2008) defines water is a common chemical substance that is essential for life. In typical usage, water refers only to its liquid form or state, but the substance also has a solid state such as ice, and a gaseous state such as water vapour or steam. Water covers 71% of the Earth surface, which is commonly in oceans, 1.6% of water below ground in aquifers and 0.001% in the air as vapour. Other than that, cloud is also considered as water since cloud is a formed of solid and liquid water particles suspended in air and precipitation.

Liquid water is found in bodies of water, such as an ocean, sea, lake, river, stream, canal, pond or puddle. The majority of water on Earth is sea water. Water is also present in the atmosphere in solid, liquid, and vapour states. It also exists as groundwater in aquifers.

The geological processes caused by water are chemical weathering, water erosion, water sediment transport and sedimentation, mudflows, ice erosion and sedimentation by glacier.

Water can dissolve many different substances, giving it different tastes and odours. Water is the chemical substance of H_2O which is containing of two hydrogen atoms bonded covalently to an oxygen atom. Water is a tasteless, odourless liquid at ambient temperature and pressure. Water is transparent, and thus aquatic plants can live within the water because sunlight can reach them. Water has a high surface tension caused by the strong cohesion between water molecules because it is polar substance. Water is a very strong solvent, referred to as the universal solvent, dissolving many types of substances. Pure water has a low electrical conductivity, but this increases significantly upon solvation of a small amount of ionic material such as sodium chloride.

1.1 Sungai Maong Background

Sungai Maong is located 37 km from the river mouth which is upstream of Kuching Barrage. It is one of the tributaries of Sungai Sarawak and the largest sub-catchment draining the city into Sungai Sarawak. The catchment area of Sungai Maong is 47 km^2 and has 51 subcatchments. Meanwhile, Sungai Maong is confluenced with the Sungai Sarawak and one of the tributaries of Sungai Sarawak at the south-western edge of Kuching city, passing through Batu Tiga and Batu Kawa. It has two tributaries which are Sungai Maong Kiri and Sungai Maong Kanan. Sungai Maong Kiri has a catchment area about 19.94 km^2 and the length of the river is 8.3 km

which conference with Batu Tiga Bridge where the catchment area is 10.55 km². Sungai Maong Kanan has a catchment area about 19.05 km² and the length of the river is 7.5 km which conferences with Batu Kawa Road Bridge where the catchment area is 12.20 km² (Sumok P., Said S., Mah, D.Y.S, 2006).

Table 1.1: Summary Characteristics of Sungai Maong

River	Sungai Maong Kiri		Sungai Maong Kanan	
Catchment area (km ²)	At confluence	At Batu Tiga bridge	At confluence	At Batu Tiga bridge
	19.94	10.55	19.05	12.20
River length (km)	8.30		7.50	

1.2 Problem: Water Quality Issues in Sungai Maong

Flash flooding and poor water quality are the common problems occurred at Sungai Maong. The flooding phenomenon is typically occurs in Sarawak especially in Kuching due to the rapid development and urbanization. Sungai Maong is facing flood problem also. Moreover, Sungai Maong has a poor river aesthetic value and often perceived by the general public as a waste dumping conduit. It is polluted too by high concentrations of organic matters. The organic matters are Biochemical Oxygen Demand (BOD) levels and ammoniacal nitrogen. The river is also highly polluted with faecal-derived coliform bacteria (NREB, 2002).

The situation occurred is due to insufficiency in wastewater treatment, wastewater dumping into the storm drains and gutters has caused a massive pollution to the Sungai Maong system which is also the source for water abstraction. Grey water including wastewater from laundry, kitchens, baths, washing basins and other in-house wastewater outlets other than toilets, are discharged untreated to streams and rivers. Black water which is the toilet wastewater will receive only primary treatment through septic tank. Individual septic tanks are equipped at most of the residential in Kuching city, however, even with the most efficient type of septic tanks, it is only effective in removing about 30% of the organic matter and no nutrients are removed prior to discharge. It has been estimated that approximately 14 to 18 tonnes of effluent from overflow septic tank reach the river daily (NREB, 2001).

