

CRUDE OIL ASSAY REPORT

"Crude oil sample dated 01-11-23"

CRUDE OIL ASSAY REPORT NUMBER:
MUM/004358/23

DATE OF ISSUE:
30-11-2023





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Job Reference Information

Date: 30/11/2023

Crude Oil Assay Report No: MUM/004358/2023

FOR THE ATTENTION OF : Mr. Krishnan Raghavan
SAMPLE DETAILS : Crude oil sample dated 01-11-23
SOURCE : M/s. Hindustan Oil exploration company Ltd
DESCRIPTION : " Crude oil sample dated 01-11-23 "
CONTAINERS : 3 X 5 Ltr IATA cans
SEALS : No Seals

Reported by:

For Intertek India Pvt Ltd
Prady

Laboratory Supervisor

Approved by:

For Intertek India Pvt Ltd.

Quality Manager



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Client: M/s. Hindustan Oil exploration company Ltd
Client Contact: Mr. Krishnan Raghavan
Intertek Reference: MUM/004358/23
Date Received: 08/11/2023
Date Completed: 30/11/2023
Subject: Assay Project



LABORATORY REPORT NO. MUM/004358/2023
CRUDE OIL - DETAILED ASSAY ALL CUTS OVERVIEW
Crude oil sample dated 01-11-23

Tests	Methods	Units	Whole Crude	Light Ends			Fractions			
				C4	C5	175	300	300	500+	
Initial BP										
Final BP				-	175	300	300	500		
Yield	ASTM D 2892 & D5236	%Wt		0.99	24.36	17.58	56.77	49.38	7.39	
		%Vol		1.44	26.62	17.74	54.20	47.55	6.65	
Position on Crude	ASTM D 2892 & D5236	%Wt		0.0 - 0.99	0.99 - 25.35	25.35 - 43.23	43.23 - 100	43.23 - 92.61	92.61 - 100	
		%Vol		0.0 - 1.44	1.44 - 28.06	28.06 - 45.80	45.80 - 100	45.80 - 93.35	93.35 - 100	
Density @ 15° C	ASTM D5002.D4052	kg/L	0.8240	0.5531	0.7566	0.8317	0.8678	0.8555	0.9145	
Specific Gravity @ 60/60° F	Conversion		0.8244		0.7566	0.8321	0.8582	0.856	0.9150	
API Gravity @ 60° F	Calculated	° API	40.1		55.5	38.6	33.4	33.8	23.1	
Composition (Up to C5)	GC	%Wt		See Page 8						
Aromatics										
Mono	P 391	%Vol				17.6				
Di		%Vol				20.0**				
Tri		%Vol					<1			
Poly		%Vol					20.0**			
Asphaltene	P 143	%Wt	<0.50				0.70		5	
Basic Nitrogen	UOP 269	ppm wt				4		65		
Benzene	ASTM D6730	%Wt			5.98					
Carbon Residue- Micro	ASTM D4530.D188	%Wt	0.56				0.97		8.2	
Organic Chloride	ASTM D4928B	ppm wt	<1		<1					
Composition - LightHC	IP 601		See Page 13							
Paraffins	ASTM D6730	Vol%			49.31					
Naphthene		Vol%			20.451					
Aromatics		Vol%			30.058					
Flash Point (PMCC)	ASTM D93.D 170	°C	<40			77.0				
Freezing Point	ASTM D2386	°C				-21				
Hydrogen Sulphide (Liquid Phase)	UOP163	ppm wt	<0.40		<1					
Kinematic Viscosity @ 40°C	ASTM D445	cSt	3.716			1.755				
Kinematic Viscosity @ 50°C		cSt	3.036							
Kinematic Viscosity @ 70°C		cSt	2.1				7.009	5.269	110.3	
Kinematic Viscosity @ 100°C		cSt					3.864	3.589	21.74	
Kinematic Viscosity @ 135°C		cSt							9.799	
Mercaptan Sulphur	UOP163	ppm wt	<1		<3					
Metals										
Copper	ICPOES	ppm wt	<1				<1	<1	1	
Iron	ICPOES	ppm wt	5				9	<1	60	
Nickel	ICPOES	ppm wt	<1				1	<1	2	
Vanadium	ICPOES	ppm wt	<1				<1	<1	1	
Motor Octane Number	ASTM D2700	Rating			65					
Penetration	ASTM D5	0.1 mm							65	
Pour Point-upper	ASTM D5853A	°C								
Pour Point	ASTM D97	°C	21		<-42	-24	48	+45	+63	
Cloud Point	ASTM D2500	°C				-20				
Aniline Point	ASTM D611	°C				57.4				
Cetane Index	ASTM D976	Rating				46.5				
Refractive Index @20°C	ASTM D1218	-				1.4724				
Roid Vapour Pressure @37.8°C	ASTM D5191.D323	psi	5.8		4.35					
Research Octane Number	ASTM D2699	Rating			67					
Salt Content	ASTM D3230	lb/1000bbls	0.5							
Smoke Point	ASTM D1322	mm				14				
Total Acid Number	ASTM D654	mg KOH/g	0.23							
Total Nitrogen	ASTM D4059.D576	ppm wt	140			12		160		
Total Sulphur	ASTM D4294.D5453	%Wt	0.0434		0.0002	0.0104	0.0731	0.0640	0.133	
Water Content	ASTM D4006	%Vol	0.15							
Wax Appearance Temperature	DSC	°C	39							
Wax Disappearance Temperature	DSC	°C	45							
Wax Content	UOP 46*	%Wt	22.7				38.50	40.00		
Distillation		°C			See Below	See Below	See Below			
Initial Boiling Point		°C			49.3	188.3	261.0			
5% recovered		°C			76.8	204.9	342.0			
10% recovered		°C			81.8	208.5	349.0			
20% recovered		°C			90.2	215.6	366.0			
30% recovered		°C			97.8	223.3	381.0			
40% recovered		°C			104.9	231.6	395.0			
50% recovered		°C			112.1	239.7	408.0			
60% recovered		°C			119.8	247.8	425.0			
70% recovered		°C			128.0	254.9	439.0			
80% recovered		°C			137.2	262.1	455.0			
90% recovered		°C			148.5	270.6	482.0			
95% recovered		°C			156.6	277.2	520.0			
Final Boiling Point		°C			165.8	283.2	559.0			
Recovery		Vol%			99.3	98.4				
Residue		Vol%			0.6	1.1				
Loss		Vol%			0.3	0.5				

