Studies of Eucalyptus Oil and Its Application to Spark Ignition Engine (III)

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Sakuzo TAKEDA, Hisao UCHIYAMA* and Takahiro CHIKU*

Introduction

In this research the out put performance of small farm and automobile engines was compared for three types of blended fuel of eucalyptus oil, alcohol, and gasoline.

The mixing percentage of each fuels was varied. In case of eucalyptus oil, the more its' mixing ratio is, the higher viscosity of fuel becomes.

This causes the decrease of the flow in the fuel system. A slightly larger diameter of the main jet nozzle was adopted for smooth fuel flow.

In case of using 100 percent eucalyptus oil, there exsisted a difficulty in engine starting under the low atmospheric temperature. But eucalyptus oil found to be one of the most hopeful types as moter fuel, since it had several advantages as discussed below.

1. Experimental results

The experimental study on the blended fuels under varies mixing percentage of gasoline and alcohol was conducted using a farm engine and a small car engine of two stroke cycle. The farm engine was connected to the dynamometer and the car engine was tested using the chassis dynamoter.

The following items were measured and analyzed.

1) Engine performance. 2) Fuel comsumption rate.

3) Exhaust gas. 4) Maximum speed and acceleration.

1-1 Distillation curves of fuels.

Generally speaking, the fuel used for spark ignition type engine has better starting ability when the quantity of distillation was low at the 10% point standardized by ASTM (American Society for Testing Materials) method.

On the other hand when the vaperization was high, vapor lock phenomena tended to occur.

Distillation curves were drawn by the Engular distillation method (or ASTM distillation method).

Fig. 1 illustrates the distillation curves for eucalyptus oil, gasoline, alcohol, and thier blended fuels.

The various distillation curves were obtained by use of six kinds of fuels, based upon the distillation curve, the eucalyptus oil had some difficulty for starting engine. This difficulty however did not exist in case of blended fuel of gasoline and eucalyptus. Similar effect were obtained for the other blended fuels as indicated by the curves b(eucalyptus oil 50%+alcohol 50%), c(gasoline34%+eucalyptus oil 33%+alcohol 33%), and d(gasoline80%+eucalyptus oil 20%) in Fig. 1.

The acceleration performance of engine was evaluated by the ASTM method. It was greatly influenced by the quantity of distillation in the range of 35-65%.

Above discussion based on the distillation curves for four blended fuels was supplemented by the further experiments.

1-2 Blended fuel (eucalyptus oil, alcohol, gasoline) test.

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*Suzuki Motor Co., LTD.

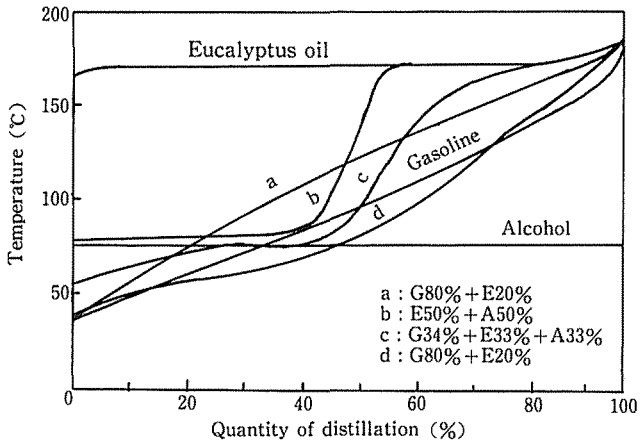

Fig. 1 Distillation curves of fuels

The tests were done by 2 stroke cycle air cooled engine (TEA0660-Shibaura).

As illustrated in Fig. 2, the engine performance and the fuel consumption rate were nearly equal for each blended fuels.

Fig. 3 illustlates the carbon monoxide contents in the exhaust gas. The carbon monoxide contents of 100 percent eucalyptus fuel showed more than the case of gasoline at the middle range revolution, because an over size main jet nozzle (0.700m／m) was used for test. But for the blended fuel test the carbon monoxide was 0.2 percent at the middle range of engine revolution.

