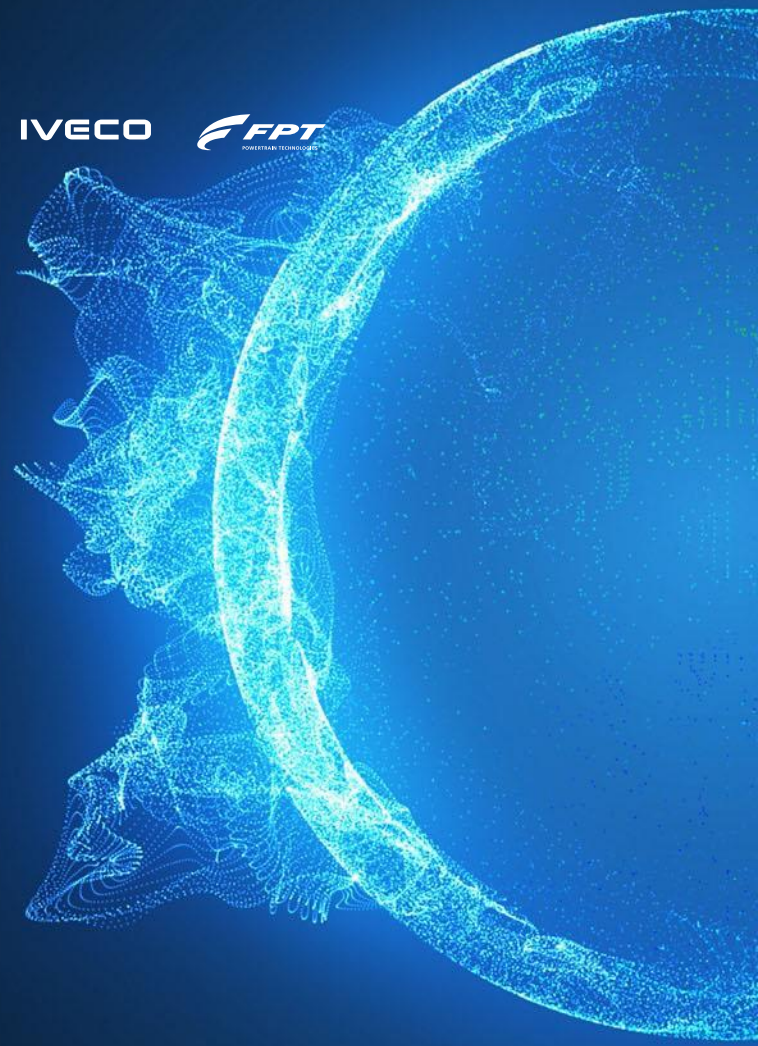
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B100 Effect on Diesel Oxidation Catalyst (DOC)

This study examines how B100 biodiesel affects Diesel Oxidation Catalyst (DOC) performance compared to conventional diesel.

We analyze light-off behavior, oxidation capacity, and hydrocarbon storage in aftertreatment systems.

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Agenda

1. Introduction
2. Test Equipment and Methodology
3. Test Methods Overview
4. DOC Light-Off Analysis Results
5. HC Oxidation Findings
6. HC Storage Capacity Findings
7. Overall Performance
8. Conclusions and Implications

Biofuel Characteristics

The general interest for biofuel or biofuel blends (e.g. B100) is increasing.

The chemical composition is different due to standard fuel (B7). In particular, the oxygen, the Alkaline- ,Alkaline Earth Metal and the Phosphorus content are higher with biofuel.

This leads to different characteristic during burning in combustion engine.

