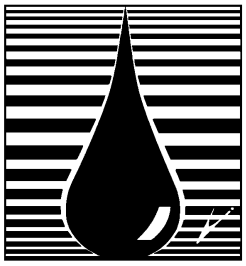
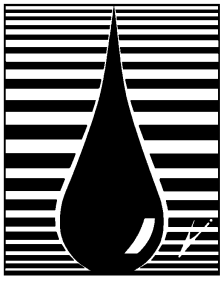


Z-BaSIC™ Crude Oil Assay

Crude - WTS

July 6, 2000

James W. Bunger and Associates, Inc.
2207 West Alexander Street
Salt Lake City, UT 84119
(801) 975-1456
assays@jwba.com



Z-BaSIC™* Crude Oil ASSAYS

Now, for the first time, you can obtain rapid, low-cost ASSAYS on specific crudes. There is no need to rely on generic libraries and suffer losses when the actual crude does not behave as expected. Use the breakthrough power of Z-BaSIC™* to improve procurement, scheduling, and process control decisions for better profits.

Our Z-BaSIC™ ASSAYS include:

D-2892 fraction yields and gravities (you specify cuts)
D-1160 fraction yields and gravities
Pseudocomponent properties (BP, MW, T_c, ^oAPI)
Simulated distillation boiling point distribution with density and MW
Sulfur content of naphtha, kerosene, diesel and gasoil
RVP for naphthas
Component analysis by type (n- and i-paraffins, naphthenes, aromatics, thiophenes) and by carbon number to C_{21}
K factor on whole crude
Cetane index on distillates

**Z-BaSIC™ is an advanced analytical and process simulation technique developed by JWBA for the petroleum industry. You supply 100 cc of your crude oil and specify the desired cutpoints and we provide the rest. $4900/assay and 10-day turnaround time. Sample report available.*

Ship samples to: **James W. Bunger and Associates, Inc., 2207 West Alexander St.**
assays@jwba.com **Salt Lake City, UT 84119 USA** **801-975-1456**

INTRODUCTION

Z-BaSIC™ crude oil ASSAYS are a new generation of ASSAYS that provide low cost, fast turnaround information for better profit optimization. Current practices utilize generic assay libraries that differ, more or less, from the actual lots of crudes fed to the crude u nit. When the process behavior differs from expectations losses occur due to less-than-optimum planning and from greater difficulties in process control. Z-BaSIC™ ASSAYS are a cost effective way to obtain accurate assays on individual crude feedstocks thereby removing uncertainty from planning and allowing the process units to operate closer to anticipated conditions.

The Z-BaSIC™ method extracts detailed composition from a GC-MS file and combines this information with property data to construct a complete profile of a crude oil, including by extrapolated functions, the vacuum residue portion. From this information ASTM distillations are simulated and properties and compositions of the so-produced fractions are obtained.

Quality control verification has shown that Z-BaSIC™ ASSAYS agree with actual ASTM procedures within limits of experimental error. An error analysis is included in this sample assay. It is not possible, however, to place quantitative accuracy limits on each individual sample. The user of Z-BaSIC™ ASSAYS is advised to carefully examine any use of the data for reasonableness and should contact JWBA with any questions that might arise. We are confident that when using Z-BaSIC™ ASSAYS procurement, scheduling and blending decisions will be improved and process control will run closer to expected setpoints.

Z-BaSIC™ ASSAYS are warranted to the extent of the costs for the assays and in no case shall JWBA be liable for special, indirect, incidental or consequential losses or for pecuniary damages.

