



## Comparative quality assessment of edible and blended edible oils

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### Abstract

The chemical and physical properties of oils are amongst the most important properties that determine the quality and help to describe the present condition of oils. The soybean oil used as based oil for replacement. The soybean oil was replaced by (40-85); mustard, sunflower and groundnut are each (5-20%). pH of individual and blended oil was ranged between 3.2 to 5.4, density (0.892 to 0.900), Specific gravity (0.8363 to 0.8391), Free fatty acid (0.14 to 0.19), Iodine value (2.20 to 2.22), Peroxide value (0.16 to 0.34), pH, density, Sp. gravity, Iodine value, FFA, Peroxide value of individual as well as blended oil was increased with increase the storage period under different storage condition. This affects was seen as replacement of soybean oil from other oil i.e. sunflower, groundnut and mustard oil. The storage oils at room temperature affect the quality of oil during storage.

**Key words:** Edible oil, iodine value, peroxide value

### Introduction

Fats and oils are an important food source for man, and are supplying essential fatty acids such as linoleic and arachidonic acids. Fats and oils are also used for producing drug dispersants in therapeutics (Rauken and Kill, 1993). Edible oil, being obtained from vegetable sources, is primarily composed of fatty acids and used for cooking, medicinal and cosmetic purposes. It is estimated that about 90% of vegetable oils are used for edible purposes. Vegetable oils have wide application in foods where they are used in frying, cooking etc. Vegetable oils are produced from plant seeds, commonly used for frying, baking and other types of cooking. Edible oils and fats are biological mixtures. Rapeseed (*Brassica napus* L.) is now the second most important source of vegetable oil in the world. Canola oil is also considered healthy for human nutrition due to its lowest content of saturated fatty acids among vegetable oils and moderate content of polyunsaturated fatty acids (Stamer *et al.*, 1999). Although, oil content is the major quality parameter, seed meal protein content is also very important as it can be used to eliminate protein malnutrition in animals. Rapeseed-mustard oil quality is determined by the constituent fatty acids including palmitic, stearic, oleic, linoleic, linolenic, eicosenoic and erucic acids. Linoleic and linolenic acids are essential fatty acids not synthesized by our body. Erucic acid, although, anti-nutritional and should be <2% in the edible oil, higher erucic acid is of considerable industrial importance.

Information regarding concentration of saturated fat, trans fat, linoleic ( $\omega$ -6) to linolenic ( $\omega$ -3) acids ratio, saturated fatty acids (SFA)/monounsaturated fatty acids (MUFA)/polyunsaturated fatty acids (PUFA) ratio, concentration of anti-nutritional factors (erucic acid, glucosinolates, phytic acid, sinapic acid and tannins etc.), presence of various phenolic compounds acting as an antioxidants and taste determinants, reducing seed meal fibre content, association of glucosinolates with different biotic and abiotic stress factors and their role in plant defense systems and other biological activities including anti-cancerous activities (Kumar *et al.*, 2014). Groundnut (*Arachis hypogea* L.) is an important oilseed crop as it contains 44-56% oil and 22-30% protein on a dry seed basis (Reddy *et al.*, 2003). Groundnut is grown on 19.3 million ha of land in about 82 countries. More than half of the production area is in arid and semi-arid regions. Groundnut otherwise called peanut, monkey nut, gobber pea and arachide belongs to the family leguminosea (Kumar *et al.*, 2018). It is conceivable that its effects could be enhanced by mixing with other vegetable products, for example in oils. Commercial oils today are mainly extracted using a hexane solvent, which has environmental and safety problems, so that it is necessary to develop alternative methods to hexane extraction. Oil oxidation is an autocatalytic reaction generating hydroperoxides from unsaturated acylglycerols. Oxidation of polyunsaturated food lipids often affect on development of unpleasant tastes and odors,

characteristic of rancid fats and oils, as well as degradation of functional and nutritional properties. Lipid oxidation can directly reflect shelf life of a product. Environmental factors, such as air, light and temperature, accelerate oxidative reactions which might end in the production of off-flavors and odors associated with low molecular weight volatiles, discoloration (Navarro *et al.*, 2012). Oil seeds have important nutritional value to diet due to high quality protein and vegetable oil, together with oil soluble like vitamin A, E, D, K. Traditionally made edible vegetable oils that are unrefined are good sources of natural antioxidants, vitamin E, polyunsaturated fatty acids and minerals which are very important for human health (FAO and WHO, 2002; Hunter and Cason, 2006).

