International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Effect of Nanoceramics on Processing Oil

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Abstract: ***Ceramics are metallic as well as non-metallic compounds incorporated in lubricating oil Oil acts as a lubricator in the compounding of rubber. Ceramic powder is prepared by combustion method in which oxidant and fuel ratio is fixed .Nitrate salts of barium, iron , copper and silver are mixed in aqueous medium , Suitable solvent is added in aqueous mixture .After heating the mixture on hot plate up to 100 ^{o}C ., Homogeneous , lustrous and uniform powder is prepared . This is highly effective to decrease saponification value of oil which acts as a plasticiser in rubber like material. Lesser the saponification value better the quality of oil.Saponification value indicates number of milligrams ok KOH required to saponify one gram of oil. Lubricating capacity oil is increased after application of ceramic in oil. Viscosity value remains unchanged***.

Keywords: Nitrate metal salts, oil, citric acid , oxalic acid , potassium hydroxide

1. Introduction

Fine ceramics was used for tribo-elements due to their superior mechanical properties such as high heat resistance, high wear resistance, lightweight, low thermal expansion and electric non-conductance, etc [1].In order to examine the fundamental boundary lubrication properties of ceramics, reciprocating friction experiments of silicon based ceramics such as silicon carbide and silicon nitride were conducted with trialkylphosphites and other oil additives[2]. Wear and tear tests of machine parts were performed after application of ceramics in oil. Ceramics were widely used as a mechanical seals ,A ceramic used for good corrosion resistance and sliding characteristics in seawater was applied to the piston cylinder of seawater pump for a 6000 m class surveying submarine[3].

Corrosion of stainless steels in atmospheric crude oil distillation column was studied in presence and absence of the ceramic coatings at different temperatures and exposure times using the weight loss technique. Petroleum chemistry data and local investigations showed that the main factor influencing the corrosion of crude oil distillation columns is the sulphur content, which had a significant effect more than other contaminates of crude oil[4].

Saponification value (SV) is one of the parameters used to evaluate the quality of edible oils, and it is determined by titration after heating the oil with KOH solution. This method is time-consuming, and requires a high amount of reagents and energy to perform the analysis [5].

2. Objectives

- To prepare the ceramics by combustion method.
- To investigate the effect of metal ceramics on the lubricating properties of processing oil.

3. Experimental Details

Define quantities of metal nitrates of silver, iron and copper are added in aqueous solution in a beaker .Citric acid as a fuel is added in above mixture. Then mixture is heated on heating mantle up to 100^{o}C for 30 min, semisolid gel is prepared. This gel is dried in hot air coven at 150^{o}c for 1hr. Homogeneous, uniform powder is developed .Ceramic powder is used for lowering the saponification value of oil.

Determination of saponification value: Approximately 1 gm of oil sample is taken in 250 ml conical flask and about 0.3 gm ceramic powder is added in oil then 10 ml of 0.5N alco.KOH solution and 10 ml ethyl alcohol, 2-3 drops of phenolphthalein indicator .

Shaked the flask well and titrated against the 0.5N HCl from burette .End point was pink to colourless. Blank titration is carried out without the sample of oil .Saponification value is determined by refluxing known quantity of the sample with known amounts of standard KOH solution and determining the alkali consumed by titrating unreacted alkali.

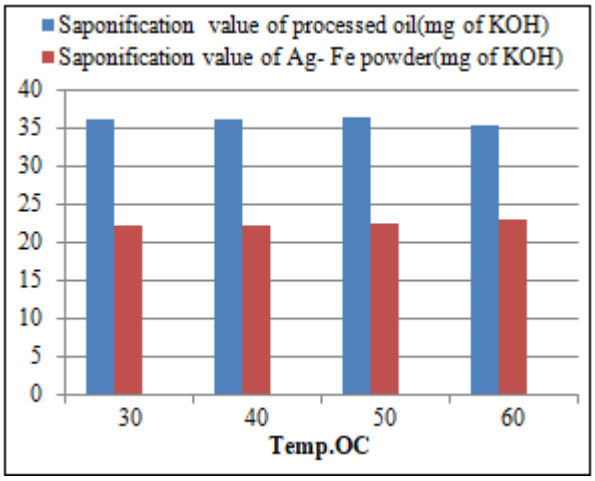
The saponification number is the number of milligrams of potassium hydroxide required to neutralize the fatty acids resulting from the complete hydrolysis of 1g of fat. It gives information concerning the character of the fatty acids of the fat- the longer the carbon chain, the less acid is liberated per gram of fat hydrolysed. It is also considered as a measure of the average molecular weight (or chain length) of all the fatty acids present. The long chain fatty acids found in fats have low saponification value because they have a relatively fewer number of carboxylic functional groups per unit mass of the fat and therefore high molecular weight.

Following observation table showing the saponification values at different temperatures.