DESCRIPTION OF CRUDE

Name: West Texas Sour

Client I.D.: sample

Date Sample Taken: m/d/y

JWBA I.D.: jwba-99-12

API Gravity	34.1
SpGr 60/60	0.8546
S %	1.25
N %	0.0897
Saybolt Viscosity @ 100°F (SUS)	44.3
UOP K-factor	11.96
Diesel* Cetane Index	42.0

* 200-675°F Distillate

File name: *.xls (floppy included with report)

Pseudocomponent Properties - WTS

All values weighted averages of pseudocomponent constituents

Component	FBP* °F AEBP	Avg. BP °F	V %	wt %	API Deg.	Sp.Gr 60/60	MW Dalton	T_c °F	Sulf. %	RVP psi
1.00	100.00	51.1	2.08	1.47	103.2	0.603	61.8	330	0.00	64.3
2.00	125.00	106.2	0.56	0.42	84.9	0.654	72.8	410	0.02	13.8
3.00	150.00	136.7	0.71	0.58	71.2	0.698	79.0	462	0.12	7.9
4.00	175.00	161.7	2.17	1.78	70.6	0.700	88.0	505	0.50	4.8
5.00	200.00	190.0	2.51	2.23	54.4	0.761	95.9	595	0.90	2.7
6.00	225.00	211.2	2.44	2.18	53.8	0.764	102.6	601	0.49	1.8
7.00	250.00	238.7	2.88	2.60	52.3	0.770	110.3	597	0.56	1.0
8.00	275.00	261.9	2.19	1.95	54.3	0.762	117.0	603	0.60	0.6
9.00	300.00	286.0	2.94	2.69	49.2	0.783	121.8	627	0.64	0.3
10.00	325.00	312.7	2.04	1.87	49.2	0.783	129.3	652	0.68	0.2
11.00	350.00	335.9	3.16	2.94	46.9	0.793	135.7	677	0.72	
12.00	375.00	364.1	3.09	2.96	41.5	0.818	141.3	707	0.76	
13.00	400.00	386.9	2.45	2.38	38.6	0.832	148.9	734	0.80	
14.00	425.00	411.8	2.60	2.55	37.2	0.839	159.3	758	1.36	
15.00	450.00	436.9	2.48	2.45	36.6	0.842	168.3	777	1.23	
16.00	475.00	461.3	2.45	2.46	33.8	0.856	173.8	797	1.11	
17.00	500.00	487.3	2.39	2.42	31.7	0.867	179.8	817	1.23	
18.00	525.00	512.3	2.77	2.85	29.7	0.878	188.1	835	1.40	
19.00	550.00	537.5	2.74	2.86	27.1	0.892	195.9	853	1.60	
20.00	575.00	561.9	2.65	2.76	27.5	0.890	207.2	868	1.80	
21.00	600.00	586.8	2.13	2.19	29.1	0.881	219.8	887	1.38	
22.00	650.00	622.2	4.25	4.37	29.5	0.879	234.0	912	1.42	
23.00	700.00	680.5	5.83	6.05	28.0	0.887	263.3	943	1.45	
24.00	750.00	723.7	7.98	8.34	27.0	0.893	291.3	977	1.48	
25.00	800.00	775.1	6.43	6.78	25.7	0.900	320.3	1026	1.49	
26.00	850.00	824.9	5.02	5.31	24.9	0.905	362.2	1072	1.51	
27.00	900.00	874.9	4.43	4.71	24.0	0.910	400.3	1119	1.52	
28.00	950.00	921.7	3.97	4.25	23.0	0.916	460.9	1165	1.53	
29.00	1000.00	973.7	2.71	2.91	22.8	0.917	530.4	1218	1.54	
30.00	1050.00	1023.8	2.36	2.54	22.3	0.920	592.0	1272	1.55	
31.00	1100.00	1074.1	1.86	2.01	21.8	0.923	661.5	1332	1.55	
32.00	RESID: 1417	1209.6	5.73	6.14	20.7	0.930	933.3	1571	1.56	

*client may specify these cutpoints

File name: *.xls (floppy included with report)

