## DIESEL VEHICLE AND ENGINE GAS EMISSION ASSESSMENTS FOR RESEARCH AND DEVELOPMENT

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he Malaysian Palm Oil Board (MPOB) has been involved in palm biodiesel research and development since the 1980s. Various experiments and field trials have been conducted searching for a better, cleaner and renewable fuel either using crude palm oil, palm olein or palm methyl ester for the diesel engine. Among the important parameters evaluated during the studies are the effects of biodiesel on vehicle performance and gas emission. To conduct these assessments, MPOB has equipped itself with the necessary testing equipment.

MPOB would like to offer some of the testing facilities related to gas emission assessment to the industry and scientific community for research purposes.

## GAS EMISSIONS

Standards for gas/exhaust emission (called 'tailpipe emission') relating to the automotive engines – either petrol or diesel engines – stipulate the maximum limit of allowable pollutants in exhaust gases emitted from a vehicle. The regulated emissions enforced for the vehicle or any engine running on diesel and the following parameters for gases have been included in the exhaust emission standards:

- particulate matter (PM);
- oxides of nitrogen (NO<sub>x</sub>) which include NO and NO<sub>2</sub>;
- hydrocarbons (HC) either regulated as Total Hydrocarbon (THC) or combined with NO<sub>x</sub>; and
- carbon monoxide (CO).

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Every country has its own emission measurement methods. However, these methods are almost

similar and can be grouped into three categories:

- 1. Snap acceleration test (SAE J1667 February 1996);
- 2. Constant speeds/loads measurement; and
- 3. Engine emission cycles.

### MPOB DIESEL GAS EMISSION TESTING EQUIPMENT

# Gas Analyser Integrated with a Chassis Dynamometer

This system (*Figure 1*) combines a gas analyser measuring  $O_2$ , CO,  $CO_2$ ,  $NO_x$ , HC, exhaust temperature, oil temperature, engine revolution per minute (rpm), and exhaust backpressure. The system incorporates a high-flow pump with United States Environmental Protection Agency (EPA) compliant sample-conditioning techniques to deliver a clean, cool and properly conditioned exhaust sample to the gas analyser. This system has been integrated with a chassis dynamometer to ensure that the tests can be conducted according to the international standard for the emission cycle test.



Figure 1. Gas analyser with heated total hydrocarbon.



#### **Technical Specifications**

Parameter	Range	Resolution	Accuracy (%)
Oxygen, O <sub>2</sub>	0.0% – 21.0%	0.1%	$\pm 0.1$
Carbon monoxide, CO	0 – 4 000/40 000 ppm	1.0 ppm	± 2
Nitric oxide, NO	0 – 4 000 ppm	1.0 ppm	± 2
Nitrogen dioxide, NO <sub>2</sub>	0 – 500 ppm	1.0 ppm	± 2
$NO_x (NO + NO_2)$	0 – 4 500 ppm	1.0 ppm	± 2
Hydrocarbons (HFID)	0 – 10/100/1 000/10k ppm	0.1 ppm	± 2

#### Gas Analyser (portable type)

A gas analyser is most commonly used for maintenance and trouble-shooting of commercial and industrial combustion systems, such as steam boilers, burners, liquid and gaseous fuel fired reciprocating engines and turbines, and performance testing of combustion and pollution control devices. The ECOM-AC portable emission-analyser system (*Figure 2*) is fitted with four to seven gas sensors, including for  $O_2$ , CO (two ranges), NO, NO<sub>2</sub>, SO<sub>2</sub>, combustibles and opacity.



Figure 2. ECOM-AC portable emission- analyser.

#### **Technical Specifications**



Figure 3. Hartridge Smokemeter 4.

#### **TERMS AND CONDITIONS OF SERVICES**

- 1. The starting date of testing is subject to the availability of the testing facilities.
- 2. Fuel and vehicles for testing are to be provided by the customer.
- 3. Services provided to the customer shall not in any way constitute an endorsement by MPOB of the end-product and/or its performance thereof, and none shall therein be inferred.
- 4. MPOB does not in any way warrant that the result of the laboratory analysis conducted hereunder for the services shall be in any way suitable, capable and/ or compatible for the use in commercial vehicles and/or other commercial applications thereto.

Parameter	Range	Resolution	Accuracy (%)
Oxygen, O <sub>2</sub>	0%-21%	0.1%	vol. $\pm 2$
Carbon monoxide, CO	0 – 4 000/40 000 ppm	1.0 ppm	± 2
Nitric oxide, NO	0-4 000 ppm	1.0 ppm	± 2
Nitrogen dioxide NO <sub>2</sub>	0-500 ppm	1.0 ppm	± 2
Sulphur dioxide, SO <sup>2</sup>	0-5 000 ppm	1.0 ppm	± 2
Combustibles (H)	0%-6%	0.01%	vol. $\pm 2$

#### **Opacity Meter**

This equipment (*Figure 3*) is used for measuring the smoke level or opacity of the diesel engine, and is normally used for vehicle inspection by the authorities such as the Department of Road Transport, PUSPAKOM and others. Using free acceleration or steady state test procedures, the opacity meter will provide data on the percentage of smoke density produced by the engine.

#### **Technical Specifications**

Opacity measurement Range (HSU Scale) : 0% - 100% Resolution : 0.1%

Speed measurement (optical/clamp-on sensors)Range (rpm): 200-6000 rpmResolution: 10 rpmAccuracy: 1% + 10 rpm

For more information kindly contact:

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