### Materials and methods

All oils (mustard oil, soybean oil, sun flower oil and groundnut oil) were purchases from Shive Sales Corporation, Delhi, India and packaging materials (PET Bottles) were purchases from local market of Meerut. Experiments were carried out to assessment of crude oil and blended oil in process and Food Engineering Laboratory of the Department of Agricultural Engineering, Sardar Vallabhbai Patel university of Agriculture and Technology, Modipuram, Meerut. Studies were also carried out to evaluate the physico-chemical property of crude and blended oil filled in PET bottle under different storage condition. The physico-chemical and sensory attributes were analysed just after preparation and during storage of 0 and 210 days under ambient condition packaging in pet bottle.

### Density

The density of edible was calculated by mass of the sample per unit volume.

$$\text{Density} = \frac{\text{mass of the oil (g)}}{\text{volume of the oil (cm}^3\text{)}}$$

### Specific gravity

Specific gravity of oil is determined as the ratio of the density of oil in to the density of water at same temperature.

$$\text{Specific gravity} = \frac{\text{Density of oil}}{\text{Density of water}}$$

### Peroxide value

Weigh 2 g of oil sample in a 25-ml test tube. Add 2 g of potassium iodide and 20 ml of solvent mixture ( $\text{CH}_3\text{COOH} : \text{CHCl}_3 : : 2 : 1$ ). Loosely stopper test tube. Boil the contents of the tube within 30 seconds by placing the test tube in

a boiling water bath. Boil for another 30 seconds. Cool the test tube immediately under tap water and transfer the contents of the tube into a conical flask. Add 20 ml of 5% potassium iodide and 50 ml of distilled water to the flask and titrate against 0.002 N sodium thiosulphate using starch indicator towards the end (Shukla, 2003).

$$\text{Peroxide value} = \frac{V}{W}$$

(ml of 0.002 N. Sodium thiosulphate per gm)

Where,

V = ml of 0.002N.  $\text{Na}_2\text{S}_2\text{O}_3$  used.

W = weight of the sample taken in gms.

### Free Fatty Acid (Acid Value)

Weigh 10 g of oil or melted fat. Dissolve the sample in hot 100 ml of neutralized ethanol and titrate using 0.01 or 0.1 N alkali using phenolphthalein as indicator. Shake vigorously during titration and keep the solution warm. When testing oils and fats which give dark coloured solution, use the indicators as stated under determination of saponification value (Ranganna, 2005).

$$\text{Acid value as oleic acid} = \frac{\text{ml of alkali} \times \text{N of alkali} \times 56.1}{\text{wt of sample (g)}}$$

### Iodine Value

The weight of to the sample required is 2.5 - 3.0g in the case of coconut oil and 0.15 to 0.6 g in the case of other oils depending upon the iodine value. Weigh accurately by difference, an appropriate quantity of the oil or fat (previously melted) into a clean dry 250-ml glass-stoppered conical flask, and add 10 ml of carbon tetrachloride. Add 25 ml of Wijs solution, replace the stopper after moistening with potassium iodide solution, mix, and store in a dark cupboard for 30 min in the case of non-drying and semi-drying oils and 60 min in the case of drying oils. Add 15 ml of 10% potassium iodide solution and 100 ml of distilled water. Titrate with 0.1 N  $\text{Na}_2\text{S}_2\text{O}_3$  solution using starch as an indicator near the end point (Ranganna, 2005). Carry out a blank determination alongside without the fat.

$$\text{Iodine value} = \frac{(\text{Blank titre} - \text{Sample titre}) \times \text{N of } \text{Na}_2\text{S}_2\text{O}_3 \times 12.69}{\text{wt of sample (g)}}$$

### Refractive Index

Refractive Index was determined using a mathematical expression derived by Perkins.

$$\text{RI} = 1.45765 + 0.0001164 \text{IV}$$

Where, RI is the Refractive Index and IV is the Iodine Value

## pH value

The digital pH meter is kept at stand by position firstly then calibrating the pH 7 and pH 4 standard buffer solutions. The electrode of pH meter is dipped in test solution and the temperature knob is placed at 0°C control to the temperature of test solution. The function selector switch is set to pH and reading of digital display is allowed to stabilize, before it sample is mix or grind with 100 ml water and filtered through what man filter paper No. 1. The filtered sample is used for pH measurement.

