

## Research Article on Iodine Value

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### ABSTRACT:

Vegetable oils are triglycerides extract from plants sources and are made of up of fatty acid chains. The fatty acid chain can be made up of saturated or unsaturated Hydrocarbons. Which can be classified as a simple triglycerides or mixed triglycerides. The degree of saturation/unsaturation is indicated by the iodine value of the oilsample. Hence this research work was aimed at comparison inbetween the iodine value of four different vegetable oil of marketed oil products and crude oilsamples Mustard oil, Safflower oil, Sunflower oil, Coconut oilsamples. The samples were bought fromgeneral provision stores and some raw material production plants. The vegetable oils were analysed for their iodine values and the following results were obtained: For groundnut oil, the iodine values were found to be: Sunflower marketed oil = 104.05 and crude oil = 158.62, Coconut marketed oil = 209.38 and crude oil = 38.07, Mustard marketed oil = 285.52 and crude oil = 171.31), Safflower marketed oil = 228.42 and crude oil = 133.24) etc, which were evaluated and calculated at institute laboratory[1]\*

coca butter, olive oil, sunflower oil, safflower oil, soyabean oil, walnut oil and wheat germ oil etc. Such oils have been part of human culture for millennia. Some vegetable oils are edible oil. Edible vegetable oils are used in food, both in cooking and as supplements. Many oils, edible and otherwise, are burned as fuel, such as in oil lamps and as a substitute for petroleum-based fuels. Some of the many other uses include wood finishing, oil painting, and skin care.

There are several types of plant oils, distinguished by the method used to extract the oil from the plant. The relevant part of the plant may be placed under pressure to extract the oil.

### Composition and nutrition:

Vegetable oils are primarily composed of triglycerides and are typically liquid at room temperature. They contain a greater variety of fatty acids than animal fats. Olive oil, for example, contains the monounsaturated fatty acid oleic acid, which contributes to healthy cholesterol (HDL, or high-density lipoprotein) levels and may reduce the risk of heart disease. Polyunsaturated fatty acids, specifically alpha-linolenic acid (omega-3) and linoleic acid (omega-6), are found in a number of expressed (or pressed) oil. The oils included in this list are of this type. Oils may also be extracted from plants by dissolving parts of plants in water or another

### I. INTRODUCTION:

#### Vegetable Oil:

Vegetable oils are triglycerides extracted from plant, vegetables, seeds, nuts, foods and cereal grains. Example include almond oil, coconut oil,

solvent. The solution may be separated from the plant material and concentrated, giving an extracted or leached oil. The mixture may also be separated by distilling the oil away from the plant material. Oils extracted by this latter method are called essential oils. Essential oils often have different properties and uses than pressed or leached vegetable oils. Finally, macerated oils are made by infusing parts of plants in a base oil, a process called liquid-liquid extraction. vegetable oils and contribute to the maintenance of cell membranes, which help to metabolize cholesterol and absorb the fat-soluble vitamins A, D, E, and K. These are considered essential fatty acids because they cannot be synthesized by the human body and must thus be obtained from dietary sources. Linseed oil has the highest level of alpha-linolenic acid of any vegetable oil.

Some vegetable oils are high in saturated fat, including coconut oil, cottonseed oil, palm oil, and palm kernel oil. These are often more viscous or even semisolid at room temperature. Coconut oil, for example, contains a number of saturated fatty acids, including caprylic acid, capric acid, lauric acid, and myristic acid. Saturated fats raise the levels of low-density lipoprotein (LDL) cholesterol in the bloodstream and thus are associated with increased risk of heart disease[2]\*

#### Some vegetable oils:

##### Coconut Oil:

Coconut oil is the refined fixed oil obtained from the dried solid part of the endosperm of *Cocos nucifera* L.

**Chemical Composition:** coconut oil contains not less than 1.5 percent w/w of cuprous acid, not less than 5.0 percent and not more than 4.0 percent w/w of caprylic acid, not less than 4.0 percent and not more than 9.0 percent w/w of capric acid, not less than 40.0 percent and not more than 50.0 percent w/w of lauric acid, not less than 15.0 percent and not more than 20.0 percent w/w myristic acid, not less than 7.0 percent and not more than 12.0 percent w/w of palmitic acid, not less than 1.5 percent w/w and not more than 5.0 percent w/w of stearic acid, not less than 4.0 percent and not more than 10.0 percent w/w of oleic acid, not less than 1.0 percent and not more than 3.0 percent w/w of linoleic acid.