Test	Method	Unit	Limit Min Max	Result
Appearance ^	Visual		Report	C&B
Cetane Number ^	EN ISO 5165		min 51.0	51.0
Density @ 15°C [a]	EN ISO 12185	kg/m³	860.0 to 900.0	882.0
Cloud Point ^	ASTM D2500	°C	0 max	-5
CFPP ^	EN 116	°C	-5 max	-13
Acid Value ^	EN 14104	mgKOH/g	0.50 max	0.25
Carbon Residue (10% Dis. Res) ^	ASTM D4530	% m/m	0.05 max	<0.01
Flash Point (Procedure A) [a]	ASTM D93	°C	min 130.0	150.0
Sulfur [a]	EN ISO 20846	mg/kg	10.0 max	3.6
Viscosity at 40°C [a]	EN ISO 3104	mm²/s	3.500 to 5.000	4.421
Water Content ^	EN ISO 12937	mg/kg	500 max	220
FAME Content *	EN 14103	% m/m	min 96.5	97.8
Polyunsaturated Methyl Ester *	EN 15779	% m/m	1.00 max	<1.00
Linolenic Acid Methyl Ester Content *	EN 14103	% m/m	12.0 max	8.0
Monoglyceride Content *	EN 14105	% m/m	0.40 max	0.40
Diglyceride Content *	EN 14105	% m/m	0.20 max	0.11
Triglyceride Content *	EN 14105	% m/m	0.20 max	0.14
Free Glycerol *	EN 14105	% m/m	0.02 max	<0.02
Total Glycerol *	EN 14105	% m/m	0.24 max	0.13
Iodine value *	EN 14111	g Iodine/100g	120 max	111
Methanol *	EN 14110	% m/m	0.200 max	0.030
Oxidation Stability ^	EN 15751	h	min 8.0	>8.0
Sulphated Ash Content *	ISO 3987	% m/m	0.020 max	<0.020
Copper Corrosion (3h at 50°C) ^	EN ISO 2160	Rating	Class 1	1A
Total Contamination ^	EN 12662	mg/kg	24 max	13
Water & Sediment *	ASTM D2709	% v/v	0.050 max	0.040
Filter Blocking Tendency ^	IP387 Procedure B		Report	1.03
Sodium + Potassium *	EN 14538	mg/kg	7.0 to 8.0	5.5
Calcium + Magnesium *	EN 14538	mg/kg	7.0 to 8.0	3.3
Phosphorus *	EN 14107	mg/kg	5.4 to 6.4	6.9
Carbon *	ASTM D5291	% m/m	Report	76.92

Test Equipment and Methodology

- Engine Specifications:

9-liter displacement 6-cylinder FPT diesel engine

Stage V compliant with WG turbocharger

Common rail injectors

- Testing Equipment:

Steady-state test cell with Eddy current dynamometer

AVL AMA i60 exhaust measurement system

Double probe system



Test Equipment and Methodology

- ATS Specifications:

Pt/Pd-Based Technology Features

- Utilizes platinum and palladium
- Effective for oxidation processes

SCRoF with Cu-Fe-zeolite coating

- Uses copper and iron zeolite
- Enhances selective catalytic reduction

CUC with SCR coating on Pt-containing washcoat

- Improves emission control

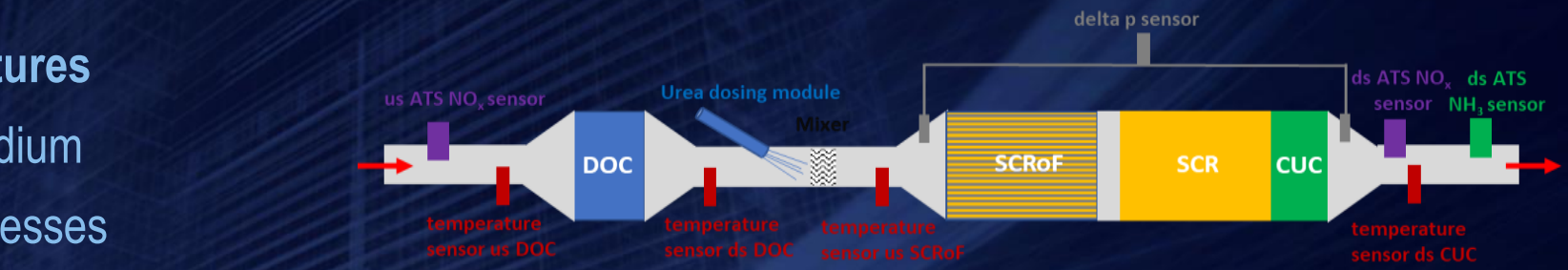


Fig. 1. ATS Architecture

Test Methods Overview

DOC Light-Off Test

Evaluates temperature profile to assess oxidation efficiency under engine bench conditions.

HC Oxidation Test

Assesses DOC's ability to convert hydrocarbons and examines downstream temperature generation.

HC Storage Test

Evaluates low-temperature assessment of HC accumulation within the DOC.

