Quality assessment of edible sesame oil samples produced in Jaffna District

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Abstract - Physico - chemical properties like relative density, moisture and other matter volatile, insoluble impurities, iodine value and unsaponifiable matter can be used to evaluate the quality of sesame oil. In this study ten sesame oil processing centers were selected randomly from seven divisional secretariats area in Jaffna district and two fresh samples of sesame oils were collected in two different time periods from these centers for quality analysis. All the laboratory analyses for sesame oils were done according to the Sri Lanka Standard (SLS) 313 procedure and the results were compared with Sri Lanka Standard 231:2013. According to the SLS 231:2013, the relative density ranges between 0.915-0.919, moisture and other matter volatile less than 0.2 percent by mass, insoluble impurities less than 0.05 percent by mass, iodine value ranges between 103-115 and unsaponifiable matter less than 1.5 percent by mass can be an indication for good quality sesame oil. The results of this study showed that the mean value of relative density and moisture content from eight and nine processing centers respectively were met the required SLS standard. Similarly the mean of iodine value and unsaponifiable matter of oils from seven out of ten processing centers were within the SLS standard value. But for the impurities only two out of ten processing centers met the SLS specification value. Samples obtained from five processing centers (50 %) contained the acceptable values for four out of five quality parameters. Results of this study show that most of the sesame oil processing centers available in Jaffna district need some modification or improvements in processing methods to meet all quality standards specified for sesame oil by SLS.

Key words - Iodine value, Insoluble impurities, Moisture content, Relative Density, Unsaponifiable matter

INTRODUCTION

Sesame Sesamum indicum L is a member of the Pedaliaceae family, is one of the oldest and most traditional oil seed crops, valued for its high-quality seed oil (1). Due to the domestic importance, the standard of oil should be analyzed to ensure its quality (2).The quality of sesame oil is influenced by many physiochemical parameters. They have a specific value which is recommended by Sri Lankan Standard institute. The quality can be evaluated by analyzing different parameters such as relative density, moisture and other matter volatile, insoluble impurities, iodine value and unsaponifiable matter. Iodine value is used to measure unsaturation or the average number of double bonds in fats and oils (3). The unsaponifiable matter in oils and fats, which consists mainly of hydrocarbons, sterols and aliphatic alcohols of high molecular mass, serves for the identification of oils and fats and for the detection of incidental and intentional impurities (e.g., falsification with mineral oils) (4). Insoluble impurities in oils and fats are generally defined as those materials which remain insoluble and can be filtered off, when the oil or fat is dissolved in diethyl ether or petroleum ether. Low level of insoluble impurities is a desirable characteristic in sesame oil. The moisture content of the oil is of great importance for many scientific, technical and economic reasons. Low moisture content is a requirement for long storage life (3).

The quality of the locally produced edible sesame oil is not known since no laboratory tests are conducted to determine the physiochemical quality. It is therefore necessary to determine the quality of oil produced in the Jaffna district. This study finds to assess the quality of edible sesame oil produced by processing centers in the Jaffna district and to compare the out comes with standards.

METHODOLOGY

Sample collection for Sesame oil

Freshly extracted sesame oil samples were collected from ten randomly selected processing centers from seven divisional secretariats area in Jaffna district during two different productions time period (April and May).The oil samples were collected in hermetically sealed plastic containers and it was kept at room temperature. Then the samples were brought to the laboratory for analysis. A total of twenty samples were used for this analysis.

Determination of Quality parameters

The parameters were relative density, moisture content, insoluble impurities, iodine value and unsaponifiable matter. Three replicate tire values of twenty samples were obtained and the mean values were considered.