2. Tests on the Automobile

2-1 Engine performance and fuel consumption test

Photo. 1 Eucalyptus oil test car

Table 1 shows the specifications of the engine used in the tests. This is the normal type of engine mounted on a small passenger car or van in Japan. It has the capacity of carring four adults or two adults and two hunderd kilogram of luggage.

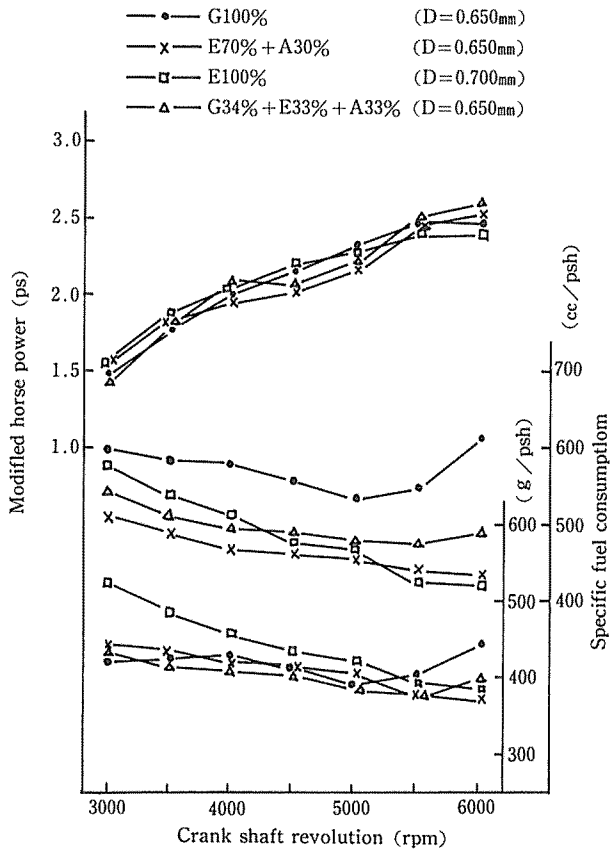

Fig. 2 Blended fuel test (1)

Fig. 4 illustlates the performance curve and fuel comsumption rate of the T5B- type engine.

For these tests three kinds of fuel were used.

The general engine performance using the blended fuels could be expected to be nearly equal to the case of gasoline.

In the tests for the case of eucalyptus fuel in the carburetter were used. Because the eucalyptus oil had higher viscosity (2.07 cst, at 30℃) than gasoline.

2-2 Running test and Bench test

Fig. 5 illustrates the relation between the maximum speed and the acceralation of the car. Four kinds of fuels were used in the experiments.

The standard size of main jet and pilot jet of the carburetter were used for the case of gasoline.

The size of main jet and pilot jet were adjusted depending upon the blending ratio as shown in Fig. 5.

The maximum speed was 105.5km/hr for the gasoline, and 103.1 km/hr was recorded for the eucalyptus oil.

The test results for the acceleration from 0m to 100m, 200m, 300m, and 400m were nearly equal each

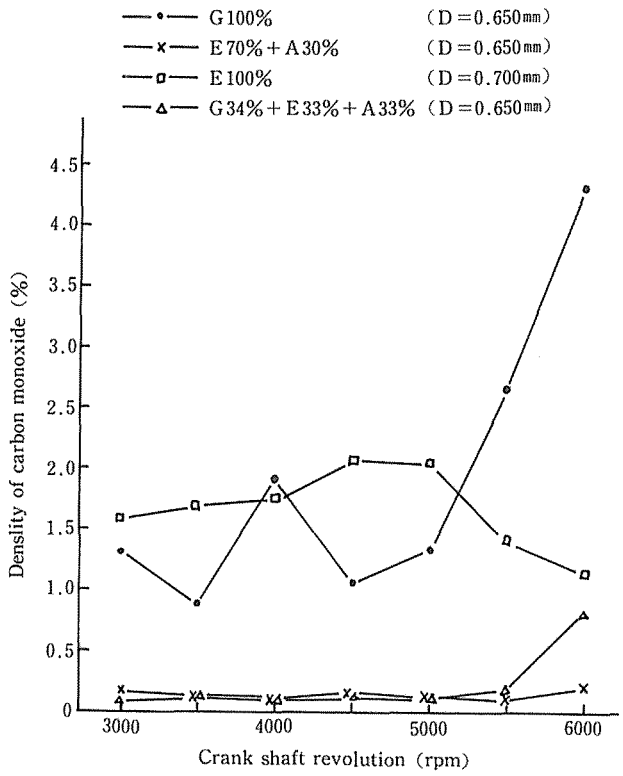

Fig. 3 Blended fuel test (2)

