CHAPTER V

CONCLUSION AND SUGGESTION

5.1 Conclusion

This research aimed to investigate the effect of the addition of fusel oil, which is a by-product of the fermentation of alcoholic beverages, into diesel oil by measuring the amount of PAHs in the diesel exhaust. From studying the GC-MS, it was found the distilled fusel oil consisted of alcohols, ether, and cyclopentane. The fusel oil was blended into the diesel oil before testing the amount of PAHs in the diesel exhaust. Exhaust emissions from the 4 JA 1L ISUZU diesel engine indicated that the amount of PAHs decreased when the amount of fusel oil in the blended fuel increased and the engine speed was varied from 800 to 1600, 2400 rpm, respectively. During traffic congestion, vehicles with engine speeds of 800 rpm are the major cause of the emission of the highest amount of PAHs. The amount of total PAHs ranged from 28.96 ppm (10% V/V of fusel oil was added at the engine speed of 2400 rpm) to 32.12 ppm (no fusel oil was added at the engine speed of 800 rpm.)

From the GC studied according to the EPA 610 method, it was found that 9 species occurred in the PAHs, i.e, naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, and benzo(b)fluoranthrene. Among these 9 species, naphthanlene, acenaphthylene, acenaphthene are main constituents. The study of the physical properties of the blended fuel according to ASTM methods, indicated that, the flash point and distillation point decreased from 68 to 44-38, and from (175.9-346.0) to (138.9-347.3)-(93.3-345.1), respectively. These values decreased as a result of the addition of fusel oil. It mainly causes the pre-ignition and the low thermal efficiency. The API gravity slightly increased from 36.9 to 37.1-37.9 and the specific gravity slightly decreased from 0.840 to 0.839-0.835. However, these values did not affect the cetane number and cetane index.

The effect of low flash point and low initial boiling point of the blended diesel caused the pre-ignition. These results indicated that there was low thermal efficiency and high exhaust emission[20]. Therefore, the injection system should be modified. High thermal efficiency was operated with the late injection (fuel metering timing), and used a multi-spray fuel injection system. The multi-spray fuel injection diesel engines had a greater percentage of vaporized fuel. This increased the burn rate and minimized the hydrocarbon emission.

Fuels with large volume flow rates, such as alcohol fuels, require fuel injection systems with high pressure [20,21]. Therefore, a higher rate fuel injection pump and larger holed area nozzles were installed.

5.5 Suggestion

Engines should be modified to be more compatible with fusel oil, because fusel oil indicates that a low flash point of blended fuel may cause pre-ignition. In this research, the exhaust emission was tested at steady state with no loading condition. Therefore, the results of this study should be comparable to the road test and loading test.

The 4JA 1L ISUZU diesel engine used in this research has never been used before. The testing of this diesel engine should be compare with a used diesel engine because the exhaust emission from the new diesel engine and the exhaust emission from the used diesel engine generated the different emission. The effect of fusel oil may also be tested with the amount of PAHs of used engines.

Finally, fusel oil was selected as oxygenated compound for this study due to its blending property, toxicity, and potential cost. Therefore, when using any certain oxygenated compound, the same basis for selection should be used.