Simulated Distillation - WTS

Z-BaSIC™ GC-Type*

Mass %	T °F	ρ	$\overline{MW}$	Mass %	T °F	ρ	$\overline{MW}$	Mass %	T °F	ρ	$\overline{MW}$
1	36.6	0.578	53.3	35	452.5	0.881	170.7	68	754.4	0.906	309.6
2	87.5	0.620	71.4	36	458.8	0.835	174.2	69	755.6	0.912	297.4
3	134.8	0.679	72.8	37	470.0	0.867	176.9	70	771.9	0.876	332.8
4	147.2	0.659	86.0	38	480.8	0.895	173.5	71	772.1	0.910	310.1
5	169.1	0.672	88.3	39	488.4	0.852	181.8	72	789.7	0.880	342.7
6	190.3	0.828	86.2	40	496.9	0.873	182.0	73	791.2	0.916	323.5
7	197.2	0.701	99.6	41	507.7	0.875	184.4	74	807.1	0.881	355.0
8	208.4	0.789	98.2	42	518.9	0.904	189.8	75	808.8	0.926	336.7
9	217.7	0.724	99.3	43	526.8	0.866	197.0	76	824.6	0.881	370.5
10	227.1	0.786	104.2	44	537.0	0.908	196.1	77	829.9	0.898	367.2
11	239.2	0.777	110.3	45	547.9	0.898	198.1	78	840.3	0.922	367.9
12	243.0	0.764	105.6	46	556.7	0.859	210.1	79	856.3	0.891	390.0
13	250.8	0.771	111.6	47	567.0	0.902	208.2	80	863.9	0.900	387.9
14	258.0	0.744	114.1	48	575.7	0.873	217.3	81	874.3	0.926	382.3
15	271.8	0.754	118.7	49	585.4	0.883	220.7	82	886.9	0.909	402.8
16	282.5	0.779	126.1	50	596.5	0.902	218.0	83	901.8	0.906	411.7
17	288.3	0.795	116.0	51	603.4	0.855	238.4	84	915.2	0.908	421.7
18	297.2	0.791	120.8	52	615.0	0.894	228.8	85	916.3	0.916	445.0
19	303.9	0.797	122.5	53	626.2	0.902	230.4	86	929.0	0.911	474.2
20	317.4	0.831	127.2	54	635.6	0.879	241.3	87	942.9	0.920	488.2
21	326.1	0.779	135.6	55	646.1	0.906	241.7	88	960.1	0.911	509.1
22	329.9	0.794	133.6	56	654.2	0.861	260.1	89	976.1	0.920	524.3
23	339.8	0.800	134.8	57	666.6	0.919	249.2	90	996.8	0.912	549.2
24	348.4	0.796	133.2	58	674.4	0.866	268.4	91	1016.8	0.921	569.8
25	357.0	0.807	141.5	59	687.2	0.892	274.1	92	1037.4	0.920	597.0
26	366.6	0.806	145.1	60	694.0	0.890	275.1	93	1058.7	0.927	625.9
27	375.4	0.795	147.8	61	695.5	0.892	286.4	94	1083.9	0.924	663.8
28	384.4	0.834	147.1	62	705.4	0.851	305.8	95	1114.7	0.924	708.2
29	395.1	0.849	150.5	63	715.6	0.917	284.0	96	1148.8	0.927	771.1
30	404.3	0.859	153.3	64	716.6	0.891	302.3	97	1181.9	0.929	845.6
31	414.1	0.833	164.0	65	732.1	0.878	306.3	98	1231.5	0.931	948.7
32	421.2	0.838	163.2	66	734.9	0.902	297.5	99	1292.1	0.933	1108.7
33	431.2	0.838	167.9	67	741.3	0.869	311.2	100	1365.1	0.936	1390.7
34	441.6	0.824	172.0								

* Z-BaSIC™ GC type simulated distillation is conceptually similar to ASTM D-2887, but extends the range of information to the crude oil end point. The density and molecular weight information are a feature of Z-BaSIC™ that is not available using ASTM procedures.