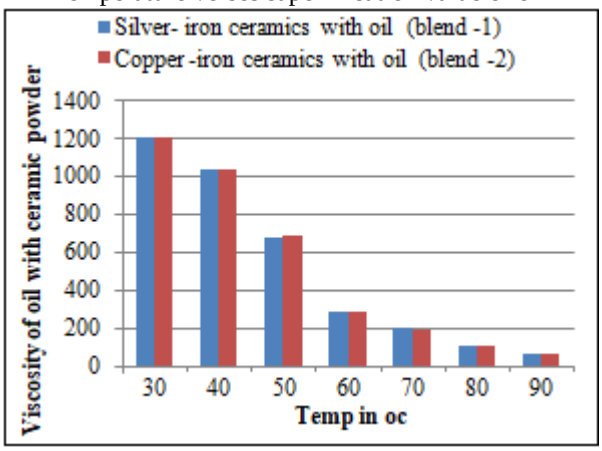
4. Observations

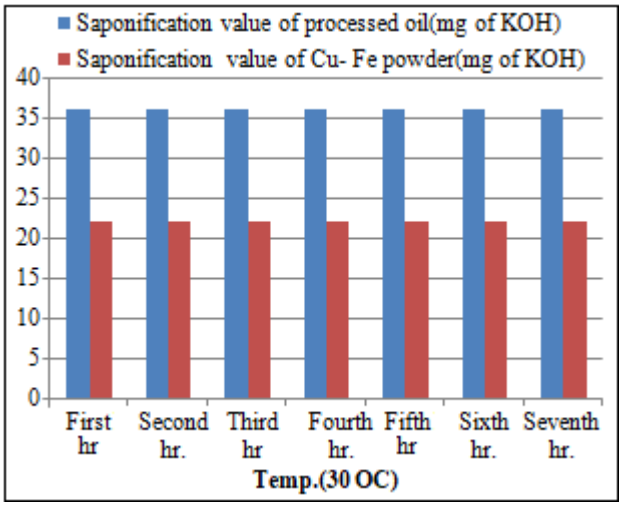
Table 1

Temp. ^{0}C	Saponification value of processed oil(mg of KOH)	Saponification value of Ag-Fe powder(mg of KOH)	Temp.(30 ^{0}C)	Saponification value of processed oil(mg of KOH)	Saponification value of Cu-Fe powder(mg of KOH)
30	37.1	23.1	First hr	36.3	22.1
40	37.1	22.9	Second hr.	36.3	22.2
50	37.2	22.8	Third hr	36.3	22.1
60	36.5	22.6	Fourth hr.	36.3	22.1
70	35.5	23.0	Fifth hr	35.9	22.2
80	35.6	22.9	Sixth hr.	36.1	22.2
90	35.7	23.1	Seventh hr.	36.1	22.1

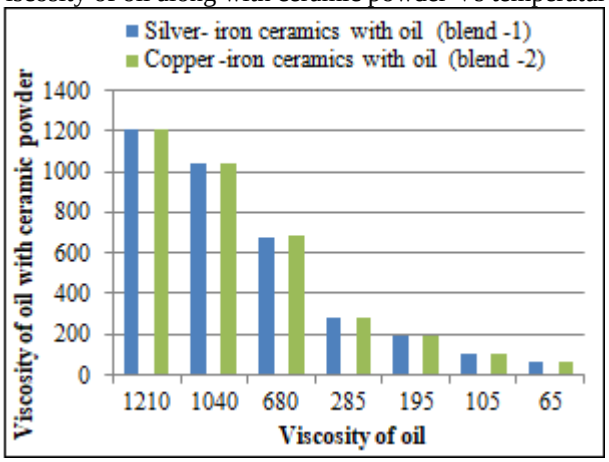


Temperature verses saponification value of oil





Viscosity of oil along with ceramic powder Vs temperature



Following table shows viscosity of oil in redwood second with temperature:

Table 2

Temp in ^{0}C	Viscosity of oil	Viscosity of oil with ceramic powder	
		Silver- iron ceramics with oil (blend -1)	Copper -iron ceramics with oil (blend -2)
30	1211	1212	1212
40	1042	1043	1042
50	678	683	691
60	284	286	289
70	196	196	195
80	106	105	105
90	66	69	66

5. Results and Discussion

With increase in temperature, decrease the viscosity of lubricated oil. This indicates that lubricating capacity of oil does not change after addition of ceramic powder. Saponification value of oil is significantly decreases after addition of ceramic powder. Lower the saponification value indicates no loss of oil while lubrication and decrease the oxidation number of lubricating oil.

6. Conclusion

- Saponification value decreased significantly after mixing the powder with oil.
- It indicates no loss of oil at high temperature.
- Less saponification value suggests that oxidation of oil is low.

- Processed oil can use for further treatment; it can recycle as well as reuse.
- Comparable viscosity indicates lubrication capacity of oil does not alter after addition of ceramic powder.

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