## Results and Discussion

### pH content

From the data it was found that the pH of individual oil ranged between 4.3 to 5.4. While in blended oil were 3.2 to 5.4 as fresh. The constant pH was observed 4.3 in T<sub>1</sub> (mustard oil) & highest 5.4 in T<sub>2</sub> (Soybean oil) where as in case of blended oil, lowest was found in 3.2 in T<sub>8</sub> (SB<sub>40</sub>+SF<sub>20</sub>+GN<sub>20</sub>+MS<sub>20</sub>) and highest i.e. 5.4 in T<sub>6</sub> Sample (SB<sub>70</sub>+GN<sub>10</sub>+MS<sub>10</sub>+SF<sub>10</sub>). It is blended that the ratio of soybean oil affects the pH of fresh blended oil in different concentrations. As per data, the pH was observed highest in soybean oil. The present studs, the soybean oil used as based oil for replacement. The soybean oil was replaced with sunflower, mustard and groundnut combined in the ratio of 5, 10, 15 and 20% each blend oil of T<sub>6</sub> single was observed highest than the other combination but lowest in T<sub>8</sub> and followed by method in ascending affected by ratio of soybean oil (5 to 20%), because the individually soybean has highest pH than the others. During the storage of individual and blended oil, pH was decreased with increasing the storage period and types of storage condition. During room of oils, the pH was observed higher followed BOD (35°C) and refrigeration storage at 210 days. In refrigeration condition,

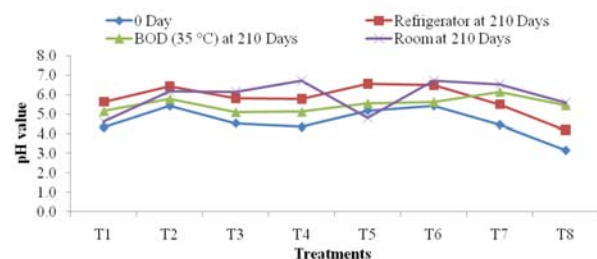


Figure 1: pH of edible and blended edible oils

**Description :-** (T<sub>1</sub>) - MS: Mustard oil, (T<sub>2</sub>) - SB: Soybean oil, (T<sub>3</sub>) - SF: Sunflower oil, (T<sub>4</sub>) - GN: Groundnut oil, (T<sub>5</sub>) - SB (85%) + MS (5%) + SF (5%) + GN (5%), (T<sub>6</sub>) - SB (70%) + MS (10%) + SF (10%) + GN (10%), (T<sub>7</sub>) - SB (55%) + MS (15%) + SF (15%) + GN (15%) (T<sub>8</sub>) - SB (40%) + MS (20%) + SF (20%) + GN (20%)

pH was found highest for T<sub>5</sub> and lowest T<sub>8</sub>; In BOD pH observed highest in T<sub>7</sub> and lowest T<sub>8</sub>. In room storage pH was assessed highest T<sub>6</sub> and lowest T<sub>5</sub> during storage of 210 days. From the Fig. 1, it seems that the highest pH of blended oil (T<sub>6</sub>) was observed in room storage and lowest 4.8 for T<sub>5</sub> & T<sub>6</sub> in room temperature after 210 days of storage. The stagnant temperature of storage for 210 day can be affecting the pH of the fresh as well blended oil. The result of study also revealed that the pH increased up to 24.59% in refrigerator followed by 23.49% in room and lowest 28.96% in BOD in storage at 210 days.

