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Correlation of True Boiling Point of Crude Oil

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Abstract :- The knowledge of the crude boiling point is very important for the refining process design and optimization. In this project the aim is to find the correlation of true boiling points. The study will be very useful in crude transportation and downstream operations. Correlation is tried to obtain by testing a number of crude oil samples from heavy to light. The comparisons of boiling point of different crude samples obtained is tried to compare with already existing correlations. Framol, Destmol and Riazi's, these three correlation models have taken. The result showed that comparison of three correlation models and which is more accurate.

Keywords:- Atmospheric Distillation - Atmospheric Pressure - Boiling Point - Boiling Range Distribution - Distillation - Force, Pressure - Petroleum Products

I. INTRODUCTION

The crude oil has different carbon content, so carbon is directly proportional to the boiling point .The importance of the true boiling point analysis standard distillation process of crude oil is used to identify the quantity of the products and value of the crude oil. ASTM is applicable in refineries and fuel selection to determine the boiling range characteristics of crude oils. It has both automatic and manual instruments.

This is a vital matter of study, the properties of natural rock oil build use of actuality Boiling purpose (TBP) distillation analyses and this can be helpful for rock oil characterization, for style and operation of works units, for the classification of rock oil, for the event of rock oil property correlations and it's been used worldwide. However, once applied to serious rock oil fractions, difficulties are typically encountered. Usually, the analysis of the TBP curve of serious rock oil fractions has been The FRAMOL correlation, because it was known as, permits conversion of the operational temperature of molecular producer in equivalent region temperatures that are employed in the traditional TBP curves. In step with the authors, the extension of TBP curve, from FRAMOL correlation, reached values next to 700°C, with continuity and substantial coincidence with the curve obtained from ASTM points. Many serious rock oil fractions were employed in order to induce enough data to be ready to get AN expression with wider relevancy and preciseness. It's vital that the correlation has continuity in regard to the TBP curve obtained from ASTM. This equation was developed from 05 differing types of rock oil. Then, this correlation permits to work out the AET of any rock oil within the vary of 540°C up to next to 700°C. These equations are going to be used for conniving the TBP curve of rock oil Beta (fantasy name).

There is a unit many sorts of ordinary distillation tests that verify the boiling purpose distribution of fossil fuel fuels, the inter-conversion between that is well documented. a lot of common commonplace check strategies for distillation of fossil fuel product include: ASTM D86-96, that is performed below air pressure and is employed for determinant the boiling purpose distribution of sunshine fossil fuel. The DESTMOL correlation, as it was called, allows conversion of the operating temperature of molecular distillation in equivalent atmospheric temperatures that are used in the conventional TBP curves. The extension of TBP curve from DESTMOL correlation reached values next to 973 K, with continuity and substantial coincidence with the curve obtained from ASTM points.

II. METHODOLOGY

In this project D86 distillation apparatus is used.100ml of crude oils(Arabian lights or heavy crude oils ,Indian crude)is taken into the round bottom distillation flask where it is heated up to certain level. When the first drop appears in the measuring jar take the IBP. Then note down the volume percentage versus operating temperature. Repeat the process up to 300^0c in the thermometer. Then plot the graph against volume percentage versus operating temperature.

Fig.1: D86 distillation apparatus

III. EQUATIONS USED

- ATMOSPHERIC EQUIVALENT TEMPERATURE (AET):-
  $AET = -1x10^{-5}T_{MD}^{3} + 0.008xT_{MD}^{2} - 0.581xT_{MD} + 427$
  AET is atmospheric equivalent temperature (◦C)
  T_{MD} = Operating Temperature of the Molecular Distillation Equipment.
- FRAMOL correlation:
  $TBP = 456.4 + 0.1677 * T_{DM} + 1.64 * 10^{-4} T^{2}_{DM} + 4.13 * 10^{-6} T^{3}_{DM}$
  TBP = True Boiling Point (^{o}C);
  T_{DM} = Operating temperature of the Molecular Distiller (^{o}C)