Detailed Composition Report

C:\PROGRAM FILES\JWBA3\WTSC.CP

		Carbon Number																		
Compound Types	Total	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Hydrocarbon Types																				
n-Paraffins	6.81	0.20	0.39	0.00	0.63	0.58	0.57	0.40	0.45	0.42	0.35	0.34	0.36	0.36	0.34	0.32	0.32	0.29	0.27	0.23
i-Paraffins	11.49	-	0.07	0.94	0.76	0.98	1.06	1.14	1.14	1.18	0.66	1.04	0.62	0.36	0.34	0.25	0.25	0.21	0.28	0.21
Monocyclonaphthenes	9.00	-	-	0.36	0.51	1.74	2.02	1.81	1.20	0.54	0.16	0.16	0.10	0.03	0.08	0.16	0.09	0.04	0.00	-
Dicyclonaphthenes	4.08	-	-	-	-	-	0.00	0.97	0.20	0.74	0.65	0.51	0.52	0.19	0.23	0.06	0.00	0.00	0.00	0.00
Tricyclonaphthenes	1.18	-	-	-	-	-	-	-	-	0.30	0.31	0.29	0.20	0.07	0.00	0.00	0.00	0.00	0.00	-
Alkylbenzenes	6.29	-	-	-	0.11	0.29	0.80	0.87	0.79	0.74	0.69	0.29	0.16	0.19	0.25	0.30	0.25	0.12	0.44	-
Tetralins/Indanes	3.71	-	-	-	-	-	-	0.01	0.11	0.16	0.62	0.42	0.30	0.48	0.09	0.62	0.37	0.36	0.16	-
Indenes	3.15	-	-	-	-	-	-	0.00	0.00	0.22	0.19	0.38	0.38	0.53	0.43	0.35	0.41	0.26	-	-
Naphthalenes	1.59	-	-	-	-	-	-	-	0.00	0.03	0.33	0.24	0.46	0.23	0.09	0.05	0.16	-	-	-
Mononaphthenodiaromatic	1.17	-	-	-	-	-	-	-	-	0.02	0.00	0.04	0.12	0.29	0.17	0.33	0.21	-	-	-
Acenaphthalenes/Fluorene	1.11	-	-	-	-	-	-	-	-	-	0.00	0.04	0.08	0.23	0.41	0.19	0.16	-	-	-
Triaromatics	0.28	-	-	-	-	-	-	-	-	-	-	-	0.01	0.10	0.12	0.06	-	-	-	-
Sulfur Types																				
Thiophenes	1.62	-	0.17	0.06	0.03	0.08	0.09	0.23	0.26	0.12	0.31	0.07	0.12	0.07	0.00	0.01	0.00	0.00	0.00	0.00
Benzothiophenes	1.21	-	-	-	-	-	0.01	0.01	0.01	0.28	0.36	0.05	0.08	0.11	0.13	0.18	0.00	-	-	-
Dibenzothiophenes	0.38	-	-	-	-	-	-	-	-	-	0.04	0.05	0.15	0.14	-	-	-	-	-	-
Unidentified	1.86	0.00	0.12	0.00	0.24	0.42	0.21	0.41	0.07	0.23	0.00	0.02	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00
C21+	45.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Detailed Composition Report