**Nutritional Information:** Coconut oil is 99% fat, composed mainly of saturated fats (82% of total; table). In a 100 g reference amount, coconut oil supplies 890 calories and 3,730 kJ

(890kcal), vitamins are 3mg vitamin E and 0.6 ug vitamin K and minerals like iron is 0.05 mg.

**Description:** white to Light Yellow Mass or colourless to light yellow, clear oil.

**Melting range:** 23<sup>0</sup> to 26<sup>0</sup>

**Refractive Index:** About 1,449, at 40<sup>0</sup>

**Peroxide value:** Not more than 5.0

**Unsaponifiable matter:** Not more than 1.0 percent, determined on 5.0 g.

**Iodine value:** 82 to 90 [3]\*

##### Mustard Oil:

Mustard oil can mean either the pressed oil used for cooking, or a pungent essential oil also known as volatile oil of mustard. The essential oil results from grinding mustard seed, mixing the grounds with water, and isolating the resulting volatile oil by distillation. It can also be produced by dry distillation of the seed. Pressed mustard oil is used as cooking oil in some cultures, but sale is restricted in some countries due to high levels of erucic acid. Varieties of mustard seed also exist that are low in erucic acid.

##### Chemical composition:

Pungent flavor is due to allyl isothiocyanate, a phytochemical of plants in the mustard family, Brassicaceae (for example, cabbage, horseradish or wasabi).

Mustard oil has about 60% monounsaturated fatty acids (42% erucic acid and 12% oleic acid); it has about 21% polyunsaturated fats (6% the omega-3 alpha-linolenic acid and 15% the omega-6 linoleic acid), and it has about 12% saturated fats.

##### Nutritional Information:

In 100 grams of mustard oil contains 884 calories of food energy, and is 100% fat. The fat composition is 11% saturated fat, 59% monounsaturated fat, and 21% polyunsaturated fat.

**Melting Range:** 480<sup>0</sup>F to 250<sup>0</sup>C

**Refractive Index:** About  $n_D^{20} = 1.47$

**Iodine Value:** mustard oil = 98 to 110

**Peroxide Value:** 0.83 meq/kg [4] \*

##### Sunflower Oil:

Sunflower oil is the non-volatile oil pressed from the seeds of the sunflower (*Helianthus annuus*). Sunflower oil is commonly used in food as a frying oil, and in cosmetic formulations as an emollient.

##### Composition and nutrition:

Sunflower oil is mainly a triglyceride. Which contain Palmitic acid (saturated): 5% ,

Stearic acid (saturated): 6%  
Oleic acid (monounsaturated omega-9): 30%  
Linoleic acid (polyunsaturated omega-6): 59%  
In sunflower oil contain 3.699 kj (884 kcal) calories, saturated fat contains 10.3 g, monosaturated fat is 19.5 g, polysaturated fat is 65.7 g and also contain vitamin like vitamin E is 41.0mg, vitamin k 5.4 ug.

**Smoke point:** 232<sup>0</sup>C to 450<sup>0</sup>F

**Refractive Index:** 1.4735

**Saponification value:** 188 -194

**Unsaponifiable matter:** 1.5 – 2.0 %

**Iodine value:** 120 -145 [5] \*

#### Safflower Oil:

Safflower may be extracted from the seeds of the safflower. Safflower seed oil is flavourless and colourless. It is used mainly in cosmetics and as a cooking oil, in salad dressing, and for the production of margarine. There nomenclature is *Carthamus tinctorius* [6] \*

#### Composition and nutrition:

Safflower oil is the composed of 5% palmitic acid, 2% stearic acid, 78 % oleic acid and 13% Linolenic acid.