Note: *Results above the detection range of the test method (-) Withdrawn method



LABORATORY REPORT NO. MUM/004358/2023

WHOLE CRUDE PROPERTIES

Sample Descriptions / Label :

Crude oil sample dated 01-11-23

Tests	Methods	Units	Results
Density @ 15° C	ASTM D5002	kg/L	0.8240
Specific Gravity @ 60/60° F	Conversion		0.8244
API Gravity @ 60° F	Calculated	° API	40.1
Asphaltene	IP 143	% Wt	<0.50
Carbon Residue- Micro	ASTM D4530	% Wt	0.56
Organic Chloride	ASTM D4929B	ppm wt	<1
Composition (Upto C9)	IP 601	% Wt & %Vol.	See Page 13
Flash Point	ASTM D93	° C	<40
Hydrogen Sulphide (Liquid Phase)	IP 570	ppm wt	<0.40
Kinematic Viscosity @ 40° C	ASTM D445	cSt	3.716
Kinematic Viscosity @ 50° C			3.038
Kinematic Viscosity @ 70° C			2.100
Mercaptan Sulfur	UOP 163	ppm wt	<1
Copper	ICPOES	ppm wt	<1
Iron	ICPOES	ppm wt	5
Nickel	ICPOES	ppm wt	<1
Vanadium	ICPOES	ppm wt	<1
Pour Point	ASTM D97	° C	21
Reid Vapour Pressure @ 100° F	ASTM D323	psi	5.8
Salt Content	ASTM D3230	PTB	0.50
Total Acid Number	ASTM D664	mg KOH/g	0.23
Total Nitrogen	ASTM D5762	ppm wt	140
Total Sulphur	ASTM D4294	% Wt	0.0434
Water Content	ASTM D4006	% Vol	0.15
Wax Appearance Temperature	DSC	°C	39
Wax Disappearance Temperature	DSC	°C	45
Wax Content	UOP 46*	% Wt	22.7

Note : (*) Withdrawn method



LABORATORY REPORT NO. MUM/004358/2023

TRUE BOILING POINT DISTILLATION DATA

(ASTM D 2892 & ASTM D 5236)

Sample Descriptions / Label :