DOC Light-Off Analysis Results

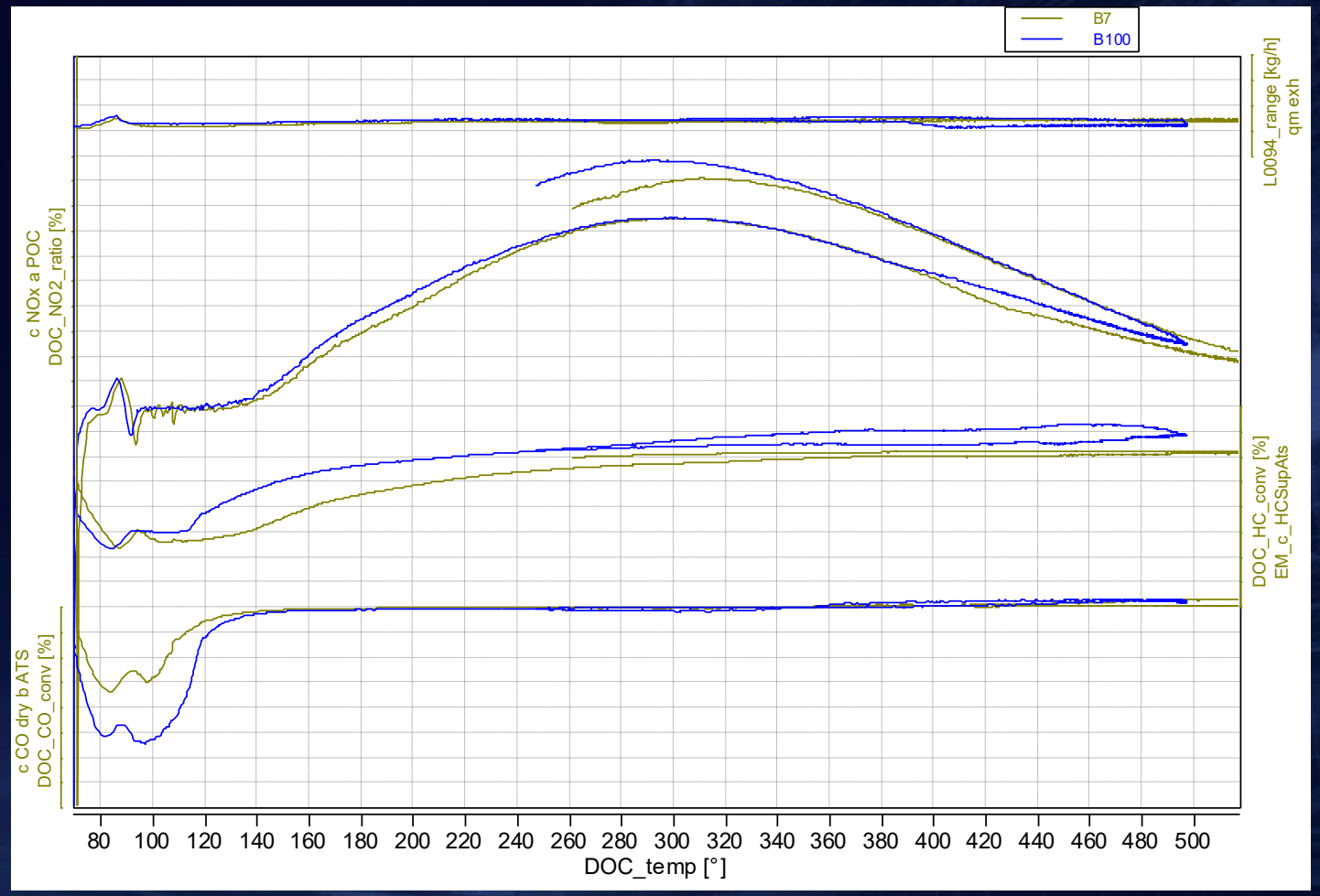


Fig. 2 Light off on DOC between B7 and B100.

Lower Light-Off

B100 demonstrated a lower light-off temperature compared to conventional diesel.

Improved HC Conversion

B100 exhibited superior HC conversion conversion and achieved light-off more more rapidly than standard B7 fuel.

Reduced HC Slip

The faster light-off with B100 reduced hydrocarbon slip during

HC Oxidation Test

Lower Peak Temperatures

B100 exhibits lower peak temperatures during HC oxidation.

Higher Conversion Efficiency

Achieves better HC conversion due to increased oxygen content.

Space Velocity Dependence

HC slip highly dependent on space velocity and temperature.

