

THE EFFECT OF
MINERAL TRANSPORTATION
TOWARDS AIR QUALITY INDEX

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SUPERVISOR'S DECLARATION

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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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This hard and precious work is dedicated to my lovely supervisor, beloved family, dearest mate and precious best friends ever who love me without fear, trust me without questioning, need me without demanding, want me without restrictions, accept me without change and love me for who I am.

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ABSTRAK

Kajian ini bertujuan untuk mengkaji hubungan antara pengangkutan sumber mineral dan indeks kualiti udara di kawasan Kuantan. Kesan pencemaran alam sekitar yang terhasil daripada aktiviti perlombongan mineral terhadap kesihatan penduduk tempatan juga dikaji. Kawasan yang telah dipilih dikategorikan sebagai kawasan pembangunan campuran antara kawasan perindustrian dan kawasan kediaman yang berhampiran antara satu sama lain yang juga berdekatan dengan jalan utama ke/dari Pelabuhan Kuantan. Penghasilan gas dan habuk di dalam kawasan telah dipantau untuk mengkaji kepekatan nitrogen dioksida (NO_2), sulfur dioksida (SO_2) dan partikel bersaiz kurang daripada sepuluh mikrometer (PM_{10}). Pengiraan jumlah lalu lintas telah dijalankan pada masa dan lokasi yang sama dengan penghasilan gas dan habuk. Data tersebut dikumpulkan pada tiga hari berturut-turut iaitu pada hari Selasa, Rabu dan Khamis bermula dari 9 pagi hingga 6 petang selama dua minggu. Hubungan antara pengangkutan sumber mineral dan kepekatan polutan udara telah dianalisis dan dikira dengan menggunakan regresi linear dan korelasi. Keputusan menunjukkan bahawa tiada korelasi yang signifikan antara kepekatan pencemar udara dengan jumlah aliran lalu lintas dan juga pengangkutan sumber mineral. Walau bagaimanapun, terdapat korelasi sederhana antara kepekatan PM_{10} dan pengangkutan sumber mineral. Kepekatan PM_{10} dengan jumlah aliran lalu lintas dan pengangkutan mineral menghasilkan pekali korelasi positif yang kuat. Ini menunjukkan bahawa kepekatan PM_{10} adalah disebabkan oleh bilangan kenderaan berat yang melalui di kawasan tersebut.

ABSTRACT

This research aims to determine the correlation of mineral transportation and air quality index in Kuantan areas. The effect of environmental problems derived by mineral mining activities towards the local health was also investigated. The area chosen was categorized as mixed development area with industrial area and residential area are near to each other next to major road to/from Kuantan Port. The gas and dust productions within the area were monitored to determine the concentration of nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and particulate matter 10 (PM₁₀). Traffic volume counting was conducted at the exact time and location as the gas and dust productions were collected. The data was collected on three consecutive weekdays which were Tuesday, Wednesday and Thursday from 9AM to 6PM for two weeks. The correlation between mineral vehicles and air pollutant concentration were analysed and calculated by using linear regression and correlation. The results show that there is no significant correlation between air pollutant concentration and number of all vehicles and mineral vehicles class. However, there is a moderate correlation between the concentration of PM₁₀ and number of mineral vehicles. The concentration of PM₁₀ and the number of all vehicles and mineral vehicles class produced strong positive correlation coefficient. It shows that the concentration of PM₁₀ is highly caused by number of heavy vehicles travelling on those areas.

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LIST OF SYMBOLS

$\mu\text{g}/\text{m}^3$	Microgram per meter cube
$^{\circ}\text{C}$	Degree Celsius
ppm	Part per million
veh/hr	Vehicle per hour

LIST OF ABBREVIATIONS

API	Air Pollution Index
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DOE	Department of Environment
FHWA	Federal Highway Administration
KATS	Ministry of Water, Land and Natural Resources
MOH	Ministry of Health
NA	Not Available
NO	Nitrogen Oxide
NO ₂	Nitrogen Dioxide
NO _x	Nitric Oxide
O ₃	Ozone
PM ₁₀	Particulate Matter 10
PSI	Pollutant Standard Index
RMG	Recommended Malaysia Air Quality Guideline
UMP	Universiti Malaysia Pahang

CHAPTER 1

INTRODUCTION

1.1 Introduction

A mineral is a chemical substance that naturally formed as result of geological processes. Minerals are divided into two types that are metal and non-metal. Focusing on non-metal mineral, Malaysia had discovered numbers of them such as gold, iron ore, bauxite, tin ore, and copper. Figure 1.1 shows the distribution of non-metal mineral sources in Malaysia.