1.3 Scope of Studies

Sungai Maong flows along Sungai Sarawak tributaries at the southern edge Kuching City. The scope of study will be focused on Sungai Maong which is only at Sungai Maong Kiri where the area has the most residential and industrial area. It is located between latitude $2^{\circ}35'00''$ N and $102^{\circ}51'00''$ E whereas the longitude is between $1^{\circ}32'00''$ and $110^{\circ}18'00''$. Location of Sungai Maong is shown in Figure 1.1.

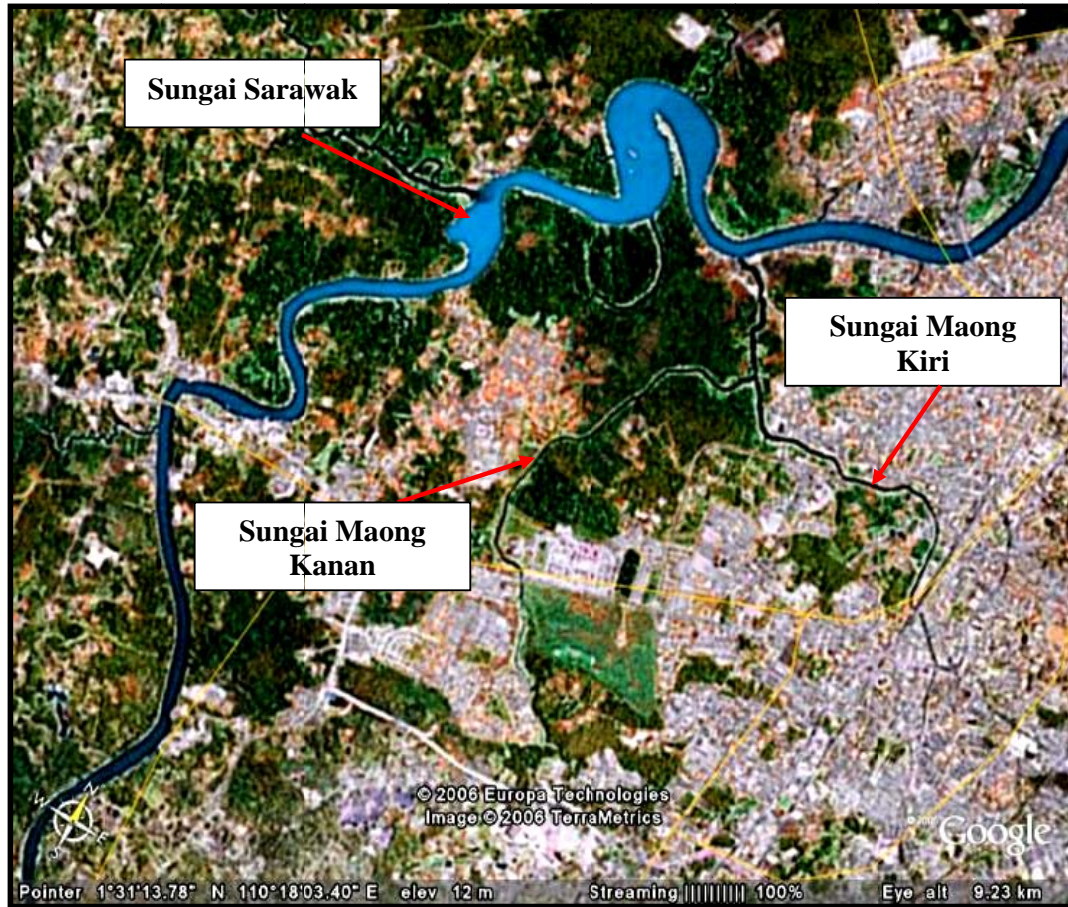


Figure 1.1: Location of Sungai Maong (Source: DID, 2006).

1.4 Objectives

1.4.1 General Objective

The general objective is to study the water quality trend of Sungai Maong Kiri by using Water Analysis Simulation Programme 7 (WASP7) software. Instead of using WASP7 software, the water quality trend also can be studied using Microsoft Excel.

1.4.2 Specific Objectives

The specific objectives of the study are:

- i. To analysis total suspended solids trend in Sungai Maong Kiri.
- ii. To compare the total suspended solids trend in Sungai Maong Kiri with the standards.
- iii. To try to model the water quality using WASP7.