CHAPTER I

INTRODUCTION

1.1 Background

The reduction of air pollution from combustion devices is an increasingly serious concern worldwide due to the rise in fuel usage especially for transport applications in urban areas. Spark-ignition (SI) and diesel engines, widely used to power various types of vehicles, have been shown to be a major source of air pollution in cities (Faiz A, et al, 1996). The primary pollutants emitted from modern SI engines are mainly oxides of nitrogen, (primarily nitric oxide, NO, with a small amount of nitrogen dioxide, NO_2, collectively known as NOx), carbon monoxide (CO), organic compounds that are mainly unburned or partially burned hydrocarbons (UHC), small amounts of oxides of sulfur and particulates.

Overcome the problem of vehicle exhaust emissions, various attempts were made many countries. One of them by applying modern technology to produce automotive exhaust gas emissions at a minimum level. To encourage technology development of environmentally friendly vehicles by the automotive industry in the world, introduced the Euro standard 1991 in European countries.

European emission standards or Euro Standard define the acceptable limits for exhaust emissions of new vehicles sold in EU

member states. The emission standards are defined in a series of European Union directives staging the progressive introduction of increasingly stringent standards.

Table 1.1 Euro Standard for Light Commercial Vehicles ≤1305 kg (Category N1-I), g/km

Tier	Date	CO	THC	NMHC	NO_x	HC + NO_x	PM
Diesel							
Euro 1	October 1994	2.72	-	-	-	0.97	0.14
Euro 2	January 1998	1.0	-	-	-	0.7	0.08
Euro 3	January 2000	0.64	-	-	0.50	0.56	0.05
Euro 4	January 2005	0.50	-	-	0.25	0.30	0.025
Euro 5	September 2009	0.500	-	-	0.180	0.230	0.005
Euro 6 (Future)	September 2014	0.500	-	-	0.080	0.170	0.005
Petrol (Gasoline)							
Euro 1	October 1994	2.72	-	-	-	0.97	-
Euro 2	January 1998	2.2	-	-	-	0.5	-
Euro 3	January 2000	2.3	0.20	-	0.15	-	-
Euro 4	January 2005	1.0	0.10	-	0.08	-	-
Euro 5	September 2009	1.000	0.100	0.068	0.060	-	0.005*
Euro 6	September 2014	1.000	0.100	0.068	0.060	-	0.005*

Note:
CO (Carbon Monoxide)
THC (Total Hydrocarbon)
NMHC (Non-Methane Hydrocarbons)
NO_x (Nitrogen Oxides)
HC (Hydrocarbon)
PM (Particulate Matter)
* Applies only to vehicles with direct injection engines

(Source: http://en.wikipedia.org/wiki/European_emission_standards)

Indonesia to address motor vehicle exhaust emissions have been set on exhaust emission limits. For older vehicles or who already operate on the road used The Decree of Environment Minister No. 35/1993 with the threshold limit is 4.5% CO and HC was 1200 ppm. As

for the new type vehicles and motor vehicles are being produced set emission standards Euro. Currently, Indonesia has adopted the Euro II standards as stated in Decree of Environment Minister No. 141/2003.[1]

Threshold of motor vehicle exhaust gas emission is a maximum limit of substances or contaminants that may be issued directly from the exhaust pipes of motor vehicles.[2]

Hydrogen has been widely acknowledged for a long time to be a most promising fuel that can continue to meet the increasingly stringent emission regulations without the production of greenhouse gas emissions. However, CO, carbon dioxide (CO_2) and UHC were shown to be present in the exhaust gases of SI engines operated on pure hydrogen (Furuhama S. and Hiruma M., 2004), albeit at very small concentration levels. These carbon-bearing species inevitably result from the complete and incomplete oxidation of the very small amounts of lubricating oil. They can be considered conveniently as natural tracers for indicating the levels of lubricating oil consumption and can be measured readily by normal gas analysis equipment and methods. There is an increasing interest in examining the engine oil consumption mechanism and develop procedures for its further reduction for economic and emissions control purposes.

The liquid hydrocarbon, typically gasoline, is not itself explosive; rather, only the vapor derived from the liquid is explosive. Since the vaporization process is exothermic, past efforts have been made to

[1] Emisikendaraan@menlh.go.id, September 5th, 2005, *explanation of Euro*
[2] Republic of Indonesia Government Regulation No. 41, 1999 on the Control of Air Pollution

warm the fuel charge before it is admitted to the combustion cylinders, in order to hasten the vaporization.

A variety of heat exchangers which warm the charge with the combustion exhaust products have been proposed as well as various electric resistant heaters and from water radiator (Erfan Jauhari, 2005). In most modern carburetors a "hot spot" is provided which is heated with the exhaust gas. Also, various forms of "atomizers" have been proposed to subdivide the fuel into droplet form, thereby increasing the surface area of a given fluid quantity to hasten its vaporization.

The present invention of Hydrocarbon Treating System broadly contemplates achieving the advantages provided by vaporized fuel charge through use of a unique liquid fuel and a novel arrangement for vaporizing that fuel to achieve a vapor fuel that may be provided directly to the combustion chamber. This is not a fluid mist formed of droplets as are the outputs of prior art devices but is in true gaseous form. The inventor of this device stated that HTS can reduce the fuel consumption up to 50 percent.

Through this research, the writer wants to analysis the effect of HTS installation to the emission of engine and fuel consumption. The result of this research will give us explanation whether this device works or not.

1.2 Objectives

1.2.1 How to know the effect of using Hydrocarbon Treating System to CO emissions of four-stroke spark-ignition engine.

1.2.2 How to know the effect of using Hydrocarbon Treating System to UHC emissions of four-stroke spark-ignition engine.

1.2.3 How to know the effect of using Hydrocarbon Treating System to fuel consumption of spark-ignition four-stroke engine.

1.3 Outcomes

Two kinds of benefits which can be gained from the study are as follows:

1. Theoretical Benefit

   The study is expected to give additional information and knowledge about effect of Hydrocarbon Treating System (HTS) on exhaust emission of four-stroke engine.

2. Practical Benefit

   The study is expected to enrich the knowledge of researcher and reader about principles and mechanisms of bubbler system and Hydrocarbon Treating System.

1.4 Problem Limitations

Problem limitation on the writing of this problem is used to adjust the tools which available and also for issues to be discussed or analyzed is not too widespread.

Limitations are as follows:

a. The fuel which used in the experiment is gasoline with octane number 88.
b. Engine that used is Honda Revo version 2008 (Standard)
c. The discussion is about the emission before and after using of Hydrocarbon Treating System.
d. The research will be done in three conditions which are low, medium and high rotation.
e. The writer will not discuss about calculation of heat transfer that occurs in the catalyst. The heat transfer process that occurs only discuss in the fundamental theory.