IV. OBSERVATIONS AND TABLES

TABLE 1: IBP test for Arabian Heavy Crude Oil

Temp	% Vol
25	0
60	5
77	10
125	15
168	20
203	25
238	30
278	35
301	40

TABLE 2: IBP test for Arabian Light Crude Oil

Temp	% Vol
25	0
65	5
97	10
130	15
156	20
182	25
213	30
238	35
263	40

Table 3: IBP test for crude oil sample 1

Temp	% Vol
54	0
65.4	10
68.8	15
73.5	20
78.4	25
82.1	30
89.2	35
93.4	40
98	45
104.5	50
109.5	55
113.6	60
119.5	65
125.7	70
133.8	75
141.6	80
154.9	85
173.5	90

Table 4: IBP test for crude oil sample 2

Temp	% Vol
32	0
40	3.84
65	5.6
100	8.43
125	11.34
150	13.98
175	17.77
200	20.91
225	26.21
250	30.13
275	35.55
300	40.22

V. RESULT

After conducting the experiment a plot between temperature and volume percent were plotted and these values were extended using Riazi model up to 700^{o}C, which is very essential result for operating actual distillation in the refineries. Similar model was developed using 3rd order polynomial fit and which was plotted and compared with riazi's model.

$$T = 0.00125x^3 - 0.0641x^2 + 6.60955x + 29.669$$

Where,

T= Boiling temperature in ^{o}C

x=Volume fraction

The obtained data's were extended to higher temperature and are as shown in the following graphs.

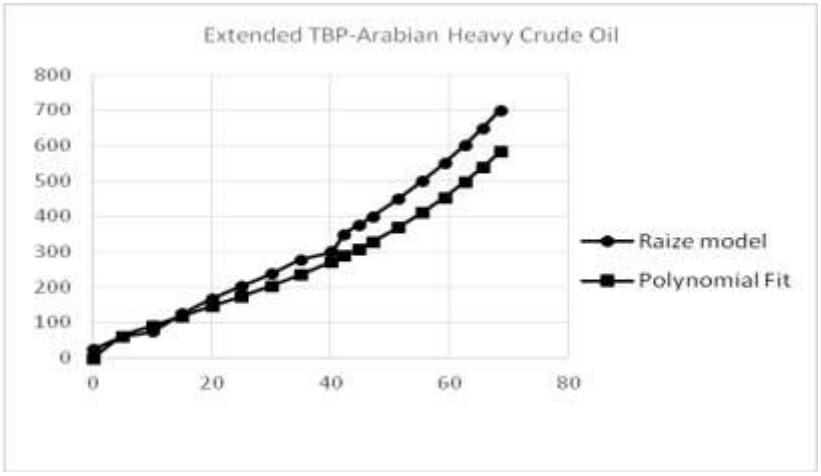

Fig.2: Result of TBP test conducted for the Arabian heavy crude oil.

