THE ASSESSMENT OF RIVER WATER QUALITY IN KUANTAN RIVER BASIN

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MASTER OF SCIENCE

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SUPERVISOR'S DECLARATION

We hereby declare that we have checked this thesis, and, in our opinions, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Penilaian kualiti air sungai adalah sangat penting kepada masyarakat dan alam sekitar. Sebarang kemorosotan kualiti air sungai akan mendorong kepada risiko yang besar kepada ekosistem hidupan serta boleh memberi kesan negatif kepada ekonomi setempat. Oleh itu, pengawasan berterusan kualiti air serta kaedah rawatan dan pengurusan yang sesuai adalah perlu. Maka, penyelidikan ini berfokus kepada pengawasan kualiti air sungai di kawasan lembangan Sungai Kuantan. Ia melibatkan Sungai Galing, Sungai Belat dan Sungai Kuantan kerana sungai- sungai ini saling berkait antara satu sama lain. Pefahaman terhadap hubungkait antara ion inorganik dan parameter terpilih sangat penting dan salah satu langkah penambahbaikan dalam pengurusan air sungai. Penyelidikan ini menumpukan kepada kefahaman terhadap taburan kepekatan ion inorganik dan parameter kualiti air yang terpilih dan pengkelasan sungai berdasarkan Piawaian Kualiti Air Kebangsaan (NWQS). Selain itu, pengkajian pengawasan secara terperinci juga dilakukan kepada sungai yang paling tercemar di antara sungai-sungai yang di kaji. Sistem ion kromatografi di gunakan dalam penyelidikan ini terutamanya dalam menganalisa sifat ion inorganik. Ion HCO_3^- di kaji dengan menggunakan Ion Kromatografi Pengecualian, manakala SO_4^{2-}, Cl^-, NO_3^-, Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+} ion di kaji dengan menggunakan Ion Kromatografi Pengecualian/ Kation Penukaran Kromatografi. Selain itu, analisis statistik dibuat dengan menggunakan ANOVA. Berdasarkan penyelidikan ini, pengkelasan berdasarkan NWQS telah dibuat dan didapati bahawa Sungai Galing adalah yang paling tercemar dalam kalangan sungai yang dikaji. Daripada kepekatan Cl^- and Na^+, didapati di kawasan G2 sangat tinggi disebabkan masalah persekitaran dan pengaruh daripada bahan buangan organik berbanding dengan kawasan yang lain. Manakala jumlah nitrogen (TN), keperluan oksigen kimia (COD) dan oksigen terlarut (DO), kepekatannya sangat tinggi terutamanya pada sebelah barat Sungai Galing. Hal ini disebabkan oleh sisa buangan yang tidak dirawat dengan sempurna daripada kawasan industri, perumahan dan pertanian yang berdekatan seterusnya menghasilkan pengkelasan yang tinggi bagi sebelah barat Sungai Galing berbanding kepada kawasan sebelah timur sungai Galing. Nilai pH di kawasan pangkal sungai di sebelah barat Sungai Galing (G1a-1 and G1a-2) di kawasan industri dikelaskan dalam kelas V atau dekat dengan kelas V. Secara umumnya, penyelidikan ini menunjukkan status terkini bagi kualiti air sungai di kawasan Kuantan. Selain itu, penggunaan Ion Pengecualian Kromatografi di dapati mampu menjadi rujukan untuk penyelidik alam sekitar yang lain dan juga institusi berkaitan dalam proses pengawasan kualiti air sungai.

ABSTRACT

Assessing water quality is of crucial importance to both society and the environment. Deterioration in water quality induces substantial risk to the living ecosystem and can have detrimental effects on the local economy. Therefore continuous water monitoring with appropriate treatment and management approach is necessary. Thus, the current study focuses on the assessment of river water quality in Kuantan River basin. It involved Galing, Belat and Kuantan rivers that link to each other. Understanding the relationship of inorganic ions and selected parameters are important and one of the improvements for river water management. Thus, the research focuses on understanding the distribution of inorganic ions concentrations and its relationship with selected water quality parameters subsequently classification of the monitored rivers was made based on the National Water Quality Standards (NWQS). The detail monitoring was done to the most polluted river among the study area. The ion chromatographic systems were used for analyzing the behavior of inorganic ions. The HCO_3^- ion concentration was determined using Ion Exclusion Chromatography. Meanwhile, SO_4^{2-}, Cl^-, NO_3^-, Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+} ions were identified by Ion-Exclusion Chromatography/Cation-Exchange Chromatography. The statistical analysis was made by using ANOVA. The classification was made based on the NWQS indicates that the Galing River is the most polluted river in the study area. Thus, detail monitoring on Galing River is done and from the obtained results, the concentration of Cl^- and Na^+, is high due to the environmental burden and anthropogenic influence that was detected in G2 compared to the rest of the Galing River area. In terms of total nitrogen (TN), chemical oxygen demand (COD), and dissolved oxygen (DO), the western side of the Galing River was affected by higher human activity such as wastewater from industrial, household, and agricultural, which classify within higher class compared to the eastern side. Class V or near Class V for pH values were obtained at upstream on the western side of the Galing River (G1a-1 and G1a-2) in the industrial area. In general, the study provides the current status of river water quality on Kuantan river basin. On top of that, the application of ion exclusion chromatography can be used as the reference for other environmental researcher and related institutional bodies in water monitoring process.

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LIST OF SYMBOLS

Ca^{+}	Calcium ion
Cl-	Chloride ion
HCO_3^{-}	Bicarbonate ion
H^{+}	Hydrogen ion
K^{+}	Potassium ion
Mg/L	Miligram per liter
Mg^{2+}	Magnesium ion
Min	Minute
Na^{+}	Sodium ion
NH_4^{+}	Ammonium ion
NO_3^{-}	Nitrate ion
SO_4^{+}	Sulphate ion
mM	mili Molar

LIST OF ABBREVIATIONS

AEC	Anion Exchange Chromatography
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
EC	Electrical Conductivity
G1	Galing 1
G2	Galing 2
IC	Ion Chromatography
IEC	Ion Exclusion Chromatography
IEC/CEC	Ion Exclusion Chromatography/ Cation Exchange Chromatography
pH	Alkalinity and acidity
TP	Total Phosphate
TN	Total Nitrogen
UV-Vis	Ultra Violet-Visible
NWQS	National Water Quality Standards Malaysia
SCX Column	Strongly Cationic Exchange Column
WCX Column	Weakly Cationic Exchange Column

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