PRECISION OF THE OCTANE NUMBER MEASUREMENT FOR GASOLINE BY PETROLEUM LABORATORIES IN ASEAN COUNTRIES (1999)

by
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ABSTRACT

A high precision of octane number measurement according to standard measurement and to standard requirement is a must in the refining industry.

The ASEAN Council on Petroleum (ASCOPE) Correlation Programme is conducted to obtain the precision of octane number measurement data for gasoline the normally used methods of ASTM D 2699 and IP 239. This programme is participated by 19 petroleum laboratories in ASEAN Countries. The test results of the various participating laboratories are subjected to statistical analysis to determine their average value, variance, standard deviation, and to rejected the outlier values.

The Grubb T-Test method was used for the statistical rejection of outliers. This method appears to be quite satisfactory for ASCOPE purpose. The implementation of the Grubb T-Test ensures the laboratory consistency and this in turn will give the buyers or sellers of the gasoline confidence in the quality of the gasoline.

This paper presents the results of 26th ASCOPE Laboratories Test Correlation Programme for Octane Number Measurement (1999).

1. INTRODUCTION

Many organizations worldwide share in interest in the precision of octane number measurement by CFR engine laboratory. A high precision of octane number measurement according to standard requirement is a must in the refining industry.

It is very important to back up fuel marketing and refineries in the production of motor fuels according to specifications.

A high precision of octane number measurement is also very important for quality control and research activities on the use of hydrocarbon fuels. The quality of all gasoline sold and used must be assessed. Gasoline specification needed to define the quality of the product bought and sold.

It is in facing these problems, that octane number measurement using the CFR engine laboratories in ASEAN and other countries should continously and regularly compare the test results through a test correlation programme, such as organized by the ASEAN Council on Petroleum (ASCOPE).

This programming is participated by 19 Petroleum Laboratories in ASEAN countries. CFR engines are used to measure the octane number of gasoilne and cetane number of diesel fuel.

There are a number of the CFR engine laboratories in existence with facilities available to undertake quality checks. It is however important that all these CFR engine laboratories use similar methods and achieve consistent results. ASCOPE laboratory test correlation programme for octane number measurement was conducted in 1999 to obtain precisions of octane number data for gasoline using the CFR engine and normaly used ASTM method D-2679.

Testing had to be conducted using the same methods and procedures, such as bracketing and compression ratio procedures. For correct analysis, the ambient operation conditions for the CFR engine during correlation measurement must be recorded.

Testing had to be carried out on a certain time (local time) specified by a programme coordinator. The test resullts had to be rounded according to the ASA procedure.

The test result of the various participant laboratories were subjected to statistical analysis to determine average value, variance, standard deviation and the outliers values. The results also enable the determination of the outliers that should be rejected.

The ASTM standard practice for dealing with outliers allows the use of several methods of which Grubbs T-

Test as practiced by ASCOPE is one of the first of the programmers, the ASCOPE laboratory group has been employing the Group T-Test at 95% confidence level for detection and subsequent rejection of outliers. This method is also used by Ethyl Corporation and ASTM National Exchange group in USA for their CFR engine correlation prorgammes.

The ASCOPE correlation programme consists of the following stages:

- sample preparation and shipment
- analyses and instrumentations
- test results collection
- evaluation of the samples qualities
- evaluation of the test procedure
- evaluation of the test results
- general conclusion.

Table 1
26th ASCOPE laboratory test correlation program for octane number measurement (1999) types code of sample

Type	Grade	Code
1. Mogas	Low grade	SC-01
2 . Mogas	High grade	SC-02

II. SAMPLE PREPARATION AND SHIPMENT

Test sample (denoted SC-01, SC-02) for the correlation programme were prepared by the Programme Coordinator who distributed them to the 21 Participating Laboratories in ASEAN Countries through their respective Country Coordinator.

