

The Aim:

To find the aniline point and through it to determine the important properties of diesel fuel.

Introduction :

Aniline point is the minimum temperature for a complete mixing of aniline and materials such as gasoline; used in some specifications to indicate the aromatic content of oils and to calculate approximate heat of combustion.

In Determination of aniline point is a test to evaluate base oils that are used in oil mud. The test indicates if oil is likely to damage elastomers (rubber compounds) that come in contact with the oil. The aniline point is called the "aniline point temperature," which is the lowest temperature ($^{\circ}\text{F}$ or $^{\circ}\text{C}$) at which equal volumes of aniline ($\text{C}_6\text{H}_5\text{NH}_2$) and the oil form a single phase. Aniline point of oil gives an indication of the possible tendency of deterioration of oil when it comes into contact with packing ,rubber sealing etc. in general oils with a high aromatic content are more detrimental to rubber products than those with a low aromatic content. The relative aromatic content of an oil is indicated by its aniline point and oils with a high aromatic content have a low aniline point and vice versa. The higher the aniline point of the oil ,the more desirable it is for drilling fluid usage. In our experiment, 5 ml aniline and 5ml diesel were taken in a test tube provided with thermometer and heat was given until both aniline and diesel become completely miscible. The aniline point of diesel was found at the temperature of 94°C .

Theory:

By definition, the aniline point is the lowest temperature at which equal volume of aniline and oil are completely miscible (clear). This method is suitable for transparent liquid samples having an initial boiling point above room temperature and where the aniline point is below the bubble point and above the solidification point of the aniline sample mixture. The procedure is useful in characterizing pure hydrocarbons. The lower the aniline point, the greater the solvency or reactivity of the oil, which in turn gives an indication of the oils aromaticity. Paraffinic hydrocarbons have higher aniline points than aromatic types.

For instance, for an aromatic oil with a 75%aromatic content, the aniline point would be between 32.2° and 48.9°C; for a naphthenic type containing 40% aromatic structures, it would be between 65.6° and 76.7°C; and for a paraffinic oil with a15% aromatic content it would be between 93.3° and 126.7°C.In a homologous series, the aniline point for mixtures of hydrocarbons such as diesel oils and mineral oils serves as a guideline for judging the aromatic hydrocarbon content of oil and for comparing oil. Aniline being an aromatic compound freely mixes with aromatics; so a low aniline point indicates a low diesel index. Aniline point also predicts the amount of carbon present in the aromatics , as given by the formula:

$$\%CA= 1039.4n_{d_{20}} - 470.4d_{20} - 0.567AP (^{\circ}C) - 1104.42; \quad (1)$$

Where, n_d^{20} =refractive index at 20°C

d_{20} =density at 20°C

Diesel index is a measure of ignition quality of fuel

The diesel index is indication of ignition quality of diesel fuel. Although it is of same order of the cetane number. It may differ widely from it and should therefore be accepted. The diesel index is useful for controlling ignition temp. It is calculated from aniline point of the diesel oil and specific gravity of diesel fuel at 60OF.

$$\text{Degree API} = \frac{141.5}{\text{Sp. Gr. at } 60/60^{\circ}\text{F}} - 131.5$$

$$\text{Diesel Index} = \frac{\text{Degree of API} * \text{Aniline point}}{100}$$

Cetane number: It is a measure of ignition characteristic of diesel fuel by comparison with a range of fuel, in which cetane is given a value 100 methyl naphthalene zero.

$$\text{Cetane No.} = 0.72 \text{ Diesel Index} * 10$$

Diesel

In Petroleum diesel, also called petrol, diesel, or fossil diesel is the most common type of diesel fuel. It is produced from the fractional distillation of crude oil between 200 °C (392 °F) and 350 °C (662 °F) at atmospheric pressure, resulting in a mixture of carbon chains that typically contain between 8 and 21 carbon atoms per molecule.

Experimental Procedure:

1. Clean and dry the apparatus. Measure 5 ml of aniline and 5 ml of the diesel to be tested into the test tube.
2. Place stopper into the test tube and insert thermometer, making sure the bulb does not touch the sides or bottom of the tube.
3. Heat the tube slowly while stirring the mixture (stir by moving the thermometer up and down) until complete miscibility (the mixture becomes clear) occurs.
4. Remove from heat source and continue stirring until aniline-oil mixture becomes cloudy. Read thermometer temperature at cloud point and report aniline point in °F.

Materials and Equipment :

- Aniline 5 ml , Diesel 5 ml
- Test Tube
- Stirrer
- Jacket
- holder with Porte iron



Fig.1 : aniline point apparatus

Discussion :

- 1- what is the purpose of the experiment ?
- 2- what happen If the aniline and oil are miscible at room temperature?
- 3- Why is the aniline point a measure of the combustion properties of diesel fuel?
- 4- What is the relationship of the aniline point with the content of the substance of the aromatic and paraffinic compounds? Explain it with example?

Reference :

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- [2] Albahri, T. A. (2012). Prediction of the aniline point temperature of pure hydrocarbon liquids and their mixtures from molecular structure. *Journal of Molecular Liquids*, 174, 80-85.
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