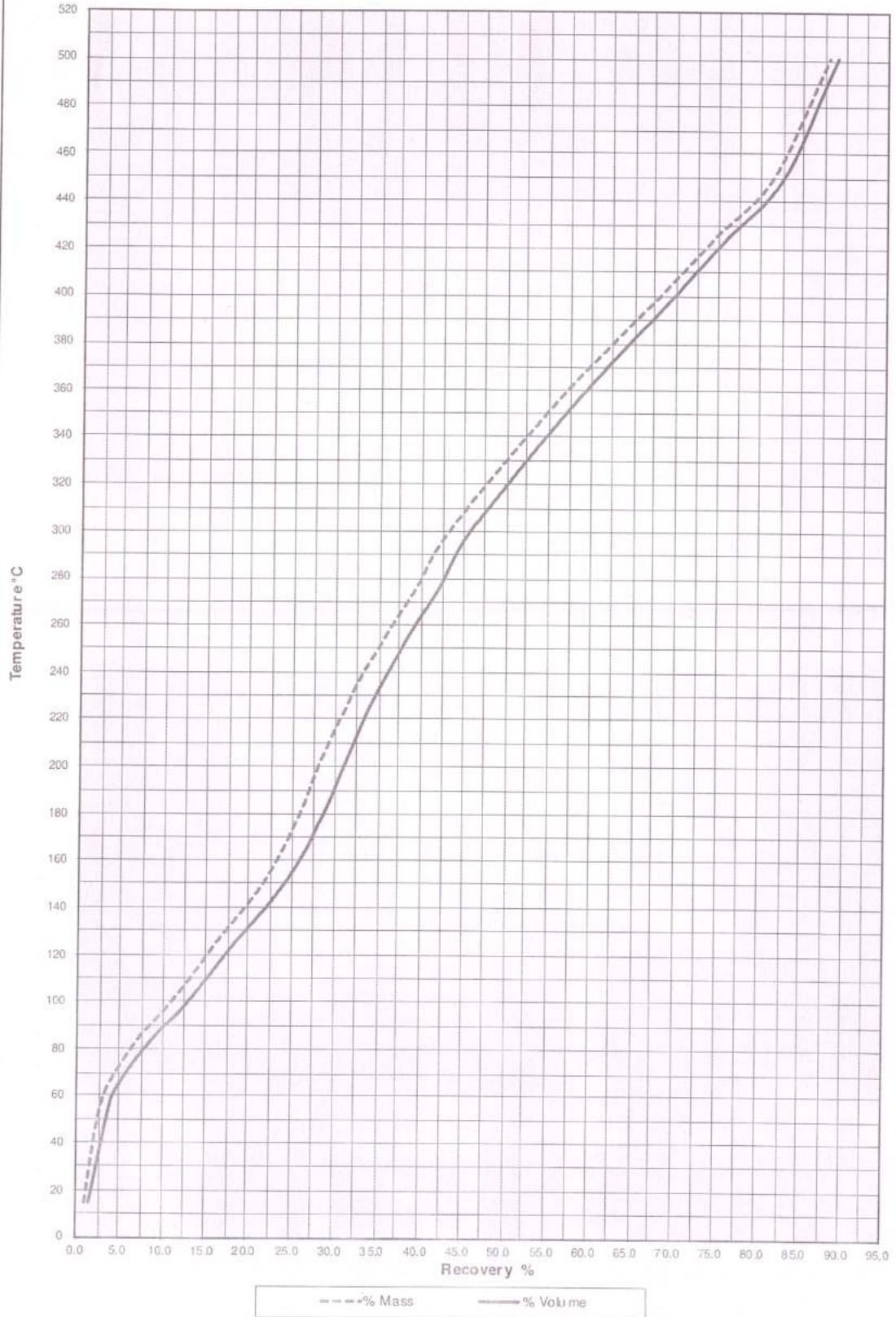
Crude oil sample dated 01-11-23

Sl. No.	Method	Vapour Temperature °C	% Mass	Cumulative % Mass	% Volume	Cumulative % Volume
1	ASTM D2892	Gas	0.99	0.99	1.44	1.44
2		15 - 50	1.46	2.45	1.91	3.35
3		50 - 65	1.20	3.65	1.46	4.81
4		65 - 85	3.76	7.41	4.21	9.02
5		85 - 100	3.56	10.97	3.91	12.93
6		100 - 125	5.12	16.09	5.44	18.37
7		125 - 150	5.45	21.54	5.72	24.09
8		150 - 175	3.81	25.35	3.97	28.06
9		175 - 200	2.71	28.06	2.80	30.86
10		200 - 225	3.02	31.08	3.07	33.93
11		225 - 250	3.70	34.78	3.64	37.57
12		250 - 275	4.44	39.22	4.33	41.90
13		275 - 300	4.01	43.23	3.90	45.80
14	ASTM D5236	300 - 350	11.55	54.78	11.19	56.99
15		350 - 375	6.46	61.24	6.24	63.23
16		375 - 400	6.76	68.00	6.52	69.75
17		400 - 425	6.74	74.74	6.48	76.23
18		425 - 450	6.67	81.41	6.40	82.63
19		450 - 475	6.58	87.99	6.30	88.93
		475 - 500	4.62	92.61	4.42	93.35
20	500 + Residue	7.39	100.00	6.65	100.00	



TRUE BOILING POINT DISTILLATION CURVE
(ASTM D 2892 & ASTM D 5236)

"Crude oil sample dated 01-11-23"