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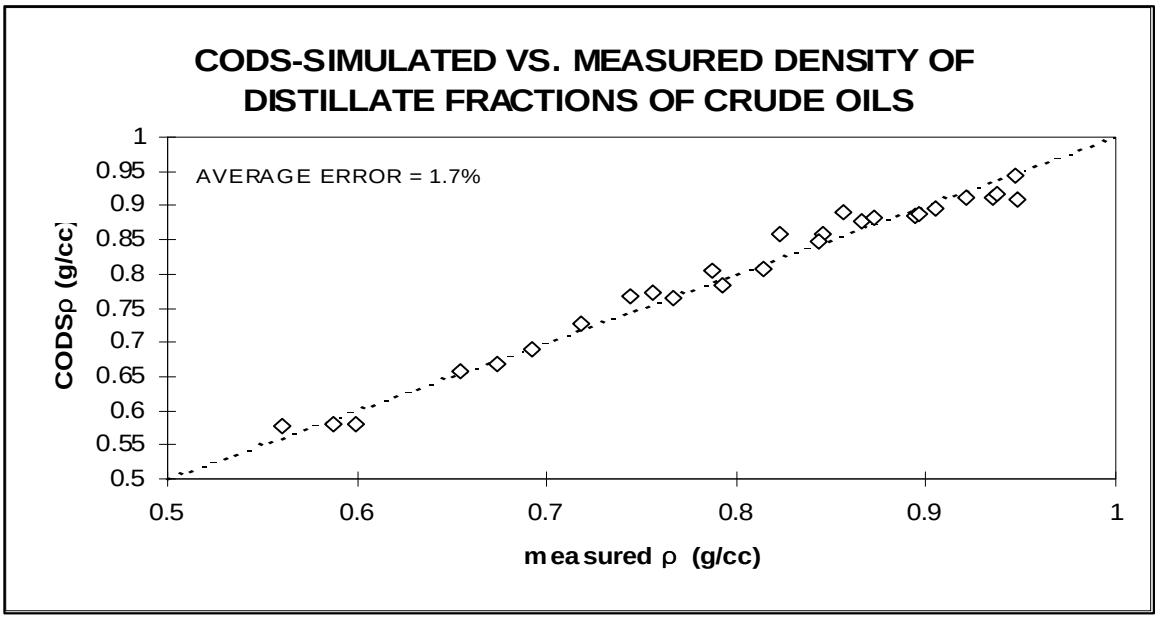
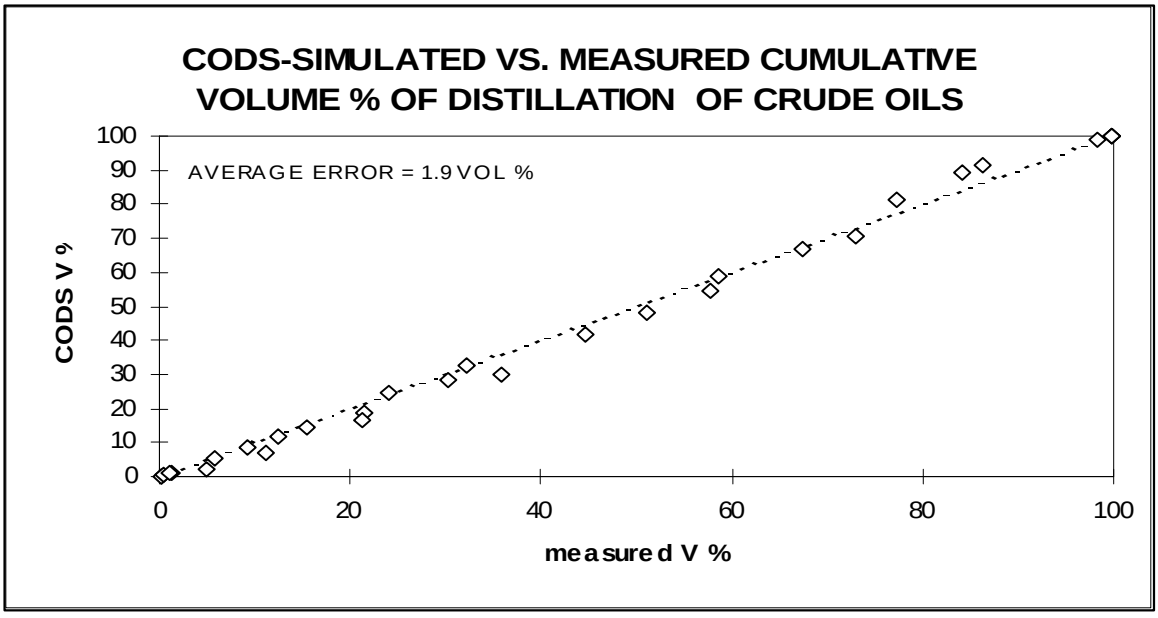
		Carbon Number																		
Compound Types	Total	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Hydrocarbon Types																				
n-Paraffins	11.2	0	0	0	0	0.84	1.28	0.89	1.02	0.94	0.78	0.76	0.8	0.82	0.75	0.72	0.72	0.62	0.2	0.02
i-Paraffins	19.7	-	0	0	0	0.4	2.3	2.55	2.56	2.64	1.49	2.33	1.39	0.81	0.77	0.56	0.57	0.48	0.59	0.24
Monocyclonaphthenes	16.2	-	-	0	0.01	2.02	4.32	4.06	2.7	1.22	0.36	0.36	0.23	0.07	0.18	0.35	0.2	0.08	0	-
Dicyclonaphthenes	9.17	-	-	-	-	-	0	2.17	0.45	1.67	1.46	1.15	1.18	0.42	0.52	0.14	0	0	0	0
Tricyclonaphthenes	2.64	-	-	-	-	-	-	-	-	0.67	0.7	0.65	0.45	0.16	0	0	0	0	0	-
Alkylbenzenes	12.7	-	-	-	0.01	0.63	1.79	1.96	1.77	1.66	1.55	0.66	0.36	0.43	0.56	0.67	0.53	0.07	0.09	-
Tetralins/Indanes	7.18	-	-	-	-	-	-	0.02	0.26	0.35	1.39	0.95	0.67	1.08	0.21	1.4	0.64	0.2	0.01	-