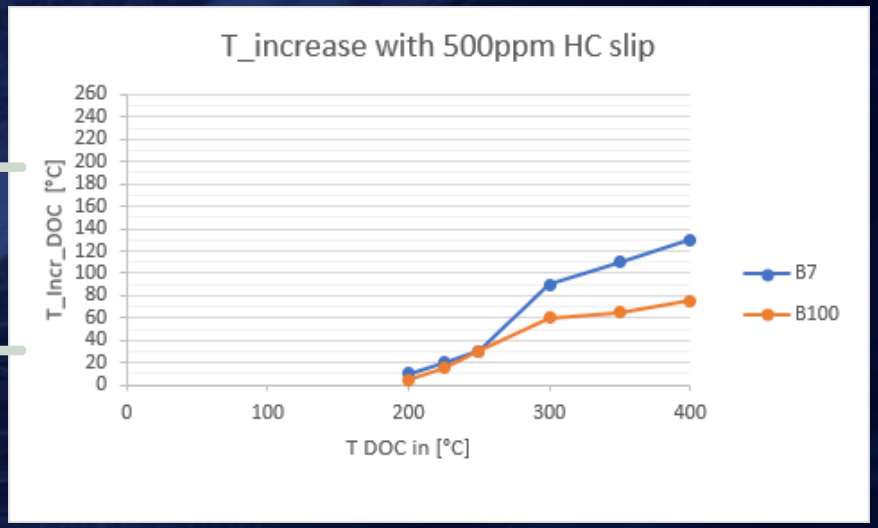


Fig. 4. T increase after DOC between B7 and B100.

HC Storage Capacity

Higher Storage Capacity

B100 shows greater HC storage capacity under idle conditions (120-130°C).

1

2

Higher Boiling Point

Increased storage likely due to B100's higher boiling point compared to B7.

3

Operational Impact

Important for low-temperature scenarios like prolonged vehicle idling.

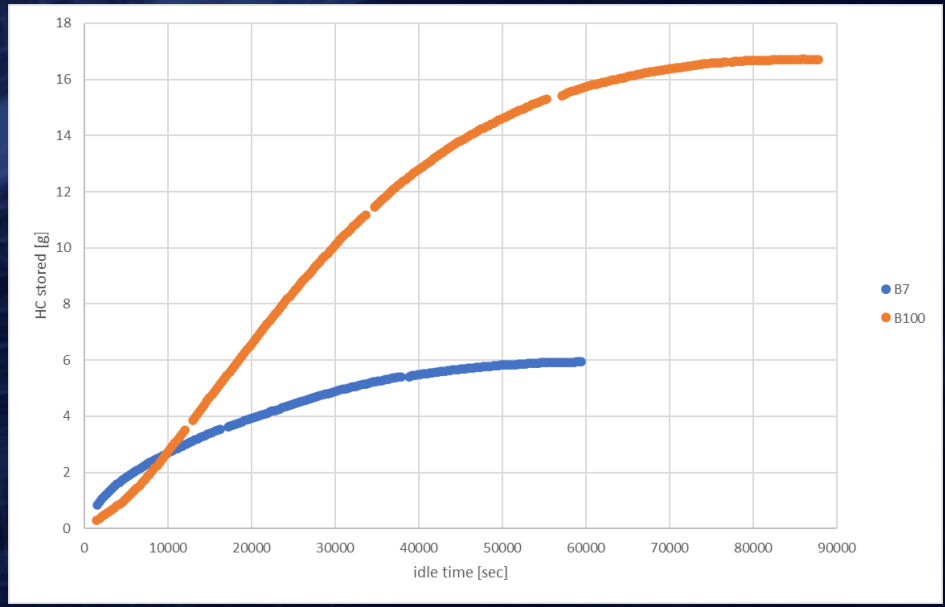


Fig. 3. HC storage capacity vs loading time between B7 and B100.

Overall Performance

Performance Metric	Change (%)	Details
Soot Reduction	-84%	Significant reduction in soot emissions
BSFC Increase	13%	Increase in brake-specific fuel consumption
BSNOx Increase	24%	Higher brake-specific NOx emissions with B100 during NRTC cycle

Conclusions

Decreased Carbon Emissions

Biodiesel produces lower carbon emissions than traditional diesel.

When evaluated on a well-to-wheel basis, there is a notable reduction.



High-Priority Research Needs for Higher Biodiesel Blends

1 | Long-Term ATS Durability
Understand B20–B100 impact on catalyst activity, storage behavior and ageing.

2 | Fuel Variability & Robustness
Define fuel-property boundaries ensuring consistent ATS performance.

3 | Real-World System Performance
Validate emissions and regeneration performance under representative transient operation.

Take-away:
Bridge the gap between demonstrated B100 capability and robust, durable OEM implementation.



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