UNIVERSITI TEKNOLOGI MARA

THE ASSESSMENT OF AMBIENT CARBON MONOXIDE CONCENTRATION LEVELS

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PhD

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Carbon monoxide (CO) problem has gained much scientific and public attention, due to its significant effects on human health and the environment. The concentration of air pollutants in the atmosphere has greatly influenced by the meteorological parameters such as wind which is the main parameter for the transport of air pollutants. Thus, it is necessary to assess the influence on the CO pollutant concentrations. This study aims to assess the influence on the ambient carbon monoxide pollutant at three different land-use sites in Peninsular Malaysia as a case study by using five years database (from 2008 to 2012) within three selected Continuous Air Quality Monitoring stations. It integrated statistical analysis to explore the trend of ambient CO and compare the CO pollutant database with the Malaysia Ambient Air Quality Standard Interim 2018. Pearson's coefficient correlation test was performed to establish the relationship between wind speed and wind direction and seasonal influence on the CO concentration. Feed-forward Neural Network with Levenberg Marquardt Back Propagation algorithm and Fixed Box Model (FBM) was used to predict the concentration of CO. The results revealed that the averaged concentration of CO pollutants recorded at S1, S2, and S3 are under the permissible value recommended by the Malaysia Ambient Air Quality Standard Interim 2018. The findings in this study indicate that CO pollutants in the S1, S2 and S3 sites were at peak value from 7.00 a.m. to 9.00 a.m., and started to increase from 5.00 p.m. The hourly CO variations are highly influenced by the traffic activity during morning and evening peak hours. The monthly mean concentrations for CO showed almost a similar pattern for all stations. The monthly CO variations at the sites are significantly affected by monsoonal effect with S2, showed the highest concentrations followed with S1 and S3. The peaks CO levels can be seen in April, December, June, October, and January. The correlation test showed CO in S1, S2 and S3 have a weak negative linear relationship with wind speed and wind direction. Similar results were found during the northeast monsoon, first inter-monsoon seasons, southwest monsoon and second inter-monsoon except S3. The findings in this study confirmed that there is no correlation between CO and wind speed and wind direction. The results of the regression coefficient (R) and mean squared error (MSE) for ANN models showed that the lowest MSE and R^2 value were obtained by using 10 neurons in the hidden layer. The regression plot of ANN model for training, validation and testing stage for all sites reveal that the feedforward neural network able to predict the CO with a close relationship between the measured and predicted values. The comparison between hourly measured and predicted ANN reveals good agreement as to the predicted values were close to the measured values. The findings from the fixed box models confirmed that the calculated CO (mg/m^3) is in reverse ratio with wind speed and mixing height and corresponding to the fixed box length and emission capacity.

Keywords: Carbon monoxide; Artificial neural network; Fixed box model; modelling.

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