The amount of the correlation samples was two liters for each grade. This was placed in two one liter cans. One liter can was used in order to comply with IATA (Air Transport Regulations) concerning the maximum volume per-

Table 2
26th ASCOPE laboratory test correlation programme for octane number measurement (1999)
Test results sample no.: SC-01

Lab. No.		LC-01	LC-02	LC-03	LC-04	LC-05	LC-06	LC-07	LC-08	LC-09	LC-10	LC-11	LC-12	LC-13
Motor Number		1110233	C-10973/1	298669	-	251913	G-42413	207440	-	1104652	G-49630	-	383031	-
Total Hours		7218.5	5830.5	1461.4	-	2796.6	4519	2191.0	-	-	4104.8	7209	3351.8	-
Running Hours After Last Overhaul/Carbon Blasting		491	-	120.4	-	380.4	239	506.8	-	-	240.1	55	554.2	-
Use Ice Tower,	Yes/No	No	No	Yes	-	Yes	Yes	No	-	No	Reh	Yes	No	-
Intake Air Temperature,	°F	126	125	129	-	126	129	125	-	124	126	123	125	-
Ambient Temperature,	°	85	68	77	-	86	75	85	-	74	77	64.4	90	-
Barometric Pressure,	in.Hg	30	29.92	29.92	-	30	30.2	29.9	-	29.92	29.97	29.8	29.9	-
R.P.M.		596	600	600	-	600	600	600	-	600	602	600	603	-
Above Sea Level,		3.65	0	28	-	4	-	4	-	41.8	6	-	4	-
Knockmeter Sensitivity		24	-	15	-	18	32	31	-	-	17	-	22	-
Cylinder Position	DC	-	712 (CR)	-	-	-	-	-	-	718	-	710	-	-
	MS	0.517	-	0.504	-	0.517	0.507	0.507	-	-	0.500	-	0.507	-

Lab. No.		LC-14	LC-15	LC-16	LC-17	LC-18	LC-19	LC-20	LC-21	LC-22	LC-23	LC-24	LC-25
Motor Number		176035	-	-	-	F-1	-	-	-	-	-	G-44173	F-1 No.2
Total Hours		2348	-	-	-	870.4	-	-	-	1886.0	-	3687	2116
Running Hours After Last Overhaul/Carbon Blasting		83	-	-	-	-	-	-	-	-	-	288	559.6
Use Ice Tower,	Yes/No	No	-	-	-	No	-	-	-	No	-	No	No
Intake Air Temperature,	°F	125	-	-	-	125	-	-	-	125	-	125	125
Ambient Temperature,	°	75	-	-	-	75	-	-	-	77	-	75.2	82
Barometric Pressure,	in.Hg	29.9	-	-	-	29.9	-	-	-	29.9	-	29.9	29.9
R.P.M.		600	-	-	-	600	-	-	-	603	-	601	606
Above Sea Level,		0	-	-	-	<1.0	-	-	-	-	-	0	1.5
Knockmeter Sensitivity		12	-	-	-	27	-	-	-	-	-	24	12
Cylinder Position	DC	>15	-	-	-	>16	-	-	-	>14	-	-	-
	MS	-	-	-	-	-	-	-	-	-	-	0.497	0.507

mitted for the air transport of flammable materials.

To facilitate and simplify the undertaking of the programme, each sample was coded alphanumerically as follows: "SC-number", where SC sample code and the number correspondents to grade of the sample in this correlation programme (Table 1).

In order to facilitate communication, laboratories In each contry were coordinated through a Country Coordinator. Each participating Laboratory was coded with "LC-number" where "LC" means laboratory in tis correlation programme.

In each case, the sample preparation consisted of five stages these where:

- Acquisition of suitable sample preparation material and equipment
- Blending of the samples
- Filling the containers with the samples
- Packing the container with the samples
- Paking
- Dispatch.

Each stage was undertaken with the utmost care under the supervision of the programme coordinator in accordance with set routine.

III. TEST DATA ANALYSIS

The laboratory test results were collected and analyzed using basic statistical methods. The statistical data obtained by these methods include: average of the results, average of deviations, variance, standard deviations, and determinations of outliers value; all which are basic to other statistical treatment such as trend etc. Test results were obtained provides sufficient parameters for comparing the data from individual laboratories. The following steps are used to calculate the basic statistical data.

