Supplementary Materials for Influence of Blending Model *n*-Butanol Alcoholysis Derived Advanced Biofuel Blends with Diesel on the Regulated Emissions from a Diesel Hybrid Vehicle

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Table S1. ECU channels logged using Rebel LT and their logging frequencies.

Data Channel	Unit	Frequency (Hz)
Time	sec	
Actual Gear	-	1
AdBlue Range Estimate	km	0.2
AdBlue Metering	g	1
Ash Content of Diesel Particular Filter	g	0.5
Atmos Pressure	hPa	1
Average Demanded Reagent Consumption	L/h	1
Average Reagent Consumption	L/h	1
Battery Cell-Av Voltage	V	1
Battery Cell-Max Voltage	V	1
Battery Cell-Min Voltage	V	1
Boost Pressure	hPa	1
Calculated Gear	-	1
Charge Air Temp	°C	1
Charge Level of High-Voltage Battery	%	1
Current AdBlue Metering Quantity	mg/s	1
Current Value of High Voltage Battery	A	1
Differential Pressure Sensor	hPa	1
Distance Since Last Regen	km	1
Exhaust Gas Recirculation Actuator	%	1
Engine Coolant Temperature	°C	1
Engine Oil Temperature	°C	1
Engine Speed	rpm	1
Engine Torque	Nm	1
Exhaust Temperature Upstream of Oxidation Catalytic Converter	°C	1
Exhaust Temperature Upstream of Turbocharger	°C	1
Exhaust Pressure Sensor	hPa	1
Fill Level of AdBlue Tank	L	0.2
Fill Level of Diesel Particular Filter	%	1
Fill Level of Selective Catalytic Reduction Catalytic Converter	g	1

Injection Quantity	mg/stroke	10
Intake Air Temp	°C	1
Lambda Value_ Equivalence Ratio Bank 1_ Sensor 1		1
Low Pressure Turbo Boost Pressure	hPa	2
Mass Air Flow Sensor A	g/s	1
Measurement Value of AdBlue Fill Level Sensor	mm	1
Metering Request	g	1
NO_X Concentration Downstream of SCR	ppm	2
NO_X Concentration Upstream of SCR	ppm	2
Pressure Downstream of Air Filter	hPa	2
Rail Pressure	bar	1
Relative Throttle Position	%	1
Requested AdBlue Metering Amount	mg/s	1
Temperature in AdBlue Tank	°C	1
Temperature Sensor Upstream of Diesel Particulate Filter	°C	1
Temperature Sensor Upstream of Selective Catalytic Reduction Catalytic Convertor	°C	1
Total Air Mass	kg/h	1
Transmission Mode	-	1
Vehicle Mileage	km	1
Vehicle Speed Sensor	km/h	1
Wide Range O_2 Sensor Voltage	V	1

Table S2. Average fuel economy for each fuel tested.

Fuel Blend	Fuel Economy (l/100km)
D100	5.77 ± 0.35
D90Bu10 – 65/30/5	6.03 ± 0.15
D90Bu10 – 85/10/5	5.80 ± 0.10
D75Bu25 – 85/10/5	5.95 ± 0.17

Table S3. Average total cumulative cold start pollutant emissions during the first 300 seconds of the test for each fuel blend.

Fuel Blend	CO (g)	NO_X (g)	PN (#)
D100	2.04 ± 0.74	1.37 ± 0.47	$(1.05 \pm 0.69) \times 10^{12}$
D90Bu10 – 65/30/5	0.98 ± 0.14	1.16 ± 0.12	$(3.34 \pm 0.69) \times 10^{11}$
D90Bu10 – 85/10/5	1.59 ± 0.17	1.12 ± 0.24	$(4.96 \pm 3.80) \times 10^{11}$
D75Bu25 – 85/10/5	2.55 ± 0.46	0.98 ± 0.09	$(1.29 \pm 0.93) \times 10^{11}$

Table S4. Average CO emission factors for each RDE section for each fuel blend.