### Density

The density data recorded was found of individual oil ranged from 0.892 to 0.900 (Fig. 2). While in blended oil was observed from 0.894 to 0.895. The density was reported that 0.892 in T<sub>1</sub> (mustard oil) & highest in T<sub>2</sub> (Soybean oil) where as in case of blended oil, lowest was found in 0.894 in T<sub>7</sub> (SB<sub>55</sub>+SF<sub>15</sub>+GN<sub>15</sub>+MS<sub>15</sub>) and highest i.e. 0.895 in T<sub>5</sub> Sample (SB<sub>85</sub>+GN<sub>5</sub>+MS<sub>5</sub>+SF<sub>5</sub>). As per data, the density was observed highest in soybean oil. It is blended oil that the ratio of soybean oil affects the fresh blended oil in different ratio. The soybean oil was replaced with sunflower, groundnut and mustard combined in the ratio of 5, 10, 15 and 20%. During the storage of individual and blended oil, density was reduced with raising the

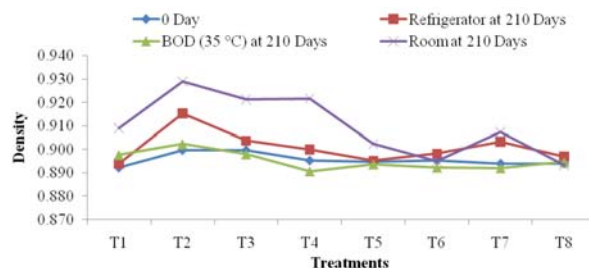


Figure 2: Density of edible and blended edible oils

storage period and different storage condition, such as refrigeration, BOD and room. Room of oils, the density was reported higher followed refrigeration and BOD (35°C) at 210 days. In refrigeration storage, density was found highest for T<sub>2</sub> and lowest T<sub>5</sub>; In BOD density was recorded highest in T<sub>2</sub> and lowest T<sub>6</sub>; In room storage density was observed highest T<sub>2</sub> and lowest T<sub>8</sub> during storage of 210 days can be affected the density of fresh as well as blended oil.

### Specific gravity

The specific gravity data was recorded of individual oil ranged from 0.8363 to 0.8432 (Fig.-2). While in blended oil was observed from 0.8379 to 0.8391. The specific gravity was reported that 0.8363 in T<sub>1</sub> (mustard oil) & highest in T<sub>2</sub> (Soybean oil) where as in case of blended oil, lowest

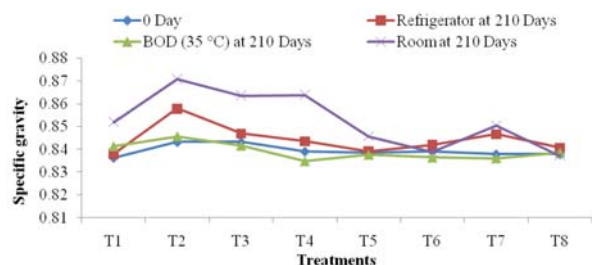


Figure 3: Specific gravity of edible and blended edible oils was found in 0.8379 in T<sub>7</sub> (SB<sub>55</sub>+SF<sub>15</sub>+GN<sub>15</sub>+MS<sub>15</sub>) and highest i.e. 0.8391 in T<sub>6</sub> Sample (SB<sub>70</sub>+GN<sub>10</sub>+MS<sub>10</sub>+SF<sub>10</sub>). As per data, the specific gravity was observed highest in soybean oil. It is blended oil that the ratio of soybean oil affects the fresh blended oil in different ratio. The soybean oil was replaced with sunflower, groundnut and mustard combined in the ratio of 5, 10, 15 and 20%. During the storage of individual and blended oil, specific gravity was reduced with raising the storage period and different storage condition, such as refrigeration, BOD and room. Room of oils, the specific gravity was reported higher followed refrigeration and BOD (35 °C) at 210 days. In refrigeration storage, specific gravity was found highest for T<sub>2</sub> and lowest T<sub>5</sub>; In BOD specific gravity was recorded highest in T<sub>2</sub> and lowest T<sub>7</sub>; In room storage specific gravity was observed highest T<sub>2</sub> and lowest T<sub>8</sub> during storage of 210 days can be affected the specific gravity of fresh as well as blended oil.