Determination of Relative density (SLS Method 313)

The relative density was determined by weighing the relative density bottle. The bottle was filled with the oil. The bottle with the oil was weighed. It was calculated using the following formula:

$$\text{Relative density of oil} = \frac{W1}{W2}$$

Where,

W1-Weight of oil

W2-Weight of same volume of water

Determination of Moisture content at 105° (SLS Method 313)

The moisture content was determined using SLS method. The sample was weighed into an already dried and pre-weighed can. The can with the contents was placed in an air – oven maintained at 105° for one hour.The moisture content was calculated using the following formula:

$$\text{Moisture content at 105 ºC, percent by mass} = \frac{M1-M2}{M1} * 100$$

Where,

M1-mass, in grams of sample taken
M2-mass, in grams of residue

Determination of Insoluble impurities (SLS Method 313)

The insoluble impurities were measured by using SLS 313 procedure. Oil was weighed and filtered through an ash less open texture* filter paper .Impurities was extracted with light petroleum (B.P 40oC to 60oC). After complete extraction, the filter paper and contents were dried in an oven at 100oC and the stoppered weighing bottle was reweighed. The procedure was repeated until the mass is constant. It was calculated using the following formula:

$$\text{Total impurities, Percent by mass} = \frac{M3-M2}{M1} * 100$$

Where,

M_3 = mass, in grams of the weighing bottle and the paper
M_2 = mass, in grams of the weighing bottle and the paper
M_1= mass in grams of the oil taken

Determination of Iodine value (SLS Method 313)

The iodine value was determined by measuring the sample into a conical flask. Cyclohexane-acetic acid solvent was added to the sample. Wijs' iodine solution was added into the flask and swirled to mix. The flask was stored in dark for 1 hour. The flask was removed from dark and KI solution was added and mixed well. Then distilled water was added. It was titrated with standard Na2S2O3 solution by using starch indicator to an end point until blue color was disappeared. It was calculated using the following formula:

$$\text{Iodine value} = = \frac{(B-S)*M*126.9}{W} * 100$$

Where,

B= volume of titrant (ml) for blank
S= volume of titrant (ml) for sample
N- Normality of Na2S2O3
126.9= Molecular weight of iodine
W= Sample mass (g)

Determination of unsaponifiable matter (SLS Method 313)

Sample was weighed. Ethanolic potassium hydroxide solution was added. The content was boiled under reflux condenser for one hour. The saponified mixture was transferred to a separating funnel, the saponification flask was washed with some ethanol and then with cold water, using a total of 25 ml of water to rinse the flask. It was cooled. Diethyl ether was added and shaked and the layers are allowed to separate. The lower soap layer was transferred into another separating funnel and the ether extraction was repeated 3 times, using 50 ml portions of diethyl ether. The ether extract was washed with water and the lower aqueous phase was discarded. Then the ether extract was washed successively with potassium hydroxide and water. The potassium hydroxide and water wash sequence was repeated three times. The ether extract was washed with water until the last washing was not reddened by the addition of phenolphthalein. The ether extract was transferred to a tared flask. The separator was rinsed with the 10ml of ether and the rinsing was added to the flask. The ether was evaporated and acetone was added to the residue. The acetone was removed in a current of air and the residue was dried at105oC.Then the residue was dissolved in 20 ml of ethanol and phenolphthalein was added. It was titrated with 0.1 N ethanolic sodium hydroxide. It was calculated using the following formula:

$$\text{Unsaponifiable matter} = \frac{M1}{M2} * 100$$

Where,

M_1-Weight of residue
M_2-Weight of the oil taken for test

Statistical analysis

Statistical analyses were done by using SPSS (20) and MS Excel (2013).Quality parameters were compared with the Sri Lanka Standard specification value.

RESULTS AND DISCUSSION

The quality of edible sesame oil was analyzed by using physicochemical parameters such as relative density, moisture and other matter volatile, insoluble impurities, iodine value and unsaponifiable matter.

Relative density 30°C of sesame oil

The relative density of the oils varies with temperature. The SLS specification value for relative density30°C of sesame oil is 0.915-0.919.Eight processing centers constituting 80% fall within the stipulated limits recommended by SLS. (Table 1) Sample of two processing centers were below the lower limit. However there was no significant difference among the samples.

