— University of Mosul —
College of Petroleum & Mining Engineering

Properties of Petroleum Products

Lecture 3

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The greater the extent to which gases are compressed the more they tend to heat up. Sometimes this causes ignition before the spark is produced. This is intended in a diesel engine, where there is no spark plug, but in a gasoline (petrol) engine the occurrence is called auto-ignition or knocking or pinking. This is quite a problem as it can cause loss of power, with obvious danger, or damage to the engine.

It can be prevented in two ways during petrol manufacture:

1. Use of additives

2. use of a suitable mixture of high-octane compounds.

The lower the octane rating the more likely it is that auto-ignition will occur Clearly, high-octane fuels are more desirable.

The scale is an arbitrary one. Two compounds were chosen, n-heptane (C_7H_{16}) and 2,2,4-trimethylpentane ($CH_3C(CH_3)_2CH_2CH(CH_3)CH_3$).

n-heptane has a high tendency to auto-ignite , so it was given an octane number of 0. On the other hand, 2,2,4-trimethvlpentane has a low tendency to auto-ignite, so it was given a rating of 100.

A mixture of these two compounds containing 80% of 2,2,4- trimethylpentane is said to have an octane number 80 vol % of iso - octane and 20 %of n-heptane.

The octane number of a fuel can be improved by adding tetraethyl- lead(TEL) $(CH_3CH_2)_4Pb$ or methyl-tertiary-butyl-ether (MTBE).

Higher octane number fuels have better engine performance so high octane number fuels are more desirable. Generally iso paraffins have higher octane number than do normal paraffins. Naphthenes have relatively higher octane number than do corresponding paraffins and aromatics have very high octane numbers.

REASERCH OCTANE NUMBER OF PURE HYDROCARBONS

Paraffins	ON	Iso Paraffins	ON	Olefins	ON	Naphthenes	ON	Aromatics	ON
n-butane	94	Iso butane	102	n-butene	99				
n-pentane	62	i-pentane	92	n-pentene	90	Cycle pentane	100		
n-hexane	25	i-hexane	76	n-hexene	90	Cyclo hexane	91	benzene	103

A > N > O > Isop > P

7- Aniline point (AP):

Aniline point of a petroleum fraction is defined as the minimum temperature at which equal volumes of aniline and the oil are completely miscible. The higher aniline point with the lower aromatic content and the higher paraffin content. Aniline is an aromatic compound with a structure of a benzene molecule where one atom of hydrogen is replaced by the $-NH_2$ group ($C_6H_5-NH_2$).

Calculate the aniline point of petroleum fractions:

$$\mathbf{AP = -1253.7 - 0.139\ MeABP + 107.8\ K_w + 868.7\ SG}$$

Where:

AP = aniline point of petroleum fraction ,R

MeABP = mean average boiling point, R

SG = specific gravity at 60^o F/ 60^o F

K_w = Watson K factor

The aromatic content in petroleum fraction may be calculated from aniline point by the following formula:

$$\mathbf{\%\ A = 692.4 + 12.15\ (SG)\ (AP) - 794\ (SG) - 10.4\ (AP)}$$

Where: %A is the percent aromatic content, SG is the specific gravity , and AP is the aniline point in ^{o}C.