FORECASTING OF PARTCULATE MATTER (PM_{10}) CONCENTRATION BY UTILIZING PCR AND MLR AT TWO DIFFERENT LOCATIONS IN KELANTAN

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FORECASTING OF PARTICULATE MATTER (PM_{10}) CONCENTRATION BY UTILIZING PCR AND MLR AT TWO DIFFERENT LOCATIONS IN KELANTAN

By
WAN HAFIZAH BT WAN ZAKARIA

As PITA research proposal submitted in partial fulfilment of
the requirements for the award of the degree of
Bachelor of Technology (Environment)

SCHOOL OF OCEAN ENGINEERING
UNIVERSITI MALAYSIA TERENGGANU
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SCHOOL OF OCEAN ENGINEERING
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VERIFICATION AND APPROVAL FORM

Hereby this PITA research report entitled prepared and submitted by *Forecasting of Particulate Matter (PM_{10}) Concentration by Utilizing PCR and MLR at Two Different Locations in Kelantan*, Matric No UK 30058 in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology (Environment), School of Ocean Engineering, UMT has been examined and is recommended for approval of acceptance.

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I hereby declare that this PITA research report entitled *Forecasting of Particulate Matter (PM_{10}) Concentration by Utilizing PCR and MLR at Two Different Locations in Kelantan* the result of my own research except as cited in the references.

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FORECASTING OF PARTICULATE MATTER (PM_{10}) CONCENTRATION BY UTILIZING PCR AND MLR AT TWO DIFFERENT LOCATIONS IN KELANTAN

ABSTRACT

Air quality is one of the most important indicators to evaluate the country's environment quality. However, the air pollution issue is rising due to the uncontrolled chemical gases release from the industrial area, burning of fossil fuels, forest fires and motor vehicles. One of the pollutants is PM_{10}. PM_{10} is the particulate matter that can be found in air which the aerodynamic diameter is less than 10μm. PM_{10} is the major pollutant in Malaysia especially in Kelantan known to gives significant impact to human and environment. The aim of this study is to forecast daily average of PM_{10} concentration by utilizing Principal Component Regression (PCR) and Multiple Linear Regression (MLR). This study focused on the trend of PM_{10} concentration for 4 years starting on January 2011 until December 2014, select the significant factors that influence PM_{10} concentrations (meteorological and gaseous pollutant factors) and establish PM_{10} concentration by utilizing PCR and MLR. It was conducted at two sites in Kelantan which having different background activities of urban and industrial. Secondary data of PM_{10} concentration, meteorological and also gaseous pollutants was acquired from Malaysian Department of Environment (DOE). The missing values were treated using linear interpolation. MLR was chosen as the best fitted models since the accuracy and error indicators (Prediction Accuracy (PA), Index of Agreement (IA), Coefficient of Determination (R^2), Normalised Absolute Error (NAE) and Root Mean Square Error (RMSE)) of the models are more relevant for MLR. The values of each accuracy and error measures for Kota Bharu (PA=1.52, IA=0.64, R^2=0.53, NAE=0.47 and RMSE=4.83) while for Tanah Merah (PA=1.17, IA=0.50, R^2=0.55, NAE=0.34 and RMSE=2.94) respectively. Assessment of model performance indicated that multiple linear regressions can be as reference model in future for forecast of PM_{10} concentration in Kelantan.

RAMALAN KEPEKATAN PARTIKEL BAHAN TERAMPAI (PM_{10}) DENGAN MENGGUNAKAN PCR DAN MLR DI DUA LOKASI BERBEZA DI KELANTAN

ABSTRAK

Kualiti udara adalah salah satu petunjuk yang paling penting untuk menilai kualiti alam sekitar di negara ini. Walau bagaimanapun, isu pencemaran udara semakin meningkat kerana pelepasan tidak terkawal dari kawasan perindustrian, pembakaran bahan api fosil, kebakaran hutan dan kenderaan bermotor. Salah satu bahan pencemar adalah PM_{10}. PM_{10} adalah zarah yang boleh didapati di udara dimana diameter aerodinamik adalah kurang daripada 10μm. PM_{10} merupakan pencemar utama di Malaysia terutamanya di Kelantan dan memberi kesan yang besar kepada manusia dan alam sekitar. Tujuan kajian ini adalah untuk meramalkan purata harian kepekatan PM_{10} dengan menggunakan Regresi Komponen Utama (PCR) dan Regresi Linear Pelbagai (MLR). Kajian ini memberi tumpuan kepada trend kepekatan PM_{10} selama 4 tahun bermula pada 2011 hingga 2014, memilih faktor-faktor yang mempengaruhi kepekatan PM_{10} (faktor pencemar meteorologi dan gas pencemar) dan juga untuk mewujudkan persamaan bagi kepekatan PM_{10} dengan menggunakan PCR dan MLR. Kajian ini dijalankan di kawasan di Kelantan yang mempunyai aktiviti latar belakang yang berbeza iaitu kawasan bandar dan perindustrian. Data sekunder kepekatan PM_{10}, meteorologi dan juga gas pencemar diperolehi daripada Jabatan Alam Sekitar (JAS) Malaysia. Nilai-nilai yang hilang akan dirawat dengan menggunakan interpolasi linear. MLR dipilih sebagai model terbaik kerana nilai ketepatan dan keralatan (Ketepatan Ramalan (PA), Indeks Perjanjian (IA), Pekali Penentuan (R^2), Ralat Mutlak Normal (NAE) dan Akar Min Kuasa Ralat (RMSE)) adalah lebih relevan untuk MLR. Nilai-nilai untuk ketepatan dan keralatan bagi Kota Bharu (PA=1.52, IA=0.64, R^2=0.53, NAE=0.47 dan RMSE=4.83) manakala bagi Tanah Merah (PA=1.17, IA=0.50, R^2=0.55, NAE=0.34 dan RMSE=2.94). Oleh itu , model ini boleh menjadi rujukan pada masa akan datang untuk ramalan kepekatan PM_{10} di Kelantan. Penilaian prestasi model ini menunjukkan bahawa model regresi linear pelbagai boleh menjadi model rujukan kepekatan PM_{10} di Kelantan pada masa akan datang