Moisture and other matter volatile at 105ºC

The SLS specification value for Moisture and other matter volatile at 105ºC, max is 0.4 percent by mass. The moisture content of the oil samples from nine processing centers (Table 1) were lower than 0.4.One of processing center oil samples didn't meet the standard. The drying process takes between 2-3 hours and drying time less than this time will have some water component in the oil. The low moisture content is a requirement for a long storage life (6).

Table 1: Relative density and moisture content of sesame oil samples collected from the centers

Sample number	Relative density	Moisture content % by mass
1	0.918±≤0.01	0.11±≤0.01
2	0.918±0.01	0.08±≤0.01
3	0.917±0.01	0.22±0.16

4	0.919±≤0.01	0.09±≤0.01
5	0.918±≤0.01	0.09±≤0.11
6	0.918±≤0.01	0.09±≤0.01
7	0.912±≤0.01	0.09±0.01
8	0.918±≤0.01	0.09±≤0.01
9	0.917±≤0.01	0.09±≤0.01
10	0.913±0.01	0.09±≤0.01

Insoluble impurities

The SLS specification value for Insoluble impurities percent by mass is less than 0.05 percent by mass. The results shows (Table.2) that the insoluble impurities of oil in eight processing centers didn't satisfied the specification value. It may be due poor filtration of oil. Low level of insoluble impurities is a desirable characteristic in sesame oil (3).

Unsaponifiable matter, percent by mass

The SLS specification value for unsaponifiable matter, percent by mass is 1.5(max). The seven processing centers constituting 70% fall within the standard limits.

Three processing centers constituting 30 % didn't meet that SLS Specification value. The unsaponifiable matter in edible oils is usually small, as high value will indicate contamination or adulterations (4).

Table 2: Insoluble impurities of sesame oil samples collected from the centers

Sample number	Insoluble impurities % by mass
1	0.504±≤0.01
2	0.167±0.02
3	0.060±≤0.01
4	0.050±≤0.01
5	0.248±0.05
6	0.051±≤0.01
7	0.827±0.01
8	0.304±≤0.01
9	0.410±≤0.01
10	0.050±≤0.01

Iodine value

The determination of the iodine value is also important in classifying oils (3). The SLS specification value for iodine value of sesame oil is 103-115. The iodine value of the oil samples from seven processing centers were within the limit. Samples from three processing centers didn't meet the SLS Specification value. Two samples were below the stipulated limits recommended by SLS and one sample was above the stipulated limits. Deterioration in the vegetable oils is reflected by the decrease in iodine value fresh oils. The low iodine value is due to the high saturation (3). Oils rich in unsaturated fatty acids have high iodine numbers. (5).

Table 3: Iodine value and Unsaponifiable matter of sesame oil samples collected from the centers

Sample number	Iodine value	Unsaponifiable matter % by mass
1	108.73±0.06	0.59±≤0.01
2	100.53±0.35	0.66±0.01
3	103.03±0.01	0.52±≤0.01
4	121.58±0.02	0.57±0.02
5	112.25±0.05	0.86±≤0.01
6	110.69±0.06	0.42±0.03
7	89.34±0.03	1.73±≤0.01
8	113.44±0.07	2.27±≤0.01
9	114.34±0.03	1.79±≤0.01
10	110703±0.75	0.58±0

CONCLUSION

According to the results of the present study showed that the mean value of relative density and moisture content from eight and nine processing centers respectively were met the SLS standard. Similarly the mean value of iodine value and unsaponifiable matter of oils from seven processing centers were within the SLS standard value. But for the impurities only two processing centers were met the SLS specification value. Only five out of ten processing centers were contained the acceptable values for four out of five quality parameters suggested by SLS. The results of this study suggested that further modification or improvements are needed in processing methods practiced by local sesame oil processing centers to meet the quality standards specified in SLS.

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