Tab. 1 Specification of T5B-(v)engine

Type	water cooled 2 cycle
bore × stroke × No. of cylider	61.0mm × 61.5mm × 3
piston displacement	539 cc
max. horse power	28/5500 ps / rpm
max. torque	5.3/3000 kg.m / rpm
compression ratio	7.0

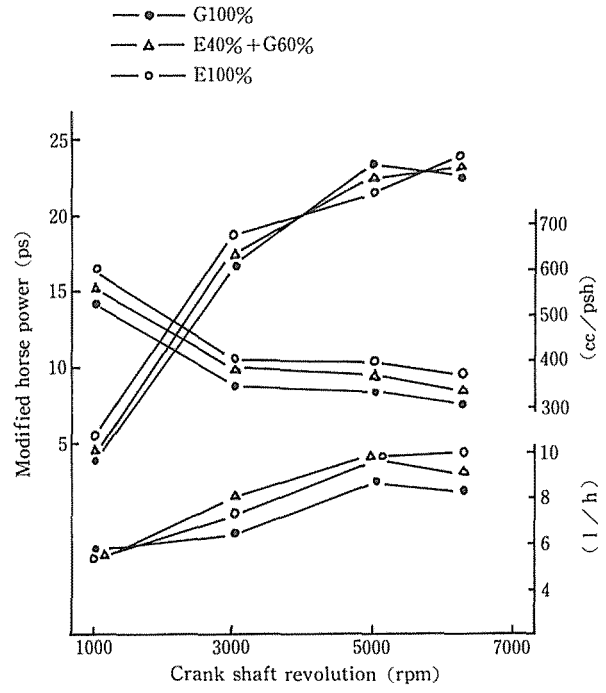

Fig. 4 Engine performance and fuel consumption (T5B-V)

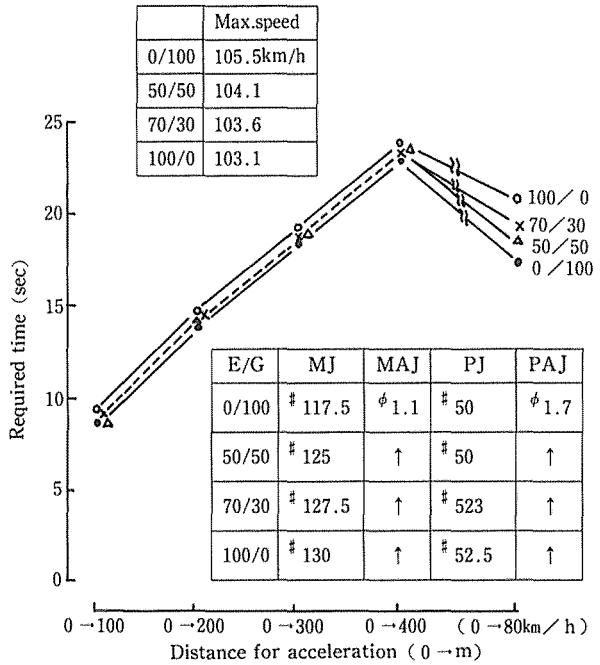

Fig. 5 Maximum speed and acceleration test

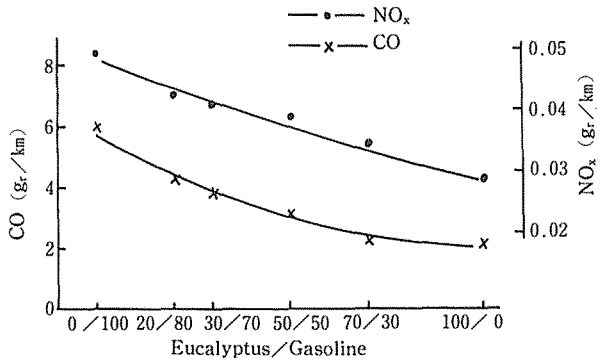

Fig.6 Analysis of exhaust gas for the ten mode standard test. (T5B-V engine)