Safflower oil contain 147 calories, 1.59 g of water, 4.59 g of protein, 10.9 g of total fat and 9.72 g of carbohydrate. It also provides 55% of copper, 37.73% of tryptophan, 31.14% of total fat, 27.50% of Vitamin B1, 26.14% of phosphorus, 25.54% of vitamin B6, 24.83% of manganese, 23.81% of magnesium, 23.48% of valine, 22.86% of vitamin B5, 19.56% of isoleucine, 17.78% of histidine, 17.38% of iron, 13% of zinc, 11.53% of threonine and 11.25% of folate.

**Refractive Index:** 1.469

**Viscosity:** 45.6 cp

**Unsaponifiable value:** 1.5% -2.5 %

**Iodine Value:** 136-148

**Saponification value:** 180-195



Sunflower oil



2. Coconut Oil



Safflower Oil



4. Mustard oil

### **Iodine value:**

The iodine value equals the number of grams of iodine required to saturate the fatty acids present in 100 grams of the oil or fat. Technically it is the value of the amount of iodine, measured in grams, absorbed by 100 grams of a given oil sample. Iodine values are often used to determine the amount of unsaturation in fatty acids. This unsaturation is in the form of double bonds, which react with iodine compounds. The higher the iodine number, the more C=C bonds are present in the fat.

All fats and oils are composed of fat molecules known as fatty acids. The molecules can be classified into three categories depending on their degree of saturation; saturated, monounsaturated, and polyunsaturated fatty acids. No oil in nature is composed entirely of any one of these three. All dietary oils contain a mixture. Soybean oil, for example, is referred to as a polyunsaturated oil because that is the predominant fatty acid. It also contains 24 percent monounsaturated fatty acids and 15 percent saturated fatty acids. Coconut oil is also a mixture. It contains 92 percent saturated fatty acids, 6 percent monounsaturated fatty acids, and 2 percent polyunsaturated fatty acids.

### **Formula:**

**Iodine Value:  $1.269(b-a)/w$**

Where,

W = Weight in gram of the substance

b = reading with blank

a = reading with sample

### **Methods to determine Iodine value:**

There are two methods to find iodine value in vegetable oils:

Iodine Monochloride method or Wijs Method

Iodine Monobromide Method or Hanus Method

### **Iodine monochloride Or Wijs Method:**

Weighed accurately quantity of substance in a dry 500 ml iodine flask. Add 10 ml carbon tetrachloride and dissolve. Add 20 ml iodine monochloride solution, insert the stopper and allow stand in dark at temp  $15^{\circ}$  to  $25^{\circ}$  for 30 min. Place 15ml of potassium iodide solution in the cup to, carefully remove the stopper and side of the flask with 100 ml of water, shake and titrate with 0.1 M Sodium Thiosulphate using Starch solution, as a indicator and note the number of ml required (a) and Repeat the procedure for without substance

under examination and note the number of ml required (b).

Calculate the iodine value by using above expression.

### **Iodine Monobromide Method and Hanus Method:**

Weighed accurately quantity of substance in a dry 300 ml iodine flask or which has been rinsed with glacial acetic acid. Add 15 ml chloroform and dissolve. Add slowly from a burette 25.0 ml of iodine monobromide solution, insert the stopper, allow to stand in dark for 30 min, unless otherwise specified in the monograph. Add 10 ml potassium iodide solution and 100 ml of water and titrate with sodium thiosulphate using starch solution as a indicator. Note the number ml required (a). Repeat the procedure for without substance under examination and note the number of ml required (b).

Calculate the iodine value by using above expression [7] \*

### **Aim:**

To determine the iodine value in given vegetable oil and comparing the iodine value between the marketed vegetable oil and pure vegetable oil.

### **Requirements:**

**Apparatus:** Burette 50 ml, stand, 100 ml measuring cylinder, 100 and 500 and 300ml beaker, 10 ml measuring cylinder, 100 ml volumetric flask, 250 ml stoppered bottle, Analytical balance, tripod stand, wire gauze, funnel, stoppered.

**Vegetable oils:** Safflower oil (marketed and crude), sunflower oil (marketed and crude), coconut oil (marketed and crude), mustard oil (marketed and crude oil).

**Chemicals:** Iodine Monochloride, carbon tetrachloride, potassium iodide solution, 0.1 M sodium thiosulphate, starch solution.

