

# Investigation of Composition and Characteristics of Propane-Butane LPG Mix in the Fuel Line of LPG Fueled Vehicle

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## Summary

Research and development on LPG vehicles have been increasing LPG engine performance which is nearly as good as the gasoline engine. Exhaust emissions produced by LPG engine is also reported lower than gasoline engines. However, results from previous studies did not explain the level of the tank at the time of data collection. Meanwhile, LPG is a mixture of propane and butane molecules which have different properties. Therefore, this paper presents an investigation of characteristic LPG composition in the fuel line during the discharging process. Samples were taken periodically on the fuel line by special gas syringe then injected to the Gas Chromatography-Mass Spectrometry (GC-MS). The series of test on lengthwise LPG tank shows that the propane and butane molecules are not evenly during the discharging of the tank. However, changes in LPG composition during the discharging process do not significant affect the energy delivery to the combustion chamber, CO<sub>2</sub> emissions, and potential cooling effect.

## Scheme & Funder

PRVI – UNIMMA (2021)

## Keywords

Discharging process; LPG composition; energy content; cooling effect.

## Output

Paper Entitled “Characteristic Of LPG Compositions in the Fuel Line During Discharging Process” was submitted to International Journal of Technology.

## Technology Readness Level (TRL)

# TRL 3

### 1. Introduction

In the last decade, biofuels from plants such as ethanol and biodiesel have been developed, but its production will challenge the availability of land for crop production. Therefore, LPG is still economically viable in some develop countries to substitute gasoline and to reduce environmental impacts.

However, Studies related to the LPG as fuel or as a heat absorber did not explain the level of the tank at the time of data collection. In fact, LPG level in the tank is decreased during the discharging process. Considering that LPG is a mixture of propane and butane with different properties, this work presents an investigation of LPG composition in the fuel line during the discharging process and its effects on energy combustion, CO<sub>2</sub> emission, and potential cooling effect.

## 2. Method

In this study, the LPG tank was removed from the vehicle and filled  $\pm 85\%$  by volume (100% by mass) at the gas station. The tank was placed on a digital balance and allowed to stand for one day. A shut-off valve was installed in the pipeline between the LPG tank and the expansion valve. An expansion valve was mounted on the evaporator inlets to decrease the pressure and to regulate the LPG flow rate. A flow meter was installed on the exit side of the evaporator for monitoring the LPG flow rate. Ambient air flows through the evaporator by an electric blower to help LPG evaporating. LPG flowed from tank to fuel line by activating shut-off valve. Samples were taken during discharging process every 2 kg of weight loss (1.4 g/s). The samples were analyzed by a Gas Chromatography-Mass Spectrometry (GC-MS) (Figure 1).

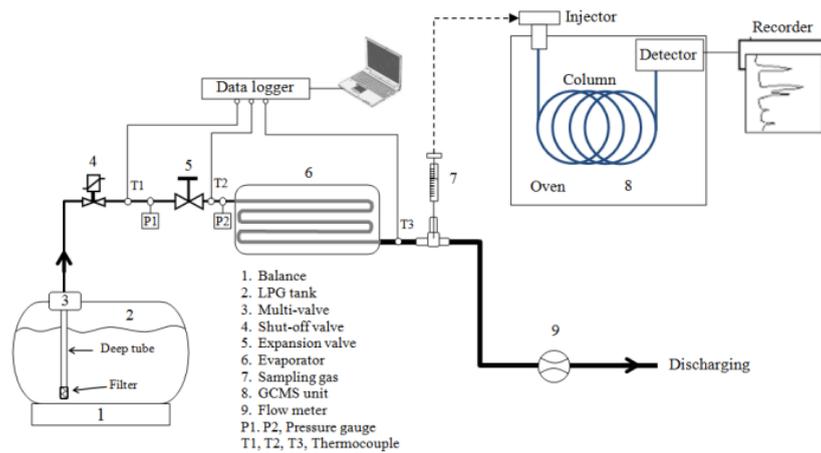


Figure 1. Experiment set up and apparatus

## 3. Result

Based on the test results, the characteristics of LPG composition during the discharging process can be observed. The series of test on lengthwise LPG tank shows that the propane and butane molecules are not evenly during the discharging of the tank (Figure 2). Six samples showing the composition of propane is higher than butane. Meanwhile, five samples showing the composition of butane is higher than propane. However, changes in LPG composition during the discharging process do not significant affect the energy delivery to the combustion chamber, CO<sub>2</sub> emissions, and potential cooling effect.

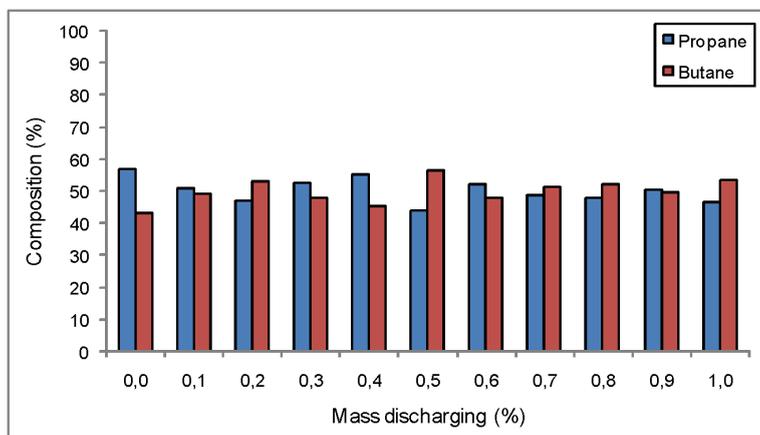


Figure 2. Molecules distribution of LPG during discharging process at 1.4 g/s

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