A. *Average*

Sum of the test results $= x_1 + x_2 + x_3 \ldots x_n = \sum_{i=1}^{n} xi$

Table 3
26th ASCOPE laboratory test correlation programme for octane number measurement (1999)
Test results sample no.: SC-01

Lab. No.	LC-01	LC-02	LC-03	LC-04	LC-05	LC-06	LC-07	LC-08	LC-09	LC-10	LC-11	LC-12	LC-13
Motor Number	1110233	C-10973/1	298669	-	251913	G-42413	207440	-	-	G-49630	-	383331	-
KnockRating F-1 ON ASTM D-2699	88.5	89.0	89.3	-	88.2	89.0	89.4	-	-	89.3	88.8	88.6	-
Density at 15°F ASTM D-1298 kg/	767.0	767.9	768.9	-	770.3	768.5	783.7	-	-	767.5	767.5	768.1	-
RVP, ASTM D-323 k	48.0	35.0	35.0	-	24.5	46.3	42.7	-	-	49.0	46.8	50.0	-
Distillation ASTM D-86													
IBP	51.5	40	40	-	45	41	37.0	-	-	42	40.4	46.5	-
10%	70.0	69	68	-	70	67	53.9	-	-	69	68.6	73.0	-
50%	107.5	107	106	-	108	107	95.8	-	-	107	108.0	108.0	-
90%	154.5	151	149	-	151	151	146.0	-	-	150	150.0	150.5	-
EP	182.5	182	180	-	180	183	175.0	-	-	180	185.2	181.5	-
Lead Content, ASTM D-526/IP 116	0.02	0.009	0.02	-	0.004	0.005	0.0043	-	-	-	0.001	0.013	-

Lab. No.	LC-14	LC-15	LC-16	LC-17	LC-18	LC-19	LC-20	LC-21	LC-22	LC-23	LC-24	LC-25	Average
Motor Number	176035	-	-	-	F-1	-	-	-	-	G-49630	G-44173	F-1 No. 2	-
KnockRating F-1 ON ASTM D-2699	89.1	-	-	-	89.3	-	-	-	89.2	88.3	89.3	89.0	89.0
Density at 15°F ASTM D-1298 kg/	766.8	-	-	-	767.9	-	-	-	767.9	769.1	768.2	768.2	767.5
RVP, ASTM D-323 k	35.0	-	-	-	44.7	-	-	-	52.0	47.0	49.0	49.0	46.8
Distillation ASTM D-86		-	-	-		-	-	-					
IBP	40	-	-	-	39.9	-	-	-	41.2	40.5	38.5	42	40.4
10%	69	-	-	-	67.2	-	-	-	69.8	64.0	68.5	69	68.8
50%	107	-	-	-	105.6	-	-	-	108.8	105.5	107.0	107	108.0
90%	151	-	-	-	147.9	-	-	-	152.0	148.5	149.5	150	150.0
EP	182	-	-	-	182.6	-	-	-	186.8	180.0	182.5	180	185.2
Lead Content, ASTM D526/IP 116	<0.026	-	-	-	-	-	-	-	<0.01	-	0.005	-	0.001

Table 4
26th ASCOPE laboratory test correlation programme for octane number measurement (1999)
Test conditions sample no.:SC-02

Lab. No.	LC-01	LC-02	LC-03	LC-04	LC-05	LC-06	LC-07	LC-08	LC-09	LC-10	LC-11	LC-12	LC-13
Motor Number	1110233	-	298669	-	251913	G-42413	207440	110465	-	G-49630	-	383331	-
Knock Rating F-1 ON ASTM D-2699	94.3	-	95.0	-	94.4	94.7	95.0	85.1	-	95.5	95.6	95.2	-
Density at 15°F ASTM D-1298 kg/m3	754.2	-	756.0	752.4	754.1	756.0	764.4	756.0	-	764.4	755.2	755.2	-
RVP, ASTM D-323 kPa	50.2	-	41.5	51.0	50.5	49.5	46.2	49.5	-	50.0	49.9	51.0	-
Distillation ASTM D-86													
IBP	C 49.0	-	40	37	40	39	38.0	38.5	-	38	38.0	40.5	-
10%	C 72.5	-	69	63	69	70	55.0	79	-	70	71.1	73.5	-
50%	C110.5	-	109	101	109	111	101.5	110	-	110	110.5	114.0	-
90%	C153.5	-	145	150	154	152	142.6	143	-	147	146.9	149.0	-
EP	C183.5	-	182	194.5	184	185	175.0	184	-	183	187.5	185.0	-
Lead Content, ASTM D-526/IP116 g/l	0.08	-	0.02	0.004	0.002	0.001	Nil	0.008	-	-	0.001	Trace	-

