

國立中興大學機械工程研究所

碩士論文

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液化石油氣（LPG）四行程機車

Liquid Petroleum Gas (LPG) Four Stroke  
Motorbike

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## 中文摘要

因LPG車輛所產生的排氣污染較相同的汽油車為低，對都會地區的空氣品質惡化問題有改善的作用。但在都會地區，機車對空氣污染的影響其實比汽車還要重要，而目前有關LPG的應用主要偏重在汽車，而對機車則尚未開始。

本文主要目的是進行引擎動力計實驗及實車改裝與測試的工作。此外，在本文中也將設計新的燃料系統。新系統先於引擎動力計上做測試，然後再進行LPG機車的行車型態排氣污染量測，包括目前管制的CO，HC，NO<sub>x</sub>，及目前並未管制的其他有害物質。由這些比較結果，將為都會地區改用液化石油氣燃料對空氣品質的影響有較堅實的評估依據。

本實驗計畫的工作包括：(1). LPG 燃料系統設計，(2). 測試車輛組裝，及(3). LPG 機車的排氣污染量測。燃料系統設計包括燃料桶，燃料管線系統，LPG 減壓閥，蒸發器，流量控制閥，混合器設計，及燃料恆溫控制系統。在排氣成分分析方面，以 GC/MS 氣相質譜分析儀來找出 HC 之成分，汽油燃燒後成分中 ethylene 約佔 21%，1-propene,2-methyl 約佔 11%，propene 約佔 8%，ethane 成分佔 7% 左右。而 LPG 燃燒後成分中 propane 約佔 62%，ethylene 約佔 11%，n-butane 約佔 9%，ethane 約佔 6%。因此在臭氧生成物方面，LPG 引擎只佔汽油引擎的 80%左右。

由實驗結果可得到LPG引擎扭力與馬力值在中低轉速下其實和汽油引擎並無太大的差別，但在高轉速時LPG引擎的性能曲線下滑，比汽油引擎的性能低大約27%。而四行程機車引擎改用LPG燃料後，在廢氣

中CO與HC的排放總量並不如預期能比汽油引擎理想，主要原因為燃料的特性與燃料系統及混合器的影響。

關鍵字：液化石油氣、四行程機車、排氣污染

## **ABSTRACT**

Due to lower Exhaust Emission, the LPG vehicle is more helpful to improve the deteriorated air quality than gasoline vehicle, especially in the urban area. Recently, all LPG application was used in the automobile issue, not in motorbike. However, in the urban area, motorbike was more influential for air pollution than automobile.

The following article is mentioned about experiment of engine and test of altered motorbike. New fuel system will be designed in this article as well. The new fuel system will be tested on the dynamometer, firstly and then on the exhaust emission of LPG motorbike, which was included the controlled CO, HC, NO<sub>x</sub> and other harmful but uncontrolled gas. From the result, it will offer more effective standard for evaluating air quality in the urban area, where was replaced using LPG in motorbike.

The workings in this experiment are (1). Design of LPG fuel system. (2). Test of altered motorbike. (3). Measure of exhaust emission in LPG motorbike. Designs of fuel system are included: fuel tank, fuel wire system, LPG reduced pressure valve, evaporator, flow control valve, mixer design and fuel temperature control system. In the exhausted gas composition, HC was analyzed by GC/MS. The burned gasoline was with 21% of ethylene, 11% of 1-propene, 2-methyl, 8% of propene and 7% of ethane. The burned LPG was with 62% of propane, 11% of ethylene, 9% of n-butane and 6% of ethane. Therefore, the OFP (Ozone Forming Potential) of LPG engine was 20% lower than that of gasoline engine.

Results of experiments showed that there is no significant difference in torque and power between LPG engine and gasoline engine in low and medium RPM. But, in high RPM, the performance curve of LPG engine was 27% lower than that of gasoline engine. Furthermore, the CO and HC emission in the waste gas was not as good as gasoline engine. The main

reasons were the effect of fuel property and that the fuel system and mixer did not function well.

**KEY WORD S:** LPG、 Four Stroke Motorbike、 Exhaust Emission

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