Indenes	6.39	-	-	-	-	-	-	0	0	0.49	0.43	0.86	0.86	1.16	0.96	0.77	0.71	0.15	-	-
Naphthalenes	3.21	-	-	-	-	-	-	-	0	0.07	0.75	0.53	1.04	0.51	0.2	0.08	0.04	-	-	-
Mononaphthenodiaromatics	1.75	-	-	-	-	-	-	-	-	0.04	0	0.08	0.26	0.63	0.22	0.27	0.23	-	-	-
Acenaphthalenes/Fluorenes	0.83	-	-	-	-	-	-	-	-	-	0	0.1	0.17	0.27	0.26	0.01	0.01	-	-	-
Triaromatics	0.01	-	-	-	-	-	-	-	-	-	-	-	0.01	0	0	0	-	-	-	-
Sulfur Types																				
Thiophenes	3.29	-	0.03	0.14	0.08	0.19	0.21	0.51	0.57	0.27	0.69	0.16	0.27	0.15	0	0.02	0	0	0	0
Benzothiophenes	1.93	-	-	-	-	-	0.02	0.02	0.02	0.63	0.81	0.11	0.18	0.11	0.03	0.01	0	-	-	-
Dibenzothiophenes	0.12	-	-	-	-	-	-	-	-	-	0.08	0.03	0.01	0	-	-	-	-	-	-
Unidentified	3.49	0	0	0	0.05	0.89	0.47	1.02	0.22	0.55	0.11	0.05	0	0	0	0.13	0	0	0	0
C21+	0.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Validation of Z-BaSIC^{tm} vs Actual Distillations