Lab. No.	LC-14	LC-15	LC-16	LC-17	LC-18	LC-19	LC-20	LC-21	LC-22	LC-23	LC-24	LC-25	Average
Motor Number	176035	-	-	-	F-1	-	-	-	-	-	G-44173	F-1 No.2	-
Knock Rating F-1 ON ASTM D-2699	99.1	-	-	-	95.3	-	-	-	95.2	94.6	95.3	95.2	95.0
Density at 15°F													
ASTM D-1298 kg/m3	755.7	-	-	-	754.3	-	-	-	755.2	755.2	755.0	755.7	756.2
RVP, ASTM D-323 kPa	40.0	-	-	-	46.8	-	-	-	53.8	44.2	49.0	44.0	46.2
Distillation ASTM D-86													
IBP	C 39.6	-	-	-	37.7	-	-	-	41.5	36.4	37.0	39	39.6
10%	C 72.9	-	-	-	68.9	-	-	-	72.7	69.0	70.5	70	69.8
50%	C110.0	-	-	-	108.6	-	-	-	111.8	109.7	110.0	110	109.0
90%	C144.5	-	-	-	146.2	-	-	-	148.3	146.2	147.0	148	147.9
EP	C186.3	-	-	-	186.4	-	-	-	189.7	182.0	184.5	184	184.1
Lead Content, ASTM D-526/IP116 g/l	<0.026	-	-	-	-	-	-	-	<0.01	-	<0.004	0.010	0.019

Table 5
26th ASCOPE laboratory test correlation programme for octane number measurement (1999)
Test resultresults sample no.:Sc-02

Lab. No.		LC-01	LC-02	LC-03	LC-04	LC-05	LC-06	LC-07	LC-08	LC-09	LC-10	LC-11	LC-12	LC-13
Motor Number		1110233	-	298669		251913	G-42413	207440	110465.2	-	G-49630	-	383331	-
Total Hours		7219.4	-	1459.2	-	2797.4	4519	2193.0	-	-	4105.9	7209	3358.8	-
Running Hours After Last Overhaul/Carbon Blasting		491.9	-	118.2	-	381.2	239	308.8	-	-	241.2	55	561.2	-
Use Ice Tower,	Yes/No	No	-	Yes	-	Yes	Yes	No	No	-	Refr.	Yes	No	-
Intake Air Temperature,	°F	126	-	125	-	126	129	125	124	-	126	123	125	-
Ambient Temperature,	°F	85	-	77	-	86	75	85	74	-	77	64.4	91	-
Barometric Pressure, in Hg		30	-	29.92	-	30	30.2	29.9	29.92	-	29.7	29.8	29.9	-
R.P.M.	±	596	-	600	-	600	600	600	600	-	602	600	603	-
Above Sea Level,	m	365	-	28	-	4	-	4	41.8	-	8	-	4	-
Knockmeter Sensitivity		28	-	22	-	16	28	23	-	-	14	-	34	-
Cylinder Position	DC	-	-	-	-	-	-	-	807	-	-	816	-	-
	MS	0.448	-	0.442	-	0.450	0.444	0.441	-	-	0.434	-	-	-