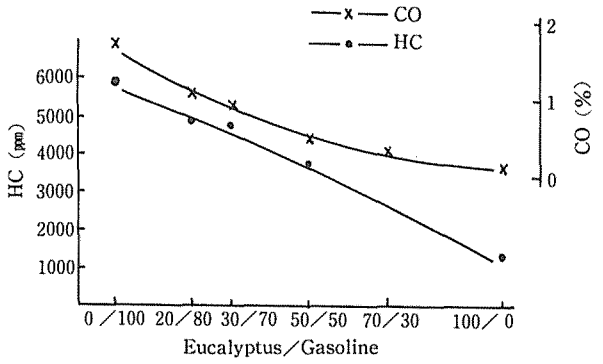

Fig. 7 Analysis of exhaust gas (T5B-V engine at idling revolution)

other in any blending of the gasoline and eucalyptus oil.

From 0km/h to 80km/h it took 17.7 second for the gasoline and 20.6 second for the eucalyptus oil.

Fig. 6 illustrates the result of the analysis of exhaust gas for the ten mode standard tests.

In the tests, the front wheels were on the rolling drum of chassis dynamometer. The test car was run by the simulate program.

The carbon monoxide and NOx in the exhaust gas had the minimum percentage in case of the eucalyptus oil.

Fig. 7 showed the same tendency as Fig. 6.

The carbon monoxide and hydrocarbon in the exhaust gas were minimum in case of the eucalyptus oil.

Conclusion

The experimental results indicated that the eucalyptus oil was one of the hopeful alternative fuels for internal combustion engine. Flash point of eucalyptus oil was much higher than gasoline (eucalyptus oil; 54℃, gasoline −25～−40℃), and the viscosity of eucalyptus oil showed about three times more viscosity than gasoline. From the fact mentioned above, the appropriate blending ratio of the eucalyptus oil for the spark ignition engines should be 10-20 percent for both gasoline and alcohol.

摘　　要

ユーカリ油の火花点火機関への応用（第3報）

竹田　策三・内山　久男・知久　孝弘

第2報に引きつづき，第3報では，2サイクル小型機関による，ユーカリ油，アルコール，ガソリン，以上3種混合燃料による実験および，ユーカリ油ガソリン混合による4輪乗用車の，機関出力ならびにテストコースにおける走行試験，加速試験を行なった。3種混合燃料試験においては，各種燃料の蒸留曲線を測定した図上考察において何れの混合燃料においても，機関の始動性，高温時における蒸気閉塞性は認められないと判断し，実機試験においてそれを確認した。また蒸留曲線における35～65%点は機関の加速性，乗用車におけるドライバビリティに影響があるが，何れの混合燃料も実用上大きな支障は認められなかった。

農用小型2サイクル機関による混合燃料試験においてユーカリ油，アルコール，およびユーカリ油，アルコール，ガソリン3者混合は，何れも機関出力，燃費率において良好な結果を示した。殊に排気中のCO濃度は，ガソリンの場合に比較し1/10程度に減少した。

ユーカリ油およびユーカリ油，ガソリン混合燃料による4輪乗用車出力試験において，機関出力，燃費率何れもガソリンとほゞ同様であった。

次に気化器メインゼットおよびパイロットゼットを，混合燃料の粘度に対応し調整したとき，車両最高スピードはガソリン105.5km／h，ユーカリ油103.1km/hであった。

0→400m加速試験および各種距離別加速試験において，ユーカリ油ならびにユーカリ油混合燃料の間に大きな差は認められなかった。

車両をシャシーダイナモメータ上にセットして行なった10（ゼン）モード試験において排気中のCO（g／km）およびNOx（g／km）排出量は，ユーカリ混入量に比例して減少した。また機関アイドリング時において，排気中の未燃焼炭化水素HC（ppm）およびCO（%），何れもユーカリ油混合量に比例して減少し，ユーカリ油100%で最小値を示した。

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