Fuel Blend	Urban Emissions (mg/km)	Rural Emissions (mg/km)	Motorway Emissions (mg/km)	Total Emission (mg/km)
Euro 6 Limit				500
D100	397.00 ± 286.71	154.82 ± 148.22	168.01 ± 162.07	237.14 ± 188.45
D90Bu10 – 65/30/5	161.70 ± 130.94	59.37 ± 99.55	75.70 ± 135.03	99.36 ± 116.50
D90Bu10 – 85/10/5	180.91 ± 178.00	62.71 ± 104.47	67.65 ± 71.13	103.42 ± 115.77
D75Bu25 – 85/10/5	127.64 ± 37.85	45.90 ± 47.15	51.01 ± 49.67	75.78 ± 41.14

Table S5. Average PN emission factors for each RDE section for each fuel blend.

Fuel Blend	Urban Emissions (#/km)	Rural Emissions (#/km)	Motorway Emissions (#/km)	Total Emission (#/km)
Euro 6 Limit				6×10^{11}
D100	$(5.22 \pm 2.64) \times 10^{10}$	$(1.00 \pm 0.31) \times 10^{10}$	$(1.53 \pm 0.50) \times 10^{10}$	$(2.53 \pm 0.76) \times 10^{10}$
D90Bu10 – 65/30/5	$(3.64 \pm 0.14) \times 10^{10}$	$(1.18 \pm 0.07) \times 10^{10}$	$(1.72 \pm 0.38) \times 10^{10}$	$(2.20 \pm 0.17) \times 10^{10}$
D90Bu10 – 85/10/5	$(3.95 \pm 1.43) \times 10^{10}$	$(1.02 \pm 0.12) \times 10^{10}$	$(1.55 \pm 0.47) \times 10^{10}$	$(2.19 \pm 0.57) \times 10^{10}$
D75Bu25 – 85/10/5	$(1.61 \pm 0.24) \times 10^{10}$	$(6.62 \pm 2.59) \times 10^{9}$	$(9.63 \pm 3.28) \times 10^{9}$	$(1.09 \pm 0.24) \times 10^{10}$

Table S6. Average NOx emission factors for each RDE section for each fuel blend.

Fuel Blend	Urban Emissions (mg/km)	Rural Emissions (mg/km)	Motorway Emissions (mg/km)	Total Emission (mg/km)
Euro 6 Limit				80
Euro 6 Limit with Conformity Factor of 2.1				168
D100	145.67 ± 24.96	97.10 ± 7.76	203.91 ± 44.24	148.08 ± 8.79
D90Bu10 – 65/30/5	166.75 ± 16.64	103.41 ± 25.40	228.42 ± 60.68	167.30 ±13.78
D90Bu10 – 85/10/5	159.06 ± 26.61	119.51 ± 32.40	215.46 ± 63.52	165.45 ± 38.98
D75Bu25 – 85/10/5	171.40 ± 13.02	123.78 ± 21.56	266.48 ± 45.91	185.86 ± 24.66

Table S7. Average total mass of NOx emitted measured with the pre- and post-SCR NOx sensors and the OBS-ONE.

Fuel Blend	Pre-SCR NOx Sensor (g)	Post-SCR NOx Sensor (g)	OBS-ONE Tailpipe Measurement (g)
D100	42.38 ± 5.56	14.09 ± 2.14	**14.39** ± 0.86
D90Bu10 – 65/30/5	45.12 ± 2.66	16.79 ± 1.63	16.23 ± 1.32
D90Bu10 – 85/10/5	41.68 ± 7.46	16.42 ± 3.30	16.02 ± 3.78
D75Bu25 – 85/10/5	40.65 ± 5.07	17.15 ± 2.48	18.03 ± 2.39

Table S8. Average fraction of NOx removed by SCR and the average total AdBlue Metering Mass.

Fuel Blend	Fraction of Total NOx removed by SCR (%)	Total AdBlue Metering (g)
D100	66.74 ± 2.88	911.73 ± 114.87
D90Bu10 – 65/30/5	62.84 ± 2.01	882.38 ± 43.40
D90Bu10 – 85/10/5	60.72 ± 1.47	894.24 ± 151.04
D75Bu25 – 85/10/5	57.83 ± 3.36	785.22 ± 128.36