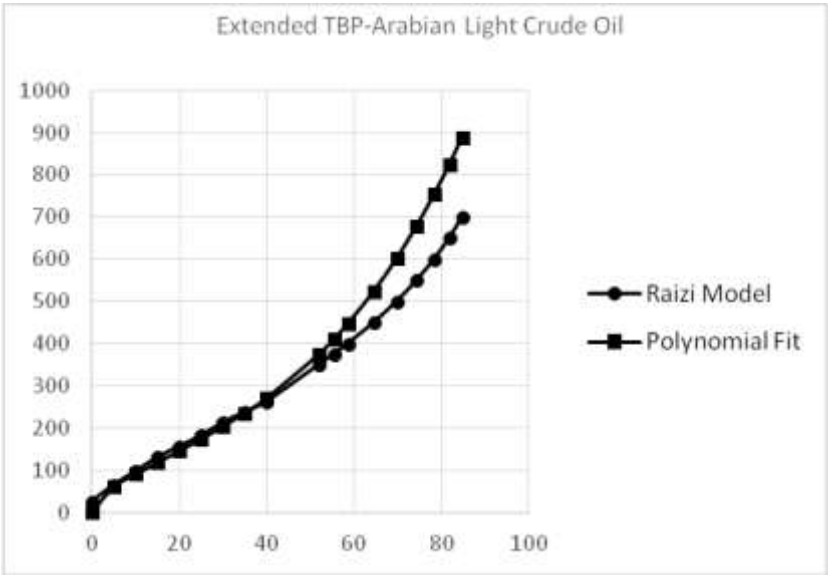

Fig.3: Result of TBP test conducted for the Arabian light crude oil.

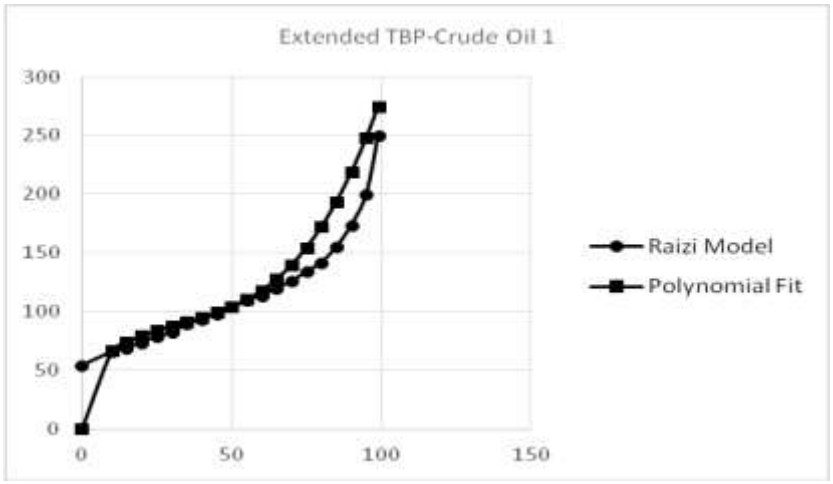

Fig.4: Result of TBP test conducted for the crude oil sample 1.

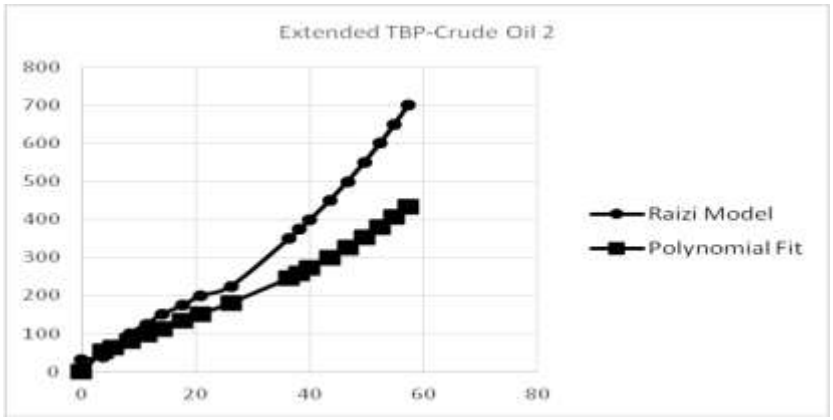

Fig.5: Result of TBP test conducted for the crude oil sample 2.

VI. CONCLUSION

Extension of ASTM distillation data is a critical method due to cracking of crude oil above 300^0c during ASTM D86 distillation. D86 is the simple and faster method compared to other physical ASTM distillation methods. The obtained data from the distillation is extended to higher temperature using Riazi model which is globally proven model. The same effort has been put to develop a similar model using 3rd polynomial fit technique the results obtained from polynomial fit are almost near to the existing proven models. This polynomial fit can be used to extend most of the heavy crudes in laboratory and for research purpose. The optimization of the model is needed for further accuracy.

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