

Supplementary Material

Chemical analysis of SP95E10 Euro 6 and Nigerian gasoline

Test Name	Method	Analyte	Unit	SP95E10 Euro6 (reference fuel)	Nigerian gasoline
Type				Certification gasoline	Light Fluid Catalytic Cracked gasoline
Origin				Givors (Total ACS)	Donges
Density at 15°C	NF EN ISO 12185	Density at 15°C	kg/m ³	747.9	734.3
Reid Vapor Pressure at 37,8°C	NF EN 13016-1	ASVP at 37,8°C	kPa	57.8	53.9
Distillation at atmospheric pressure	NF EN ISO 3405	Initial Boiling Point	°C	36.2	34.3
		5%V Point	°C	48.7	52.1
		10%V Point	°C	52.9	58.9
		20%V Point	°C	58.4	68.5
		30%V Point	°C	63.1	76.8
		40%V Point	°C	67.7	84.3
		50%V Point	°C	89.8	92.1
		60%V Point	°C	101.9	101.3
		70%V Point	°C	110.1	111.1
		80%V Point	°C	118.5	122.3
		90%V Point	°C	143.5	137.4
		95%V Point	°C	165.4	150.0
		Final Boiling Point	°C	183.5	178.6
		Residue	mL	1.1	0.6
		Losses	mL	1.6	0.9
Distillated percentage at 70°C		% distillated at 70°C	% v/v	42	21.7
Distillated percentage at 100°C		% distillated at 100°C	% v/v	59	58.6
Distillated percentage at 150°C		% distillated at 150°C	% v/v	92	95.0
Sulfur content	NF EN ISO 20846	S content	mg/kg	<10	820.0
Gum content of light and middle distillates fuels	NF EN ISO 6246	Before washing	mg/100mL	5	1.0
		After washing	mg/100mL	<1	<1
Research Octane Number	NF EN ISO 5164	RON	N/A	96.7	90.6
Motor Octane Number	NF EN ISO 5163	MON	N/A	85.7	79.9
Oxidation induction period of gasolines	NF EN ISO 7536	Oxidation induction Period	min	>360	341
Elements content in gasoline	Internal method	Ag content	mg/kg	<0,1	<0,1
		Al content	mg/kg	0.3	0.1
		B content	mg/kg	<0,1	<0,1
		Ba content	mg/kg	<0,1	<0,1
		Ca content	mg/kg	0.3	<0,1
		Cd content	mg/kg	<0,1	<0,1
		Co content	mg/kg	<0,1	<0,1
		Cr content	mg/kg	<0,1	<0,1
		Cu content	mg/kg	<0,1	<0,1
		Fe content	mg/kg	<0,1	<0,1
		K content	mg/kg	<0,1	<0,1
		Li content	mg/kg	<0,1	<0,1
		Mg content	mg/kg	<0,1	<0,1
		Mn content	mg/kg	<0,1	<0,1
		Mo content	mg/kg	<0,1	<0,1
		Na content	mg/kg	<0,1	<0,1
		Ni content	mg/kg	<0,1	<0,1
		P content	mg/kg	<0,1	<0,1
		Pb content	mg/kg	<0,1	<0,1
		Si content	mg/kg	1	0.4
Sn content	mg/kg	<0,1	<0,1		
V content	mg/kg	<0,1	<0,1		
Zn content	mg/kg	<0,1	<0,1		
Visual aspect	N/A	Visual aspect	N/A	Clear & Limpid	Clear & Limpid
Analysis of gasolines by family PONA	ASTM D6730	total normal paraffins	% w/w	6.06	10.82
		total iso paraffins	% w/w	33.96	28.18
		total olefins	% w/w	6.82	24.23
		total naphthenes	% w/w	8.06	13.26
Analysis of gasolines by reformulyzer	NF EN ISO 22854	total aromatics	% w/w	34.47	21.18
		total paraffins	% w/w	50.6	37.1
		total olefins	% w/w	7.1	30.4
		total naphthenes	% w/w	9.5	14.9
		total aromatics	% w/w	32.8	17.6
C, H, N content	ASTM D5291	teneur en benzene	% v/v	0.0	0.00
		C content	% w/w	83.70	83.40
		H content	% w/w	14.40	13.40
		C/H	N/A	5.81	6.22
Calorific Value	ASTM D240	N content	% w/w	<0,75	<0,75
		inferior calorific value	MJ/kg	41.34	43.34
Water Content : Karl-Fischer	NF EN ISO 12937	superior calorific value	MJ/kg	44.39	-
		Water content	mg/kg	270.00	100.00