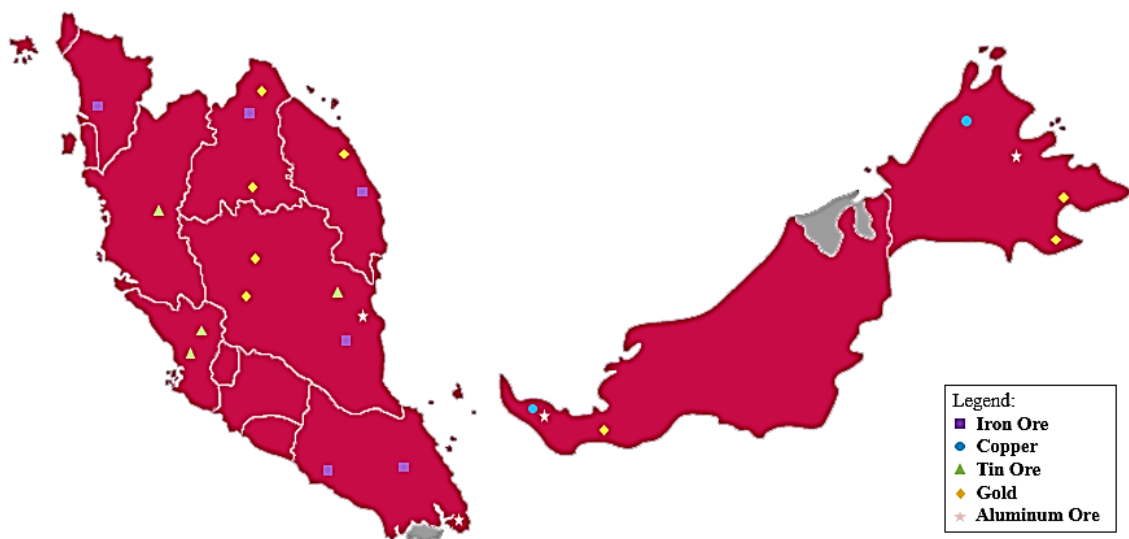


Figure 1.1 Distribution of Non-Metal Mineral Sources in Malaysia

Peninsular Malaysia are rich with non-metal mineral especially in Pahang state. There are four non-metal minerals discovered at Pahang that are gold, iron ore, tin ore and aluminium ore. Lately, aluminium ore became the talk of the town when it had risen numerous issues due to the mining activities. Aluminium ore is the most abundant metal on Earth. Despite this, the production cost of aluminium is very expensive yet extremely

damaging to the environment. An aluminium ore called bauxite must be mined first before aluminium could be produced. The main sources of bauxite are currently from Australia, China, Brazil, Indonesia and India including Malaysia that also have large amounts of the bauxite.

In Malaysia, the history of the bauxite industry began at Teluk Ramunia, Penggerang in Johor Bahru around 1955. Bauxite mining offers some exciting economic opportunities for various parties especially individual landowners. Since the excavation of bauxite began in Kuantan in year 2013, bauxite mining in Kuantan has created a different scenario for the whole Kuantan town within a short period. Extensive, aggressive and uncontrolled mining activities had cause adverse impacts on the environment, health and quality of life of the people living in the affected areas. In comparison with bauxite mining activities in Teluk Ramunia, the bauxite issue in Kuantan is far more serious.

Bauxite pollution issues in Kuantan started in the middle of 2014. After dragging for almost two years without any workable countermeasure to improve the quality of life of nearby residents in specific and Kuantan's population in general, the Ministry of Natural Resources and Environment has imposed a moratorium on the bauxite industry. The process of bauxite extracting is an open cast method where bauxite extraction was done by removing the topsoil and overburden layer of the soil. Bauxite will be transported to the washing site to remove excess materials from bauxite ores and temporarily stockpiled before being shipped off to China via Kuantan Port. The environmental issues namely air pollution and noise pollution were experienced by the locals attributable through these processes.

The process of bauxite transportation contributed to degradation of air quality, mainly related to dust pollution. The dust spilled into the surrounding from bauxite lorries that are not cleansed up before leaving the mining site that cause the road tinted dark red that harm to road users. Nuisance dust also has negative effects on human health. The tree, vehicles, houses, food premises along the route of the lorries transporting bauxite was also contaminated with red dust.

An open cast bauxite mining operation are using dynamites, heavy machinery operation and truck transport that contributed to degradation of ambient conditions. The noise quality index is most affected by transportation of bauxite ores from bauxite mines using unpaved roads exiting into regular public roads that pass through residential areas at any time including night time. Most of the lorries carried 40 to 50 tons of bauxite causing noise in the local area. Noise pollution also causes loss of peace and quietude of the neighbourhood.

Mineral mining activities issues need to be resolved promptly and efficiently for the virtue of locals. A research on the impact of environment issue generated from mineral routing and logistics towards road users and local residents nearby affected area could be proposed. For instance, guideline on mineral logistic and routing by taking into account the health and safety of the public road users and local residents could be suggested.

1.2 Problem Statement

Environment impact arises from mineral logistics has been long discussed and experienced by other active mineral exporter especially bauxite exporter countries around the world. India who is the world's fifth bauxite producer with almost eight percent of world production has been experiencing problems caused by bauxite long ago. Several bauxite mines were located within the ecologically sensitive wildlife corridor region of the Western Ghats. Various environmental impacts of bauxite mining activities are dig out such as dust pollution, noise pollution also creation of depression, craters and large wastelands in forest in the vulnerable ecologically sensitive region. Bauxite mining activities in Western Ghats has led to increase in dust pollution that majorly sources from bauxite mining transportation and operation activities. These activities causing bauxite dust accumulate on their houses and premises. The locals also complained of respiratory problem associated with dust pollution.

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