LABORATORY REPORT NO. MUM/004358/2023

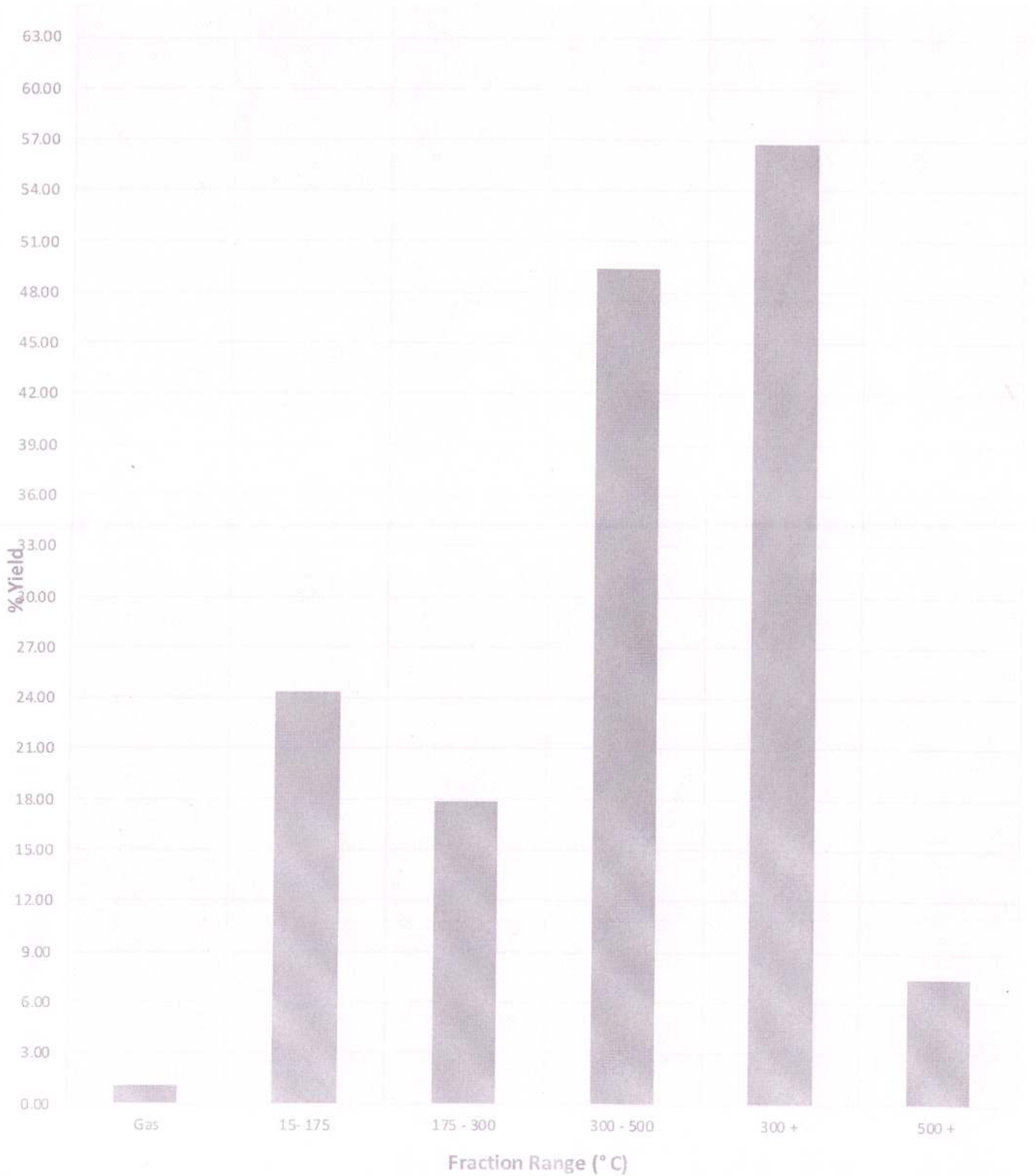
SUMMARY OF PRODUCT / RESIDUE CUT POINTS AND YIELDS

Sample Descriptions: Crude oil sample dated 01-11-23

Products	Cut Points (° C)	Yield	
		% Mass	Volume %
Gas	Below 15	0.99	1.44
Naphtha	15- 175	24.36	26.62
Gas Oil	175 - 300	17.88	17.74
Vacuum Gas Oil	300 - 500	49.38	47.55
Residues	300 +	56.77	54.20
	500 +	7.39	6.65

