



UNIVERSITI PUTRA MALAYSIA

**INTERPRETATION OF RIVER WATER QUALITY USING ENVIRONMETRIC
TECHNIQUES AND STATISTICAL PROCESS CONTROL PERFORMANCES FOR
SELECTED RIVER BASINS IN PENINSULAR MALAYSIA**

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FPAS 2014 2



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By

MOHD SAIFUL BIN SAMSUDIN

**Thesis Submitted to the School Of Graduate Studies, University Putra Malaysia,
in Fulfillment of the Requirements for the Degree of Master of Science**

July 2014

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

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July 2014

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The river basin pollution becomes a serious issue in Peninsular Malaysia. This research is to clarify river water quality using environmetric techniques (PCA, MLR and HACA) and statistical process control (control chart and capability indices) performances consist of three river basins (North-Middle-South) in Peninsular Malaysia. Commonly, lack of knowledge of analysis and modeling for river pollution are unable to encounter either present or future river pollution loading in Malaysia. Besides, total water quality management by using statistical approaches are needed for a sustainable environment. Nevertheless, quality engineering tools are not often applied in river pollution problems for a sustainable environment. The abundant water quality data monitoring are required to utilize for exact identification and distribution of pollution for more effective and optimized sampling strategy. The objectives of this research are to identify the types of pollution sources in each of the river basins, to determine the most significant parameters of each river basin which contribute to river pollution loading and to discover the potential contamination of pollutants and perform the process capability of water quality. In this study, secondary data from monitoring stations under the river water quality monitoring program by the Department of Environment (DOE) from 2003 to 2007 were packed into consideration to extract the spatial-temporal information on Perlis River, Klang River and Johor River. From this study, the deviations of the types of pollution sources and dissimilar of significant possible pollution sources can be sanctioned. In Perlis River Basin, the results show BOD and COD as the principal parameters which indicate as the quantity of the agricultural pollution. For Klang River Basin, $\text{NH}_3\text{-N}$ has been unveiled as the main parameters which indicate from anthropogenic activities. Johor River Basin has revealed $\text{NH}_3\text{-N}$ and PO_4 as the main parameter as the main pollutants that give highest

contribution towards the river and it is believe from land alterations towards oil palm plantation. However, SPC indicates the level of all significance parameters concentration for each basin shown the risk of unacceptable water pollution level according to WQI. This is because of a dissimilar type of human activities and area development surrounding the study areas. This study shows the important of statistical analysis and modeling for river water quality management to save time consuming and help to save money in managing river water quality analysis.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk Ijazah Master Sains

**PENAFSIRAN KUALITI AIR SUNGAI DENGAN MENGGUNAKAN TEKNIK
ENVIRONMETRIC DAN PRESTASI STATISTIK KAWALAN PROSES BAGI
BEBERAPA LEMBANGAN SUNGAI YANG DIPILIH DI SEMENANJUNG
MALAYSIA**

Oleh

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Pencemaran lembangan sungai menjadi satu isu yang serius di Semenanjung Malaysia. Kajian ini bertujuan untuk menjelaskan kualiti air sungai terdiri daripada tiga lembangan sungai (Utara-Tengah-Selatan) di Semenanjung Malaysia dengan menggunakan teknik *environmetric* (PCA, MLR dan HACA) dan kawalan proses statistik (carta kawalan dan indeks keupayaan). Malaysia kekurangan pengetahuan analisis dan pemodelan bagi pencemaran sungai tidak dapat bertahan sama ada masa kini atau masa depan. Selain itu, pengurusan kualiti air dengan menggunakan pendekatan statistik yang diperlukan untuk persekitaran yang mampan. Walau bagaimanapun, alat kejuruteraan kualiti tidak kerap digunakan dalam masalah pencemaran sungai terhadap alam sekitar yang lestari. Pemantauan data kualiti air dikehendaki bagi mengenal pasti pencemaran sungai dengan lebih berkesan dan strategi persampelan dioptimumkan. Objektif kajian ini adalah untuk mengenal pasti jenis-jenis punca pencemaran dalam setiap satu daripada lembangan sungai, menentukan parameter yang paling penting bagi setiap lembangan sungai yang menyumbang kepada pencemaran sungai dan mencari pencemaran potensi pencemaran dan melaksanakan keupayaan proses kualiti air. Dalam kajian ini, data sekunder daripada memantau stesen di bawah air sungai program pemantauan kualiti oleh Jabatan Alam Sekitar (JAS) 2003-2007 telah digunakan dalam mengambil maklumat spatial-temporal pada Sungai Perlis, Sungai Klang dan Sungai Johor. Di Lembangan Sungai Perlis, keputusan kajian menunjukkan BOD dan COD sebagai parameter utama yang disebabkan oleh pencemaran daripada aktiviti pertanian. bagi Lembangan Sungai Klang, $\text{NH}_3\text{-N}$ telah diumumkan sebagai parameter utama yang menunjukkan daripada aktiviti antropogenik. Lembangan Sungai Johor telah mendedahkan $\text{NH}_3\text{-N}$ dan PO_4

sebagai parameter utama sebagai pencemar utama yang memberi sumbangan tertinggi ke arah sungai dan dipercayai berpunca daripada aktiviti perladangan kelapa sawit. Walau bagaimanapun, SPC menunjukkan tahap kepekatan semua parameter penting bagi setiap lembangan menunjukkan risiko yang tidak boleh diterima tahap pencemaran air. Ini kerana dari jenis yang berbeza daripada aktiviti manusia dan aktiviti pembangunan di kawasan sekitar kawasan kajian. Kajian ini menunjukkan kepentingan dalam analisis statistik dan pemodelan bagi pencemaran air akan menjimatkan masa dan membantu menjimatkan kos kewangan dalam pengurusan kualiti air sungai.



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Finally, this thesis is dedicated to my late beloved, supportive and respected father. I would like to leave the remaining space in memory of Allahyarham Hj. Samsudin Mat (1957-2013). Al-Fatihah.

I certify that a Thesis Examination Committee has met on 24 July 2014 to conduct the final examination of Mohd Saiful bin Samsudin on his thesis entitled “Interpretation of River Water Quality Using Environmetric Techniques And Statistical Process Control Performances For Selected River Basins In Peninsular Malaysia” in accordance with the Universities and University Colleges Act 1971 and the Constitution of Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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DECLARATION

Declaration by the student

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