Lab. No.		LC-14	LC-15	LC-16	LC-17	LC-18	LC-19	LC-20	LC-21	LC-22	LC-23	LC-24	LC-25
Motor Number		176035	-	-	-	F-1	-	-	-	-	-	G-44173	F-1 No.2
Total Hours		2351	-	-	-	969.9	-	-	-	1898.5	-	3886	2117
Running Hours After Last Overhaul/Carbon Blasting		90	-	-	-	-	-	-	-	-	-	287	161.6
Use Ice Tower,	Yes/No	No	-	-	-	No	-	-	-	No	-	No	No
Intake Air Temperature,	°F	125	-	-	-	129	-	-	-	125	-	125	125
Ambient Temperature,	°F	75	-	-	-	75	-	-	-	77	-	75.2	82
Barometric Pressure,	in Hg	29.9	-	-	-	29.92	-	-	-	29.9	-	29.9	29.9
R.P.M.		600	-	-	-	600	-	-	-	603	-	601	606
Above Sea Level,	m	0	-	-	-	<1.0	-	-	-	-	-	0	1.5
Knockmeter Sensitivity		13	-	-	-	27.3	-	-	-	-	-	24	16
Cylinder Position	DC	811	-	-	-	811	-	-	-	810	-	-	-
	MS	-	-	-	-	-	-	-	-	-	-	0.441	0.441

Table 6
26th ASCOPE laboratory test correlatiopn programme for octane number measurement (1999)
Individual rating reported by ASCOPE lab participant

Lab. No.	Research Method					
	SC-01		SC-02		SC-03	
	O.N.	Dev.	O.N.	Dev.	O.N.	Dev.
LC-01	88.5	- 0.6	94.5	- 0.5		
LC-02	89.0	0.0	-	-		
LC-03	89.3	+ 0.3	95.0	0.0		
LC-04	-	-	-	-		
LC-05	88.2	- 0.8	94.4	- 0.6		
LC-06	89.0	0.0	94.7	- 0.3		
LC-07	89.4	+ 0.4	95.0	0.0		
LC-08	89.4	+0.4	95.1	+0.1		
LC-10	89.3	+ 0.3	95.5	+ 0.5		
LC-11	88.8	- 0.2	95.6	+ 0.6		
LC-12	88.6	- 0.4	95.2	+ 0.2		
LC-14	89.1	+ 0.1	95.1	+ 0.1		
LC-17	-	-	-	-		
LC-18	89.3	+ 0.3	95.3	+ 0.3		
LC-19	-	-	-	-		
LC-22	89.2	+ 0.2	95.2	+ 0.2		
LC-23	88.3	- 0.7	94.6	- 0.4		
LC-24	89.3	+ 0.3	95.3	+ 0.3		
LC-25	89.0	0.0	95.2	+ 0.2		
n	16	-	15	-		
Average	89.0	- 0.31	95.0	- 0.29		
Standard Deviatio	-	- 0.39		- 0.35		
Minimum	88.2	- 0.8	94.4	- 0.6		
Maximum	89.4	+ 0.4	95.6	+ 0.6		
Grubbs' Limits	-	- 0.95	-	- 0.84		

Rejected Grubbs' criterian for 95% probability
Results are not included in computation

n = number of test results

$$\text{Average} = \frac{sum\ of\ test\ results}{no\ of\ test\ result} = = \bar{x}$$

B. *Average Deviation*

Average deviation is the average of all deviations from the set average taken without regard to algebraic sign.

D = deviation = $xi - \bar{x}$

Xi = test results

Average deviation =

$$\frac{sum\ of\ test\ results}{no\ of\ test\ result} = \frac{1}{n} \times \sum_{i=1}^{n} (xi - \bar{x})^2$$

C. *Variance*

Variance is a measure of a dispersion of a set of accepted results around the average. It is equal to the sum of the squares of the deviations.

Squares of deviation = $(xi - \bar{x})^2$

Sum of squares of the deviation = $\sum_{i=1}^{n} (xi - \bar{x})^2$

$$\text{Variance} = S_1 = \frac{1}{n-1} \sum_{i=1}^{n} xi - \bar{x})^2$$

Table 7
26th ASCOPE laboratoey test correlation programme for octane number measurement (1999)
CFR correlation program conducted from 1980 to 1999 percentage of rating exeeding standard devition

