

## Engine Testing using B10 Diesel: A case study by Kuala Lumpur City Hall (DBKL)

Nursyairah Jalil\*; Harrison Lau Lik Nang\*; Rusnani Abdul Majid\*; Ropandi Mamat\*; Daryl Jay Thardeus\*; Yung Chee Liang\*; Wan Hasamudin Wan Hassan\*; Yahaya Hawari\*; Noraida Omar\*; Astimar Abd Aziz\* and Muhammad Alif Muhamad Noor\*\*

### INTRODUCTION

The Kuala Lumpur City Hall (DBKL), an agency under the Ministry of Federal Territories has been involved in the National Biodiesel Programme since February 2009. The first collaboration on biodiesel fuel between the Malaysian Palm Oil Board (MPOB) and DBKL was to use B5 diesel for the whole DBKL diesel fleet. B5 is a blend of 5% palm biodiesel with 95% petroleum diesel. The successful implementation of the B5 project with DBKL has supported the government to implement B5 program nationwide in phases for transportation and other subsidised sectors beginning in 2011. To further increase the biodiesel blending ratio in diesel, the government had then upgraded B5 to B7 programme since January 2015. So far, no technical complaints were received.

With the successful implementation of B5 and B7 programme, MPOB has initiated B10 project (a blend of 10% palm biodiesel with 90% petroleum diesel) with DBKL starting in February 2014. The project involved 50 units of DBKL diesel vehicles with various brands and applications including Nissan, Komatsu, Isuzu, JCB, TCM, Ford, Mazda, Toyota, Hicom, Kia, Volvo, Weststar, Case, etc. The manufacturing years of vehicles and machineries involved in the testing were ranging from 2000 to 2013. The brands and types of vehicles and machineries in DBKL B10 Project are listed in *Table 1*. Selected images of some vehicles and machineries used are shown in *Figure 1*.

As of July 2018, a total of 375, 520 liters of B10 had been used with total mileage accumulation of 1.7 million km for normal vehicles and 6200 hours for machinery

\* Malaysian Palm Oil Board  
6, Persiaran Institusi, Bandar Baru Bangi  
43000 Kajang, Selangor  
E-mail: nursyairah@mpob.gov.my

\*\* Kuala Lumpur City Hall (DBKL)  
Km 4, Jalan Cheras  
56100 Kuala Lumpur



**TABLE 1. BREAKDOWN OF BRANDS AND TYPES OF VEHICLES AND MACHINERIES IN DBKL B10 PROJECT**

Brand	Application	No. of Machinery	Engine Manufacturer
Case	Excavator and backhoe	1	Italy
Komatsu	Tractor shovel	1	Japan
Hitachi	Excavator	1	Japan
JCB	Excavator and backhoe	2	UK
<b>Total of Machinery</b>		<b>5</b>	
Brand	Application	No. of Vehicle	Engine Manufacturer
HICOM	Vehicle carrier	2	Malaysia
	Flatbottom lorry, 2.5 t with taillift	1	
Hino	Flatbottom lorry with taillift	1	Japan
	Tipper, end with high side	3	
	Patching lorry	2	
	Tipper, end with high side	3	
	Tipper, 3 way 5 t	6	
	Tipper, end 5 t	2	
Nissan	Aerial platform	2	Japan
	Water tanker	5	
	Pick-up truck	2	
	Pick-up truck with crew cab	3	
	Flatbottom lorry 3 t with taillift	1	
	Flatbottom lorry with taillift	2	
	Tipper, 3 way 5 t	1	
	Tipper, end 5 t with crane	1	
	Water tanker	1	
	Pick-up truck with crew cab	1	
Ford	Pick-up truck with crew cab	2	USA
Toyota	Pick-up truck	1	Japan
Mazda	Pick-up truck with crew cab	1	Japan
Kia	Van	1	Korea
Weststar	OKU Van	1	China
<b>Total of Vehicle</b>		<b>45</b>	
<b>Grant total</b>		<b>50</b>	

operation. So far, no technical issues have been reported due to the use of B10 diesel.

### **VISUAL INSPECTION OF FUEL FILTERS AND LUBRICATING OIL PERFORMANCE**

Monitoring on the fuel filters and lubricating oil indicated that the operation of the B10-fuelled vehicles was the same as that of normal diesel and the replacement of fuel

filter and lube oil was in accordance with normal service and maintenance schedule. Lubricating oil was collected during normal oil change interval of each vehicle by using extraction vacuum pump (*Figure 2*). Sample was taken after running engine for at least 15 min to ensure homogeneity. Analysis of fresh and used engine oil were conducted by ALS Technichem (M) Sdn. Bhd. Based on the laboratory results, all lubricating oil samples showed no unusual engine wear



a) Excavator Hitachi ZX210W-3



b) Pick-up Truck Nissan Navara



c) Water tanker Nissan LKA211N



d) Tractor Shovel, wheeled Komatsu WA200-5

Figure 1. Some of the vehicles and machineries using B10 diesel.