### Free fatty acid

The free fatty acid of individual oil ranged between 0.18 to 0.19. While in blended oil were 0.14 to 0.18 as fresh. The constant free fatty acid was observed 0.18 in T<sub>2</sub> (soybean oil) & highest 0.19 in T<sub>1</sub> (mustard oil) where as in case of blended oil, lowest was found in 0.14 in T<sub>7</sub> (SB<sub>55</sub>+SF<sub>15</sub>+GN<sub>15</sub>+MS<sub>15</sub>) and highest i.e. 0.18 in T<sub>5</sub> Sample (SB<sub>85</sub>+SF<sub>5</sub>+MS<sub>5</sub>+GN<sub>5</sub>). It is blended that the ratio of soybean oil affects the free fatty acid of fresh blended oil in different concentrations. As per data, the free fatty acid was observed highest in mustard oil as compared to soybean oil. The present studs, the soybean oil used as based oil for replacement. The soybean oil was replaced with sunflower, groundnut and mustard combined in the

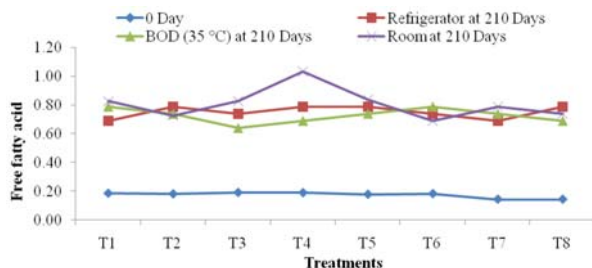


Figure 4: Free fatty acid of edible and blended edible oils

ratio of 5, 10, 15 and 20%. During the storage of individual and blended oil, free fatty acid was decrease with increasing the storage period and types of storage condition. During room of oils, the free fatty acid was observed higher followed refrigerator and BOD (35 °C) storage at 210 days. In refrigeration condition, free fatty acid was found highest for T<sub>5</sub> and lowest T<sub>7</sub>; In BOD free fatty acid observed highest in T<sub>6</sub> and lowest T<sub>5</sub>; In room storage free fatty acid was assessed highest T<sub>5</sub> and lowest T<sub>6</sub> during storage of 210 days. From the Fig. 4, It seems that the highest free fatty acid of fresh oil (T<sub>4</sub>) was observed in room storage and lowest T<sub>2</sub> for T<sub>1</sub> & T<sub>3</sub> in BOD temperature after 210 days of storage. The stagnant temperature of storage for 210 day can be affecting the free fatty acid of the fresh as well blended oil.

### Iodine value

From the data it was found that iodine value of individual oil ranged from 2.20 to 2.22. The constant iodine value was recorded 2.20 in T<sub>4</sub> (sunflower oil) & highest 2.22 in T<sub>1</sub> (mustard oil) where as in case of blended oil, lowest was found in 2.18 in T<sub>6</sub> (SB<sub>70</sub>+SF<sub>10</sub>+GN<sub>10</sub>+MS<sub>10</sub>) and highest i.e. 2.20 in T<sub>8</sub> Sample (SB<sub>40</sub>+GN<sub>20</sub>+MS<sub>20</sub>+SF<sub>20</sub>). It is blended that the ratio of soybean oil affects the iodine value of fresh blended oil in different concentrations. As per data, the iodine value was observed highest in mustard oil as compared to soybean oil. The present studs, the highest T<sub>8</sub> and lowest T<sub>7</sub> during storage of 210 days. From the Fig. 5, It seems that the highest iodine value of blended oil (T<sub>3</sub>) was observed in refrigeration storage and lowest 1.27 for T<sub>6</sub> & T<sub>5</sub> in BOD temperature after 210

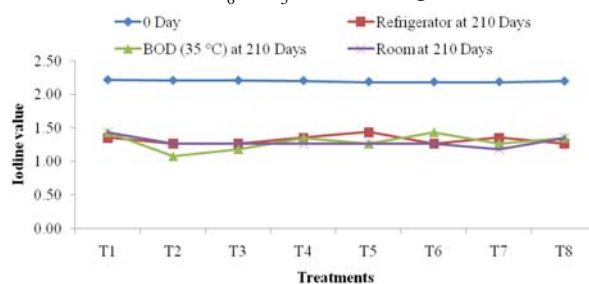


Figure 5: Iodine value of edible and blended edible oils

days of storage. The stagnant temperature of storage for 210 day can be affecting the iodine value of the fresh as well blended oil.