Sample Correlation	1st Program (1980)	2nd Program (1981)	3rd Program (1982)	4th Program (1982)	5th Program (1983)	6th Program (1983)	7th Program (1984)	8th Program (1984)	9th Program (1985)
SC-01	30.6	33.3	25.0	25.0	41.7	36.4	30.8	20.0	25.0
SC-02	38.5	16.7	25.0	16.7	38.5	18.2	30.8	26.7	33.3
SC-03	38.5	25.0	25.0	16.7	38.5	25.0	23.1	20.0	20.0

Sample Correlation	10th Program (1985)	11th Program (1986)	12th Program (1986)	13th Program (1987)	14th Program (1988)	15th Program (1989)	16th Program (1989)	17th Program (1990)	18th Program (1990)
SC-01	30.8	42.8	33.3	25.0	33.3	25.0	-	30.0	-
SC-02	16.7	16.7	33.3	37.5	33.3	35.0	23.5	30.0	12.5
SC-03	25.0	35.7	-	25.0	-	-	22.2	-	25.0

Sample Correlation	19th Program (1991)	20th Program (1991)	21st Program (1993)	22nd Program (1994)	23rd Program (1995)	24th Program (1997)	25th Program (1998)	26th Program (1999)
SC-01	22.2	35.0	42.1	44.4	26.0	5.9	31.2	33.3
SC-02	22.2	35.0	23.8	44.4	35.0	26.3	25.0	35.1
SC-03	-	-	-	-	-	-	-	

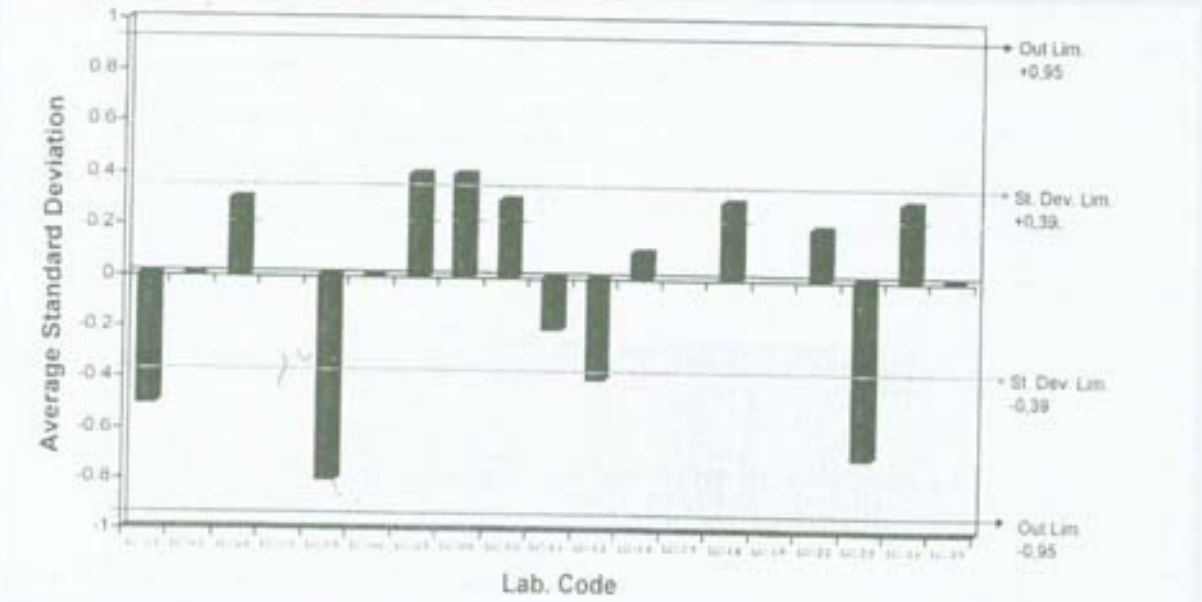

Figure 1
26th ASCOPE laboratory test correlation programme for octane number measurement (1999)