### **Principle:**

The iodine value equals the number of grams of iodine required to saturate the fatty acids present in 100 grams of the oil or fat. Technically it is the value of the amount of iodine, measured in grams, absorbed by 100 grams of a given oil sample. Iodine values are often used to determine the amount of unsaturation in fatty acids. This

unsaturation is in the form of double bonds, which react with iodine compounds. The higher the iodine number, the more C=C bonds are present in the fat.

**Formula:**

Iodine Value:  $1.269(b-a)/w$

Where,

W = Weight in gram of substance

b = reading with blank

a = reading with sample

**Procedure:**

**Starch Solution:** Take 1 g of starch in 10 ml of water then boil 90 ml water. Add starch suspension into boiling water until it become gelatinized.

**0.1M sodium Thiosulphate:** Take 100 ml water and add 25 gm sodium thiosulphate and 0.2 gm

**Calculations:**

Vegetable oils	Marketed Oils	Crude oils	Blank
Sunflower oil	343	300	425
Coconut oil	260	495	425
Mustard oil	200	290	425
Safflower oil	245	320	425

**Sunflower oil:**

**For Marketed:**

$$\begin{aligned} \text{Iodine value} &= 1.269 \times b - a / w \\ &= 1.269 \times (425 - 343) \\ &= 104.058 \end{aligned}$$

**For crude:**

$$\begin{aligned} \text{Iodine Value} &= 1.269 \times b - a / w \\ &= 1.269 \times (425 - 300) \\ &= 158.625 \end{aligned}$$

**Coconut Oil:**

**For Marketed:**

$$\begin{aligned} \text{Iodine value} &= 1.269 \times b - a / w \\ &= 1.269 \times (425 - 260) \\ &= 209.385 \end{aligned}$$

**For crude:**

$$\begin{aligned} \text{Iodine Value} &= 1.269 \times b - a / w \\ &= 1.269 \times (425 - 495) \\ &= 38.07 \end{aligned}$$

**Mustard Oil:**

**For Marketed:**

$$\begin{aligned} \text{Iodine value} &= 1.269 \times b - a / w \\ &= 1.269 \times (425 - 200) \\ &= 285.525 \end{aligned}$$

sodium carbonate in 700ml water or makeup volume up to 1000 ml.

**Potassium Iodide:** Dissolve 5 gm potassium iodide in 10 ml water and mix the two solution and add water to make up 100 ml.

**Potassium Iodide solution as per IP:**

For 1.5g= Dissolve 1.5g of potassium iodide in 100 ml of 1% sodium bicarbonate solution.

**Procedure for 1/10<sup>th</sup> portion:**

Take a 1 gm of substance and add 1 ml Carbon Tetrachloride and 2 ml of Iodine monochloridethen cool up to 15-30<sup>o</sup>c for 30 min. Then add 1.5ml potassium iodide solution and 10 ml water water then add starch solution as indicator. Titrate with 0.1M sod. Thiosulphate.

**For crude:**

$$\begin{aligned} \text{Iodine Value} &= 1.269 \times b - a / w \\ &= 1.269 \times (425 - 290) \\ &= 171.315 \end{aligned}$$

**Safflower Oil:**

**For Marketed:**

$$\begin{aligned} \text{Iodine Value} &= 1.269 \times b - a / w \\ &= 1.269 \times (425 - 245) \\ &= 228.42 \end{aligned}$$

**For Crude:**

$$\begin{aligned} \text{Iodine Value} &= 1.269 \times b - a / w \\ &= 1.269 \times (425 - 320) \\ &= 133.245 \end{aligned}$$

**II. CONCLUSION:**

The vegetable oil samples were analysed for the parameter iodine value and the following results were obtained: For groundnut oil, the iodine values were found to be: Sunflower marketed oil = 104.05 and crude oil = 158.62, coconut marketed oil = 209.38 and crude oil = 38.07, mustard marketed oil = 285.52 and crude oil = 171.31, safflower marketed oil = 228.42 and crude oil =

133.24 etc. Hence from the above cited method we can have an idea about the difference between the Saturation and Unsaturation in the raw (Crude oils) dietary oils and marketed/Processed food oils. From that we can get an idea about the saturation present in food oils, so that we can use a healthy food oil in our daily routine food intake.

#### REFERENCE:

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