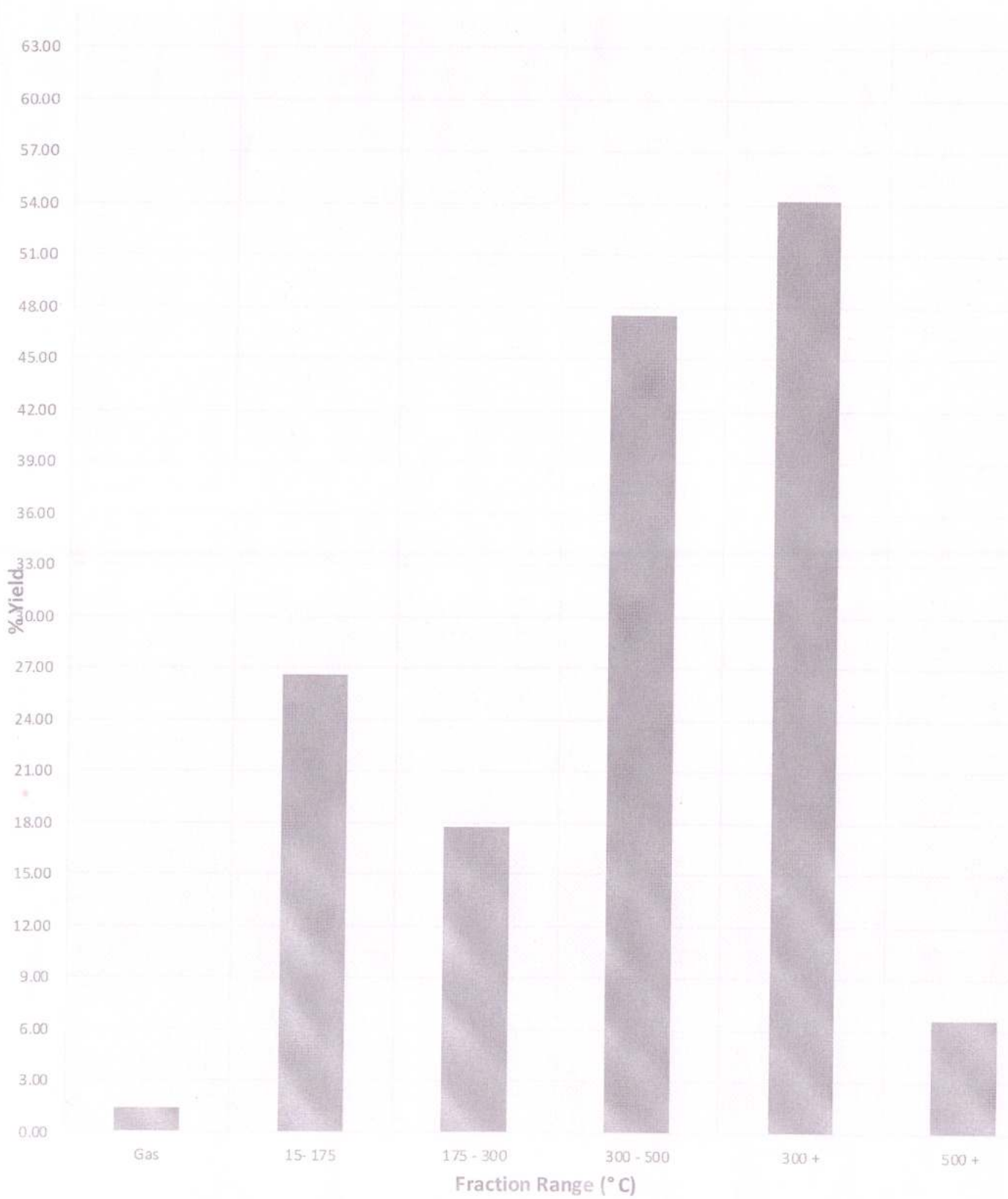


Yield Distribution-Graph (% Mass)
"Crude oil sample dated 01-11-23"





Yield Distribution-Graph (% Volume)
"Crude oil sample dated 01-11-23"





LABORATORY REPORT NO. MUM/004358/2023

SUMMARY OF LIGHT END COMPOSITION

Sample Descriptions : Crude oil sample dated 01-11-23

Tests	Methods	Units	Results
Yield	ASTM D 2892	% Wt.	0.99
Yield		% Vol.	1.44
Position on Crude	ASTM D 2892	% Wt.	0.0 - 0.99
		% Vol.	0.0 - 1.44
Density @ 15°C	GC / Calculated	kg/L	0.5531
Methane	GC	% Wt.	<0.010
Ethane			0.455
Propane			34.899
i-butane			21.524
n-Butane			41.231
i-pentane			1.521
n-Pentane			0.370



LABORATORY REPORT NO. MUM/004358/2023

Sample Descriptions:

Crude oil sample dated 01-11-23

Tests	Methods	Units	Results
Initial BP		°C	15
Final BP		°C	175
Yield	ASTM D2892	% Wt.	24.36
		% Vol.	26.62
Position on Crude	ASTM D2892	% Wt.	0.99 - 25.35
		% Vol.	1.44 - 28.06
Density @ 15°C	ASTM D4052	kg/L	0.7566
Specific Gravity @ 60/60° F	Conversion		0.7568
API Gravity @ 60° F	Calculated	° API	55.5
Benzene	ASTM D6730	% Wt.	5.98
Paraffins	ASTM D6730	% Vol.	49.310
Naphthene		% Vol.	20.451
Aromatics		% Vol.	30.058
Hydrogen Sulphide (Liquid Phase)	UOP163	ppm wt	<1
Mercaptan Sulphur	UOP 163	ppm wt	<3
Organic Chloride	ASTM D4929B	ppm wt	<1
Motor Octane Number	ASTM D2700	Rating	65
Pour Point	ASTM D97	°C	<-42
Reid Vapour Pressure @ 100° F	ASTM D5191	psi	4.35
Research Octane Number	ASTM D2699	Rating	67
Sulphur	ASTM D5453	% Wt.	0.0002
Distillation			
Initial Boiling Point	ASTM D86	°C	49.8
5% recovered		°C	76.0
10% recovered		°C	81.8
20% recovered		°C	90.2
30% recovered		°C	97.8
40% recovered		°C	104.9
50% recovered		°C	112.1
60% recovered		°C	119.8
70% recovered		°C	128.0
80% recovered		°C	137.2
90% recovered		°C	148.5
95% recovered		°C	156.8
Final Boiling Point		°C	165.8
Recovery		Vol %	98.3
Residue		Vol %	1.0
Loss		Vol %	0.70



LABORATORY REPORT NO. MUM/004358/2023

Sample Descriptions:

Crude oil sample dated 01-11-23

Tests	Methods	Units	Results
Initial BP		°C	175
Final BP		°C	300
Yield	ASTM D2892	% Wt.	17.88
Yield		% Vol.	17.74
Position on Crude	ASTM D2892	% Wt.	25.35 - 43.23
		% Vol.	28.06 -45.80
Density @ 15° C	ASTM D4052	kg/L	0.8317
Specific Gravity @ 60/60° F	Conversion		0.8321
API Gravity @ 60° F	Calculated	° API	38.6
Aromatics			
Mono	IP 391	% Wt.	17.6
Di		% Wt.	20.0**
Tri		% Wt.	<1
Poly		% Wt.	20.0**
Basic Nitrogen	UOP 269	ppm wt	4
Flash Point (PMCC)	ASTM D93	°C	77.0
Freezing Point	ASTM D2386	°C	-21
Kinematic Viscosity @ 40°C	ASTM D445	cSt	1.755
Pour Point	ASTM D97	°C	-24.00
Cloud Point	ASTM D2500	°C	-20
Aniline Point	ASTM D611	°C	57.4
Cetane Index	ASTM D976	Rating	46.5
Refractive Index @20°C	ASTM D1218	-	1.4724
Smoke Point	ASTM D1322	mm	14
Total Nitrogen	ASTM D4629	ppm wt	12
Total Sulphur	ASTM D5453	% Wt	0.0104
Distillation			
Initial Boiling Point	ASTM D86	°C	188.3
5% recovered		°C	204.9
10% recovered		°C	208.5
20% recovered		°C	215.6
30% recovered		°C	223.3
40% recovered		°C	231.6
50% recovered		°C	239.7
60% recovered		°C	247.8
70% recovered		°C	254.9
80% recovered		°C	262.1
90% recovered		°C	270.6
95% recovered		°C	277.2
Final Boiling Point		°C	283.2
Recovery		Vol %	98.4
Residue		Vol %	1.1
Loss		Vol %	0.5