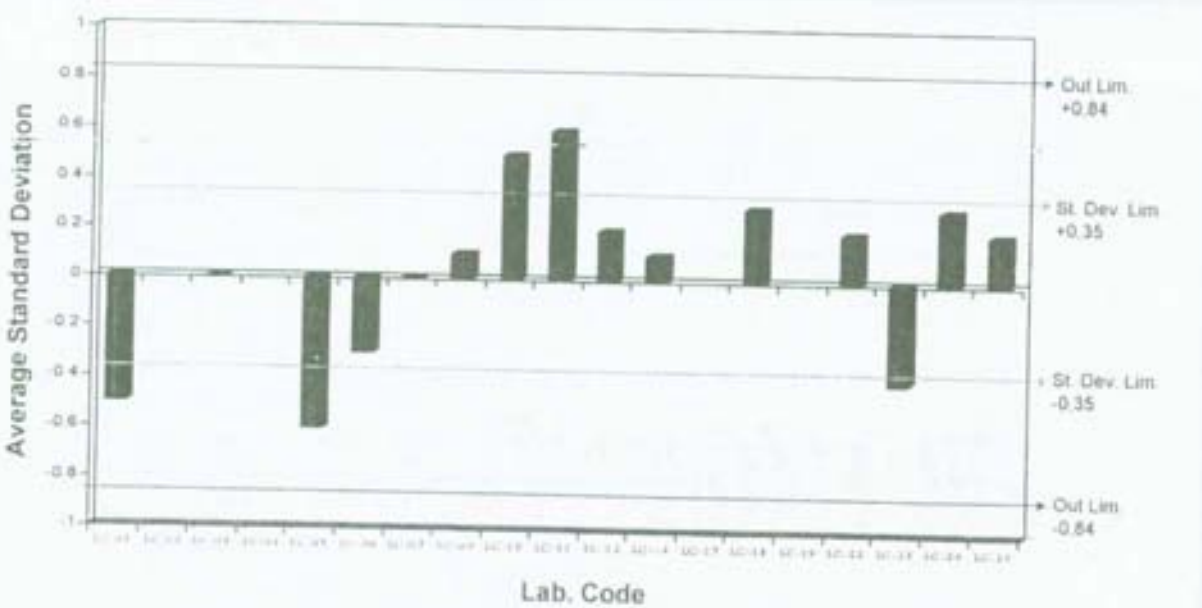

Figure 2
26th ASCOPE laboratory test correlation programme for octane number measurement (1999)

D. *Standard Deviation*

Standard deviation is a measure of the dispersion of a set of accepted results around their average, equal to the square root of the variance.

$$S = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(xi - \bar{x})^2}$$

E. *Rejection of Outliers*

$$\text{"}T\text{" factor x } S = T \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(xi - \bar{x})^2}$$

T factor was obtained from the table of Grubbs rejection criteria for 95% convidence level. In the computations of standard deviation the use $(n-1)$ is statistically more correct than n.

The result at the octane number measurement (xi) is rejected, if

$$\text{Deviation } (xi - \bar{x}) > T \times S.$$

F. *Test Results Collection*

The test results submitted by the participating laboratories were complied and evaluated following the procedure described above. The results for samples SC-01 are listed in Table 2 and Table 3.

The results for sample SC-02 are listed in Table 4, and Table 5. These shows the physical/chemical properties of samples octane number and ambient and engine operation conditions.

Test results of octane number are reported by participating laboratories, that are presented in Table 6 and 7. These results are summarized and can be seen in Figures 1, and 2 which plots the laboratory test results, standard deviation and rejection of outliers for sample SC-01 and SC-02.

IV. EVALUATION

From the results of the test conducted by participating laboratories, the evaluation of correlation samples, evaluation of test procedures (Table 2, and 3) and analysis of test results about standard deviation and rejection of outliers (see Table 6 and Figure 1, and 2). The following conclusion can be drawn.