### Peroxide value

The peroxide value of individual oil ranged between 0.16 to 0.34. While in blended oil were 0.20 to 0.21 as fresh. The constant peroxide value was observed 0.16 in T<sub>3</sub> (sunflower oil) & highest 0.34 in T<sub>1</sub> (mustard oil) where as in case of blended oil, lowest was found in 0.20 in T<sub>7</sub> (SB<sub>55</sub>+SF<sub>15</sub>+MS<sub>15</sub>+GN<sub>15</sub>) and highest i.e. 0.21 in T<sub>5</sub> Sample



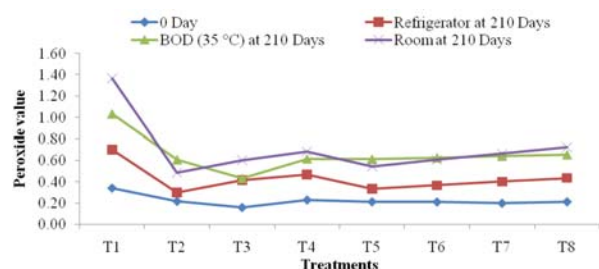


Figure 6: Peroxide value of edible and blended edible oils

(SB<sub>85</sub>+ SF<sub>5</sub>+ GN<sub>5</sub>+ MS<sub>5</sub>). It is blended that the ratio of soybean oil affects the peroxide value of fresh blended oil in different concentrations. As per data, the peroxide was observed highest in mustard oil as compared to soybean oil. The present study, the soybean oil used as based oil for replacement. The soybean oil was replaced with sunflower, mustard and groundnut combined in the ratio of 5, 10, 15 and 20%. During the storage of individual and blended oil, peroxide value was increased with increasing the storage period and types of storage condition. During room of oils, the peroxide value was observed higher followed BOD (35°C) and refrigerator storage at 210 days. In refrigeration condition, the peroxide value of blended oil highest T<sub>8</sub> and lowest T<sub>5</sub>; In BOD peroxide value recorded highest in T<sub>8</sub> and lowest T<sub>5</sub>; in room storage peroxide value was assessed highest T<sub>8</sub> and lowest T<sub>5</sub> during storage of 210 days. From the Fig. 6, it seems that the highest pH of blended oil (T<sub>8</sub>) was observed in room storage and lowest 0.54 for T<sub>8</sub> & T<sub>5</sub> in BOD (35°C) temperature after 210 days of storage. The stagnant temperature of storage for 210 day can be affecting the peroxide value of the fresh as well blended oil.

## Conclusion

The soybean oil used as based oil for replacement. During the storage of individual and blended oil, pH was decreased with increasing the storage period and types of storage condition. The result of study also revealed that the pH increased up to 24.59% in refrigerator followed by 23.49% in room and lowest 28.96% in BOD in storage at 210 days. As per data, the density was observed highest in soybean oil. It is blended oil that the ratio of soybean oil affects the fresh blended oil in different ratio. The soybean oil was replaced with sunflower, groundnut and mustard combined in the ratio of 5, 10, 15 and 20%. During the storage of individual and blended oil, specific gravity was reduced with raising the storage period and different storage condition, such as refrigeration, BOD and room. Room of oils, the specific gravity was reported higher followed refrigeration and BOD (35°C) at 210 days. It is blended that the ratio of soybean oil affects the free fatty acid of fresh blended oil in different concentrations. As per data, the free fatty acid was observed highest in mustard oil as compared to soybean oil. During the

storage of individual and blended oil, iodine value was decrease with decreasing the storage period and types of storage condition. During the storage of individual and blended oil, peroxide value was increased with increasing the storage period and types of storage condition. During room of oils, the peroxide value was observed higher followed BOD (35°C) and refrigerator storage at 210 days.

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