



## CHAPTER I

### INTRODUCTION

In recent decades global interest in environmental problems has grown to such an extent that it has become one of the most important topics of discussion in international organizations as well as in individual nations.

Air pollution is one of the major environmental problems found in many big cities. Bangkok, for example, is one that suffers from the detrimental effect of air pollution. The air quality of Bangkok in 1996 is shown in Table 1.1 [1].

Table 1.1 Air Quality of Bangkok in 1996

Pollutants	Maximum	Average	Standard
Total Suspended Particulate (mg/m <sup>3</sup> ; 24 hr)	0.56	0.16	0.33
Lead (μg/m <sup>3</sup> ; 1 month)	0.23	0.06	1.50
Carbon monoxide (ppm; 8 hr)	18.1	10.0	9.00

Exhaust emissions from vehicles are important contributors to air pollution in urban areas. The population of vehicles and their emission in Bangkok in 1995 are shown in Table 1.2 and Table 1.3, respectively [1]. Exhaust emissions from vehicles comprise regulated and unregulated pollutants. Emission of carbon monoxide (CO), unburned fuel hydrocarbon (HC), nitrogen oxides (NO<sub>x</sub>), and particulate are regulated by law. Polycyclic aromatic hydrocarbons (PAHs) are included in the great number

**Table 1.2** Vehicle Population in Bangkok in 1995

	<b>Unit : Thousand</b>
Gasoline vehicles	
- cars	946
- light duty gasoline trucks	73
Motorcycles	1,162
Taxis (gasoline/LPG fuel)	65
Tuk-tuk (LPG fuel)	8
Diesel vehicles	
- light duty	654
- heavy duty	126

**Table 1.3** Vehicle Emission in Bangkok in 1995

	<b>Unit : Thousand Tons</b>
Carbon monoxide (CO)	2,914
Hydrocarbon (HC)	661
Nitrogen oxide (NO <sub>x</sub> )	164
Particulate	63
Lead	80

of compounds present in the group of unregulated pollutants emitted from vehicles. Several of these compounds in the group of PAHs are mutagenic and even, in some cases cause cancer in animals after skin painting experiments [2]. Reports on humans show that individuals exposed by breathing or skin contact for long periods of time to mixtures of other

compounds and PAHs can also develop cancer [2]. PAHs react rapidly with  $\text{NO}_x$ ,  $\text{HNO}_3$ ,  $\text{SO}_2$ ,  $\text{SO}_3$ , and  $\text{H}_2\text{SO}_4$  (the latter reactions form sulphinic and sulphonic acids). These processes tend to yield carcinogens of increased potency. Sixteen PAHs were classified as priority pollutants by the U.S. Environmental Protection Agency (EPA). Because of these, it is important to limit the emission of PAHs from vehicles especially in densely populated high-traffic urban areas.

Important factors affecting the emissions of PAHs from vehicles are the following [3] : (i) engine exhaust aftertreatment, i.e. catalyst contra noncatalyst; (ii) driving conditions; and (iii) selection of fuel and fuel components.

In this study, an investigation was carried out on the exhaust emission from a gasoline engine. Two factors affecting the emission of PAHs were studied. One is the effect of driving conditions. The other is the effect of an additive in gasoline fuel, dispersant, incorporated into the gasoline fuel to prevent harmful carbon and sludge deposits and also used to provide fuel injector, carburettor, and valve cleanliness [4].

## **1.1 Objectives and Scope of the Research**

### **1.1.1 Objectives**

1. To investigate the effect of dispersant on PAHs in gasoline engine exhaust.
2. To study the effect of engine speeds on the PAH compounds in the exhaust.

### **1.1.2 Scope of the research**

This research performed qualitative and quantitative investigation of selected PAHs, according to EPA 610, in the exhaust emission from a gasoline test engine at various engine speeds and different quantities of dispersant additive in gasoline base fuel.