A. *Evaluation of Correlation Sample*

The test results also agree with the test of general

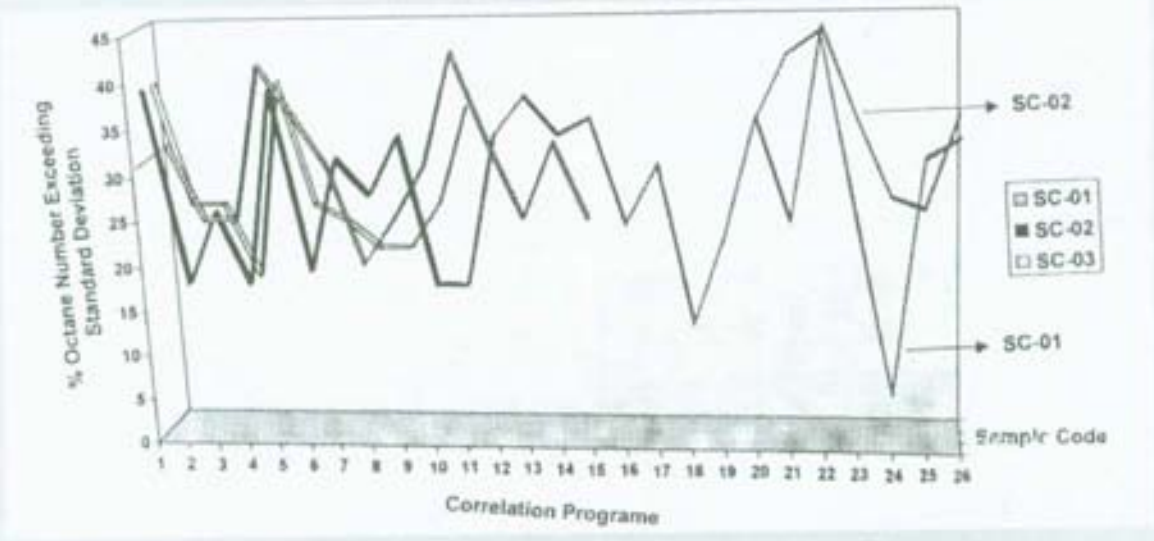

Figure 3
26th Laboratory test correlation programme for octane number measurement (1999)
Presentage of rating eceeding standard deviation (1980-1999)

properties for each sample (SC-01, SC-02) as shown in Table 3 and 5. Regarding the deviation of general properties of the samples, there are no significant deviations concerning the test results for density at 15 °C and RVP . This means that all samples were in good condition before testing.

B. *Evaluation of the Test Procedure*

From the test results conducted by participating laboratories, the test procedure was evaluated. The following conclusion can be drawn. From Table 2 and 4 it can be seen that in some laboratories the test deviated from the test procedure, established by the ASTM.

Some laboratories carried out the test without reporting for the engine operation condition, the running hours after last overhaul, such as, the participating laboratories form LC-092, LC-09, LC-18 and LC-22 and LC-02, LC-09, LC-11, and LC-22 whereas LC-02, LC-09, LC-11 and LC-22 did not report the knockmeter sensitivity (basic spread setting). According to the standard method, the basic spread setting should be 10 to 18 knockmeter division for octane number at 90 octane level.

C. *Evaluation of the Test Results*

Concerning sample SC-01 as shown in Table 6, and displayed in Figure 1, the calculation shows six test results exceeded the standard deviation defined for the test results coming from LC-01, LC-0, LC-07, LC-08, LC-12, LC-23, but all test results are not rejected as outlier. They are not outside the Grubb rejection limit.

Concerning sample SC-02 as shown in Table 6, and displayed in Figure 2, that five test results exceeded the standard deviation viz the test results coming from LC-01, LC-05, LC-10, LC-11, and LC-23, but all test results are not rejected as outlier. It means that they are still within the outliers rejection limits. Hence the test results from all participating laboratories are satisfactory.

V. CONCLUSION

The Grubb's T-Test for 95% convidence level appears to be quite satisfactory for 26th ASCOPE laboratory test correlation programme for octane number measurement in 1999. All the results in general seem quite good, some participating laboratories still need to pay more attention to the conduct of their test, particularly as regards adherence to the ASTM procedure.

As can be observed from the evaluation, all test results of the ASCOPE participating laboratories are not rejected.

It seems that the percentage of rating in the 26th programme exceeding standard deviation for SC-01 has increased from 31,2% to 33,3% and for SC-02 increased from 25% to 35,1% are listed in Figure 3.

The correlation programme enables each participating laboratory to monitor its own performance and to take corrective action when necessary. In the meantime correlation test programme for octane number measurement can be beneficial from sharing data and new ideas to improve testing procedure and testing precision.

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