Figure 2. Extraction vacuum pump for lube oil sampling

and no fuel dilution. All samples tested were within the acceptable limits. Example of certificate of results from a third party laboratory is shown in Figure 3.

The fuel filter collected was cut open for checking of any abnormality, and was found in normal condition as compared to fuel filter using B7 diesel. The replacement of fuel filter was done during normal service schedule, following standard procedure by manufacturers.

Engine assessment was conducted for two selected vehicles, *i.e.* Nissan UD truck LKA211N and Nissan Navara. The objective of engine assessment was to check the condition of the engine after using B10 including fuel system and other parts that were in direct contact with the fuel. Considering the problem-free operation of the two selected vehicles, *i.e.* Nissan UD truck LKA211N with Euro2 engine (WPA9372 – 130, 000km) and Nissan Navara with Euro3 common rail engine (WXK 3673 – 90, 000km), the dealers (representing Original Equipment Manufacturers – OEM) decided that the overhaul of these vehicles will only be carried out when they reach the recommended mileages (LKA211N – 150 000 km and Navara – 100 000 km). Following the standard procedure, overhauling should only be carried out when the vehicle has a problem. While waiting for these vehicles to achieve recommended mileages, compression test and injector diagnostic test were conducted for Nissan LKA211N and Nissan Navara at dedicated Nissan service workshop. The exhaust emission test was

### Engine Assessment







Figure 6. Engine compression test by Tan Chong Industrial Equipment (TCIE) Sdn Bhd for Nissan UD truck LKA211N (WPA9372).



Figure 7. Smoke test by Department of Environment (DOE).

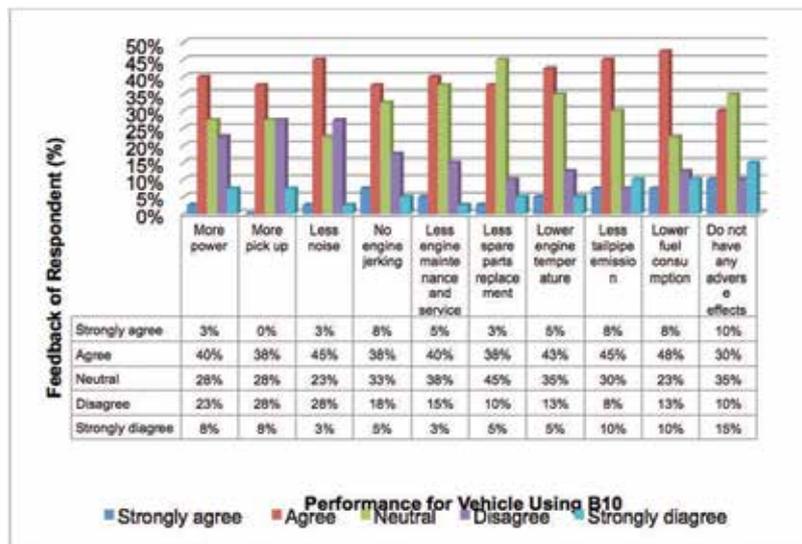


Figure 8. Performance of vehicle using B10 based on driver's experience.

and tear were found using B10 diesel for 100 000 km.

### 3) Tail-pipe Emission Test

Smoke test (Figure 7) for Nissan Navara at 60 000 km and Nissan UD LKA211N at 100 000 km was conducted by Department of Environment (DOE). The results of the exhaust and smoke emissions test for

Nissan Navara and Nissan UD LKA211N were 2.7% and 2.8% respectively, which were below the maximum opacity limit of 50% set by the DOE. The tailpipe exhaust emission quality for the vehicles using B10 diesel has been greatly improved due to cleaner combustion of the fuel resulted in less smoke and unburnt hydrocarbon.

## Driver Survey

Survey questionnaires have been given to all drivers to gather the experience of using B10. From the survey, it was noted that the drivers agreed that the engine performance of using B10 was comparable with engine running using normal diesel. In fact, majority of the drivers experienced better engine performance, better fuel consumption, smoother engine operation and more power when using B10 as shown in *Figure 8*.

## CONCLUSION

The technical evaluation on vehicles using the B10 fuel for 4.5 years showed that the use of B10 will not cause any problem to the engine and operational issues. B10 diesel will not affect daily operation and maintenance cost of a vehicle as compared to the B7 diesel.