ASSAYS FROM REMOTE DATA

JWBA will generate an ASSAY remotely from specific information supplied by the client.

The following information is need to provide an ASSAY remotely.

Density (API gravity)
Sulfur content
Nitrogen content
Viscosity at 100F
Chemstations data.ms file obtained by specified procedure (see below).

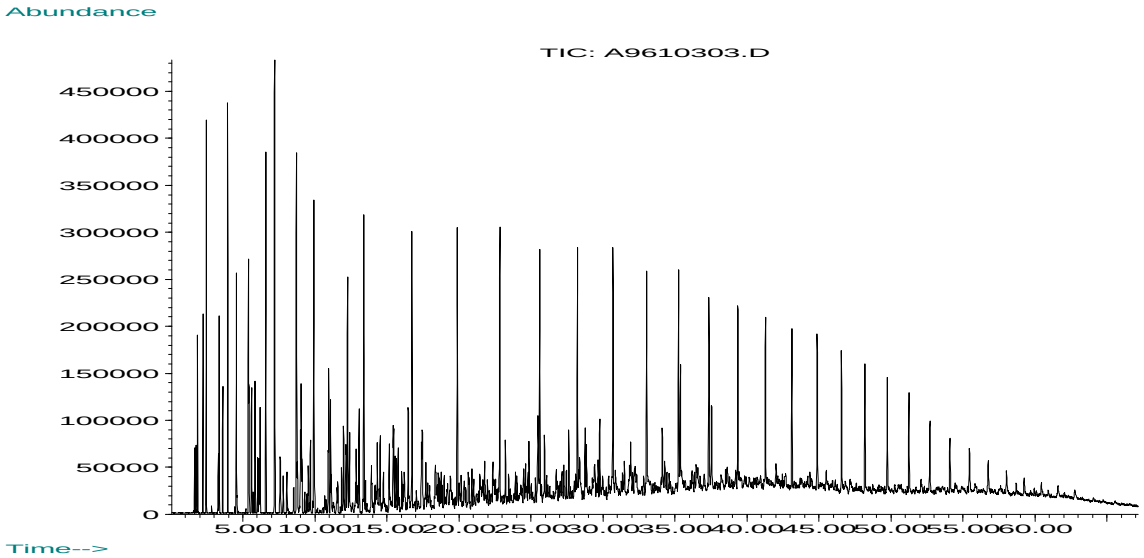
NOTE: IT IS IMPERATIVE THAT ALL OF THE INFORMATION BE OBTAINED ON THE SAME SAMPLE, NOT TYPICAL SAMPLES. Z-BaSIC™ is precise enough that deviations in internal agreement of the properties will result in undetected errors in the quantification.

Crude Oil Analysis

One tenth of a micro liter of the crude oil, neat, is injected into a Hewlett Packard model 5890 series II Gas Chromatograph (GC) using a Hewlett Packard model 7673 automatic liquid sampler (ALS). The injection port is pressure programable and is set for constant flow with an initial pressure of 4 psig and a temperature of 275^{o}C. The injection port is operated in the split mode with the split ratio set at approximately 50:1. This ratio may need to be optimized to give a total ion chromatogram (TIC) with a maximum abundance of 0.5-1.5 million. The GC is equipped with an HP-5MS capillary column 30 meters long and 0.25 mm internal diameter. The stationary phase consists of a 5%-Diphenyl-95%-Dimethylpolysiloxane Copolymer with a film thickness of 0.25 micrometer. The Helium carrier gas is flowing at approximately 0.826 ml/min. in constant flow mode. The GC oven temperature is initially set to 0^{o}C and programmed to heat up to 310^{o}C at 5^{o}/min. with a 5 min. final hold. The analytes are detected with a Hewlett Packard 5972 series mass selective detector (MSD). The data.ms file may be several megabytes and will need to be compatible with Hewlett Packard MSD ChemStation software.

Note: If the crude oil lacks sufficient amounts of normal paraffins from C_3 to C_{21} to give good carbon number retention time data, contact JWBA for instructions. E-mail cods@jwba.com

Crude Oil Analysis



GC:	HP 5890
Carrier:	Helium 0.826 ml/min constant flow
Column:	HP-5MS 30m x 0.25mm x 0.25 µm
Inlet:	275°C Split mode (50:1), 0.1 µl neat injection
Oven:	0°C, 5°C/min to 310°C (5 min hold)
Detector:	HP 5972A MSD, TIC mode