**Results above the detection range of the test method.



LABORATORY REPORT NO. MUM/004358/2023

Sample Descriptions:

Crude oil sample dated 01-11-23

Tests	Methods	Units	Results
Initial BP		°C	300
Final BP		°C	500
Yield	ASTM D2892/D5236	% Wt.	49.38
Yield		% Vol.	47.55
Position on Crude	ASTM D2892/D5236	% Wt.	43.23 - 92.61
		% Vol.	45.80 - 93.35
Density @ 15° C	ASTM D4052	kg/L	0.8555
Specific Gravity @ 60/60° F	Conversion		0.8560
API Gravity @ 60° F	Calculated	° API	33.8
Basic Nitrogen	UOP 269	ppm wt	65
Kinematic Viscosity @ 70°C	ASTM D445	cSt	5.269
Kinematic Viscosity @ 100°C	ASTM D445	cSt	3.589
Copper	ICPOES	ppm wt	<1
Iron	ICPOES	ppm wt	<1
Nickel	ICPOES	ppm wt	<1
Vanadium	ICPOES	ppm wt	<1
Pour Point	ASTM D97	°C	+45
Total Nitrogen	ASTM D5762	ppm wt	160
Total Sulphur	ASTM D4294	% Wt	0.0640
Wax Content	UOP 46*	% Wt	40.0

Note: (*) Withdrawn method



LABORATORY REPORT NO. MUM/004358/2023

Sample Descriptions:

Crude oil sample dated 01-11-23

Tests	Methods	Units	Results	
Initial BP		°C	300 + Residue	500 + Residue
Final BP		°C		
Yield	ASTM D2892/D5236	% Wt.	56.77	7.39
Yield		% Vol.	54.20	6.65
Position on Crude	ASTM D2892/D5236	% Wt.	43.23 -100	92.61 - 100
		% Vol.	45.80 - 100	93.35 -100
Density @ 15° C	IP 365	kg/L	0.8678	0.9145
Specific Gravity @ 60/60° F	Conversion		0.8582	0.9150
API Gravity @ 60° F	Calculated	° API	33.4	23.1
Asphaltene	IP 143	% Wt.	0.70	5.00
Carbon Residue- Micro	ASTM D4530	% Wt.	1.0	8.20
Kinematic Viscosity @ 70°C	ASTM D445	cSt	7.009	110.3
Kinematic Viscosity @ 100°C			3.864	21.74
Kinematic Viscosity @ 135°C				9.799
Copper	ICPOES	ppm wt	<1	1
Iron			9	60
Nickel			1	2
Vanadium			<1	1
Penetration	ASTM D5	0.1 mm		65
Pour Point	ASTM D97	°C	48	+63
Total Sulphur	ASTM D4294	% Wt.	0.0731	0.133
Wax Content	UOP 46*	% Wt.	38.50	
Initial boiling point	ASTM D1160	°C	261.0	
AET @ 5% Recovery		°C	342.0	
AET @ 10% Recovery		°C	349.0	
AET @ 20% Recovery		°C	366.0	
AET @ 30% Recovery		°C	381.0	
AET @ 40% Recovery		°C	395.0	
AET @ 50% Recovery		°C	409.0	
AET @ 60% Recovery		°C	425.0	
AET @ 70% Recovery		°C	439.0	
AET @ 80% Recovery		°C	455.0	
AET @ 90% Recovery		°C	482.0	
AET @ 95% Recovery		°C	520.0	
Final Boiling Point		°C	558.0	

Note: (*) Withdrawn method



LABORATORY REPORT NO. MUM/004358/2023

Sample Descriptions / Label :