Test Name	Method	Analyte	Unit	SP95E10 Euro6 (reference fuel)	Nigerian gasoline
PONA details (DHA)	ASTM D7900				
Normal paraffins					
		nP C1	% w/w	0.00	0.00
		nP C2	% w/w	0.00	0.00
		nP C3	% w/w	0.00	0.00
		nP C4	% w/w	0.86	3.12
		nP C5	% w/w	0.63	1.97
		nP C6	% w/w	0.60	2.81
		nP C7	% w/w	3.44	1.58
		nP C8	% w/w	0.31	0.90
		nP C9	% w/w	0.21	0.36
		nP C10	% w/w	0.02	0.00
		nP >C11	% w/w	0.00	0.08
TOTAL nP			% w/w	6.06	10.82
Iso paraffins					
		iP C1	% w/w	0.00	0.00
		iP C2	% w/w	0.00	0.00
		iP C3	% w/w	0.00	0.00
		iP C4	% w/w	0.12	0.54
		iP C5	% w/w	10.72	4.05
		iP C6	% w/w	6.85	9.33
		iP C7	% w/w	4.40	5.83
		iP C8	% w/w	10.31	6.16
		iP C9	% w/w	1.12	1.70
		iP C10	% w/w	0.15	0.46
		iP >C11	% w/w	0.28	0.12
TOTAL iP			% w/w	33.96	28.17
Naphtenes					
		N C1	% w/w	0.00	0.00
		N C2	% w/w	0.00	0.00
		N C3	% w/w	0.00	0.00
		N C4	% w/w	0.00	0.00
		N C5	% w/w	0.98	0.34
		N C6	% w/w	1.26	3.80
		N C7	% w/w	5.45	4.02
		N C8	% w/w	0.24	4.54
		N C9	% w/w	0.02	0.52
		N C10	% w/w	0.00	0.04
		N >C11	% w/w	0.11	0.00
TOTAL N			% w/w	8.06	13.26
Olefins					
		OI C1	% w/w	0.00	0.00
		OI C2	% w/w	0.00	0.00
		OI C3	% w/w	0.00	0.00
		OI C4	% w/w	0.40	0.28
		OI C5	% w/w	3.86	6.03
		OI C6	% w/w	1.82	11.13
		OI C7	% w/w	0.64	4.20
		OI C8	% w/w	0.11	1.37
		OI C9	% w/w	0.00	1.17
		OI C10	% w/w	0.00	0.05
		OI >C11	% w/w	0.00	0.00
TOTAL OI			% w/w	6.82	24.23
Aromatics					
		A C1	% w/w	0.00	0.00
		A C2	% w/w	0.00	0.00
		A C3	% w/w	0.00	0.00
		A C4	% w/w	0.00	0.00
		A C5	% w/w	0.00	0.00
		A C6	% w/w	0.21	1.24
		A C7	% w/w	18.34	7.13
		A C8	% w/w	4.42	8.18
		A C9	% w/w	5.61	3.31
		A C10	% w/w	2.59	1.04
		A >C11	% w/w	3.29	0.28
TOTAL A			% w/w	34.46	21.18
Oxygenates					
		Ox C1	% w/w	0.00	0.00
		Ox C2	% w/w	9.71	0.00
		Ox C3	% w/w	0.00	0.00
		Ox C4	% w/w	0.00	0.02
		Ox C5	% w/w	0.10	0.27
		Ox C6	% w/w	0.00	0.29
		Ox C7	% w/w	0.00	0.00
		Ox C8	% w/w	0.00	0.00
		Ox C9	% w/w	0.00	0.00
		Ox C10	% w/w	0.00	0.00
		Ox >C11	% w/w	0.00	0.00
TOTAL Ox			% w/w	9.81	0.58
TOTAL Unknowns			% w/w	0.82	1.76
TOTAL BY CARBONS					
		C1	% w/w	0.00	0.00
		C2	% w/w	9.71	0.00
		C3	% w/w	0.00	0.00
		C4	% w/w	1.38	3.96
		C5	% w/w	16.29	12.66
		C6	% w/w	10.74	28.60
		C7	% w/w	32.27	22.76
		C8	% w/w	15.39	21.15
		C9	% w/w	6.96	7.06
		C10	% w/w	2.77	1.59
		>C11	% w/w	3.68	0.48
		Unknowns	% w/w	0.82	1.76
TOTAL BY CARBONS			% w/w	100.00	100.00

Test Name	Method	Analyte	Unit	SP95E10 Euro6 (reference fuel)	Nigerian gasoline
Sulfur speciation (expressed as sulfur content)	GC-SCD analysis Internal method				
		H2S	% w/w	-	-
		COS/SO2	% w/w	-	-
		methyl mercaptan	% w/w	-	-
		ethyl mercaptan	% w/w	-	-
		dimethyl sulfide	% w/w	< 0.6	-
		CS2	% w/w	1	-
		isopropyl mercaptan	% w/w	-	-
		terbutyl mercaptan	% w/w	-	-
		N propyl mercaptan	% w/w	-	-
		methyl ethyl sulfide	% w/w	< 0.6	0.1
		thiophene and/or secondary butyl mercaptan	% w/w	1.6	14
		isobutyl mercaptan	% w/w	-	-
		diethyl sulfide	% w/w	-	-
		N butyl mercaptan	% w/w	-	-
		mercaptans, sulfides, disulfides, thiophenes	% w/w	< 0.6	1.5
		dimethyl disulfide	% w/w	-	-
		C1 thiophenes	% w/w	< 0.6	32.5
		tetrahydrothiophene	% w/w	< 0.6	4.9
		N pentyl mercaptan	% w/w	-	-
		methyl ethyl disulfide	% w/w	-	-
		C2 thiophenes	% w/w	-	28.4
		diethyl disulfide	% w/w	-	-
		dimethyl trisulfide	% w/w	-	-
		C3 thiophenes	% w/w	-	11.8
		benzothiophene	% w/w	-	1.6
		dimethyl tetrasulfide	% w/w	-	-
		C1 benzothiophenes	% w/w	-	3.9
		C2 benzothiophenes	% w/w	-	1.3
		C3 benzothiophenes	% w/w	-	-
		C4 benzothiophenes	% w/w	-	-
		C5 benzothiophenes	% w/w	-	-
		dibenzothiophene	% w/w	-	-
TOTAL SULFUR			% w/w	3.00	100.00