Crude oil sample dated 01-11-23

COMPOSITION UP TO C9

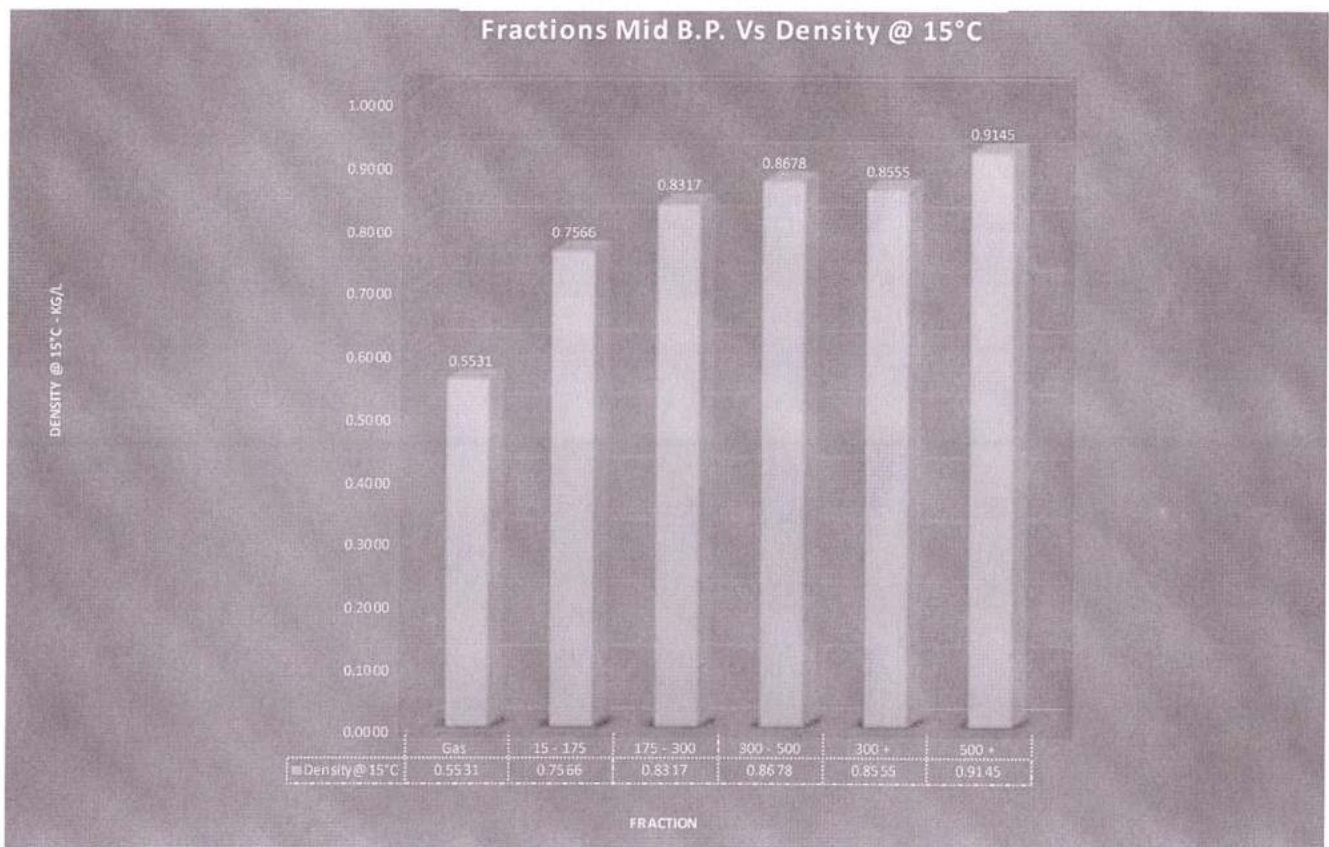
Component	Mass %	Volume %
propane	0.1533	0.3064
i-butane	0.1771	0.3179
n-butane	0.5911	1.0212
i-pentane	0.5612	0.9057
n-pentane	1.0047	1.6044
2,2-dimethylbutane	0.0224	0.0345
cyclopentane	0.1042	0.1398
2,3-dimethylbutane	0.0791	0.1196
2-methylpentane	0.5395	0.826
3-methylpentane	0.2804	0.4221
n-hexane	1.2903	1.9568
2,2-dimethylpentane	0.0149	0.0221
methylcyclopentane	0.4762	0.6361
2,4-dimethylpentane	0.0349	0.0519
benzene	1.4205	1.6162
3,3-dimethylpentane	0.0141	0.0204
cyclohexane	0.865	1.1112
2-methylhexane	0.2753	0.4057
2,3-dimethylpentane	0.0816	0.1174
1,1-dimethylcyclopentane	0.0437	0.0579
3-methylhexane	0.2511	0.3654
1c,3-dimethylcyclopentane	0.1046	0.1405
1i,3-dimethylcyclopentane	0.1009	0.1347
3-ethylpentane	0.014	0.02
1i,2-dimethylcyclopentane	0.1504	0.2001
n-heptane	1.1792	1.7247
unknown	0.0203	0.029
methylcyclohexane	1.5022	1.9524
2,2-dimethylhexane	0.0366	0.0527
unknown	0.0903	0.1289
ethylcyclopentane	0.0333	0.0435
unknown	0.0304	0.0435
1c,2i,4-trimethylcyclopentane	0.0494	0.0647
3,3-dimethylhexane	0.0101	0.0142
1i,2c,3-trimethylcyclopentane	0.0422	0.0548
toluene	2.4222	2.7938
unknown	0.0183	0.0261
2,3-dimethylhexane	0.0255	0.0359

Component	Mass %	Volume %
2-methylheptane	0.2815	0.4034
4-methylheptane	0.0614	0.0872
3-methylheptane	0.1351	0.1915
1i,4-dimethylcyclohexane	0.0142	0.0186
1c,2i,3-trimethylcyclopentane	0.2639	0.3426
unknown	0.0106	0.0152
1,1-dimethylcyclohexane	0.0907	0.1161
3c-ethylmethylcyclopentane	0.0348	0.0454
3i-ethylmethylcyclopentane	0.0275	0.0359
2t-ethylmethylcyclopentane	0.0256	0.0332
1,1-methylethylcyclopentane	0.0355	0.0454
1c,2c,3-trimethylcyclopentane	0.0932	0.1196
n-octane	0.9993	1.4226
unknown	0.0759	0.1084
2,4,4-trimethylhexane	0.0117	0.0158
2,2-dimethylheptane	0.0161	0.0226
N4	0.0246	0.0315
ethylcyclohexane	0.027	0.0345
2,4-dimethylheptane	0.3282	0.4589
4,4-dimethylheptane	0.0463	0.0647
2,5-dimethylheptane	0.0491	0.0685
3,3-dimethylheptane	0.0241	0.0332
2,6-dimethylheptane	0.0105	0.0148
ethylbenzene	0.2886	0.3329
1c,2i,4i-trimethylcyclohexane	0.0233	0.0298
1,3-dimethylbenzene	1.5219	1.761
1,4-dimethylbenzene	0.4637	0.5386
I7	0.0264	0.0362
4-methyloctane	0.0538	0.0747
I4	0.0931	0.1275
3-ethylheptane	0.0152	0.0209
3-methyloctane	0.0869	0.1206
1,2-dimethylbenzene	0.4317	0.4904
I6	0.0257	0.0352
N18	0.0649	0.0832
I8	0.0268	0.0367
unknown	0.0113	0.0161



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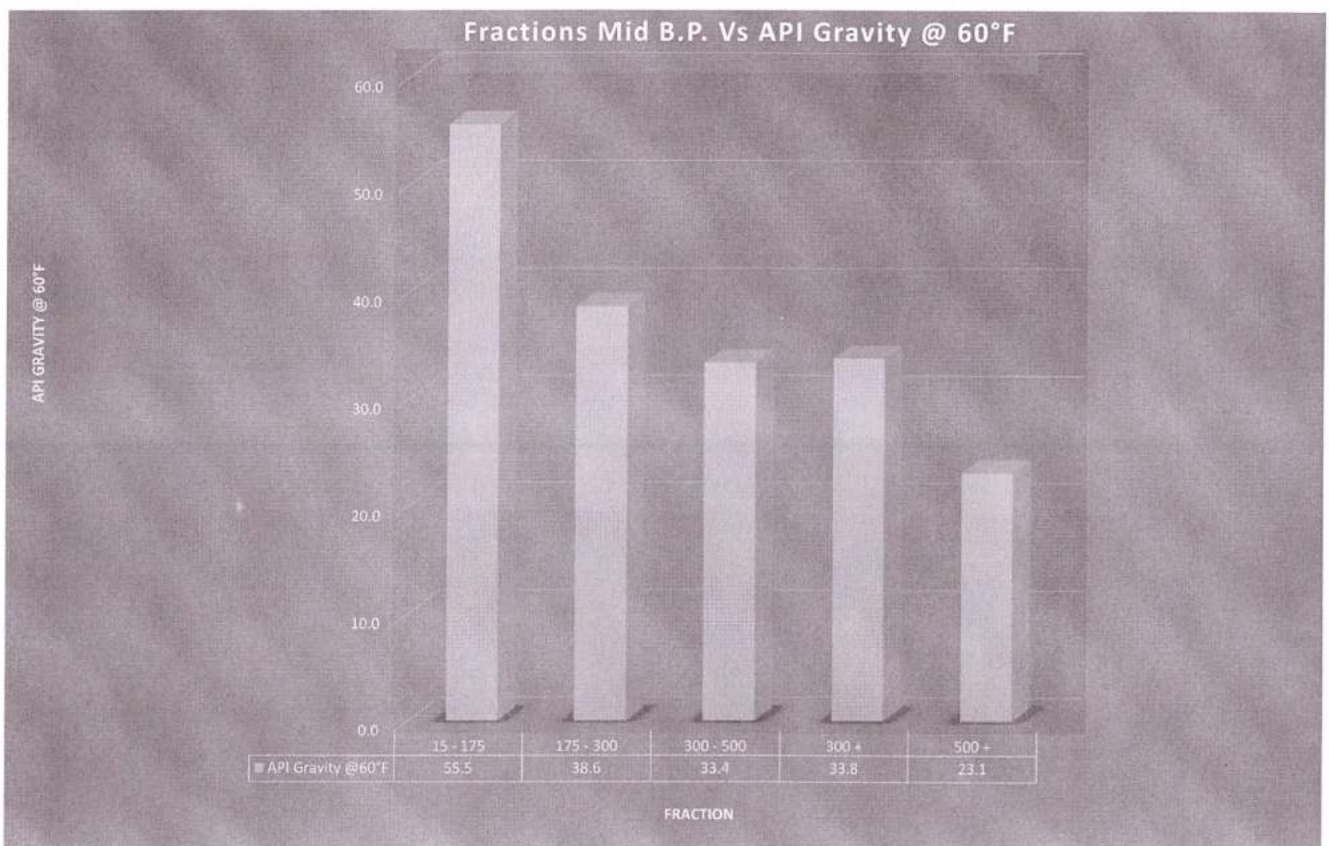
"Crude oil sample dated 01-11-23"





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