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Research Article

ASSESSING THE GUINENITY OF EXTRACTED OIL OF ARACHIS HYPOGAEA L. (PEANUT) FROM FOUR DIFFERENT SEED VARIETIES GROWN IN INDIA USING BELLIER TURBIDITY TEMPERATURE TEST (BTTT)

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A R T I C L E I N F O

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A B S T R A C T

In this study an attempt has been made to investigate the applicability of BTTT to groundnut oils obtained from different varieties of seeds grown in different parts of India and thereby examine the influence of geographical variations on BTTT. In the present data analysis, low oil yielding groundnut seed varieties (% oil content: 35-40) such as **Chitra (Cr) and Chandra (Cd)** exhibited BTT in the range of 39.4 to 39.6 ^{0}C while High oil yielding varieties (% oil content: 41-44) such as **Prakash (Ps) and Kuber (Kr)** displayed BTT in the range of 40.5-40.8 ^{0}C. The result have demonstrated the reproducibility through the analyzed data. Hence It is observed that groundnut oil fulfils BTTT values as per Regulation (Food Products and Standards) 2011 of Food Safety Standards and Act 2006. The standard mean error is in between 0.06-0.15 in case of BTT while in case of percentage of oil yielding, it is 0.29-0.62. BTT values prescribed for the certain vegetable oils comes under the mandatory food laws in some countries but due to development towards hybridization in oil seeds, reconsideration in laws is required.

INTRODUCTION

The quality of fats and oils is dictated by several physical such as texture, density, pacific gravity, colour, refractive index etc and chemical parameters such as acid value, iodine value, saponification value, unsaponifiable matter BTT etc are dependent on the source of oil; geographic, climatic, and agronomic variables of growth. Thus one must assess quantitatively the influence of these variables on characteristics of oils and fats; in present case on characteristics of groundnut oil, Bellier Turbidity Temperature Test (BTTT) (acetic acid method), based on insolubility of Arachidic acid is used as a qualitative method for identification of pure groundnut oil. Sometimes it is observed that groundnut oil fulfils all specifications of refined oil but fails to pass BTTT. Moreover Groundnut from different geographical locations differs in oil content. The Bellier figure or the temperature at which turbidity appears in a specified and neutralized oil sample under specified conditions was first proposed by Bellier and modified by several workers including Franz and Adler. According to Ever in 1912, the addition of sufficient acetic acid used instated of 1% hydrochloric acid succeeding modifications in the BTT. This had been adopted by several workers and gives satisfactory results for sufficient to judge the purity of peanut oil and admixture of oils.

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In most cases the Bellier figure increases with the % of peanut oil in the mixture. The increase is not proportional and there is a steep rise for the % of peanut oil below 25 %[10].

The objective of the present studies was to investigate the applicability of BTTT to groundnut oils obtained from different varieties of seeds grown in different parts of India and thereby examine the influence of geographical variations on BTTT as tool for identification of groundnut oil in reference to high oil yielding varieties of groundnut as well as low oil yielding varieties from different regions of India. Hence when one undertakes investigations on BTTT on such seeds, it is easy to investigate the influence of oil content on BTTT.

LITERATURE REVIEW

Arachis hypogaea L.(peanut) is now grown worldwide in the tropical and temperate zones primarily as an oil seed crop [1].India is the largest producer of groundnut in the world. About 88% of the groundnut area and production in India is concentrated in five states: Andhra Pradesh, Gujarat, Karnataka, Tamil Nadu, and Maharashtra. Nearly 83% of the total area is under rainy-season groundnut and the other 17% is cultivated during the post rainy season[2].

Groundnut shells (*Arachis hypogea* L) are an agricultural by-product from an oilseed leguminous crop groundnut. Scientifically Groundnut is known as *Arachis hypogaea*, its origin was traced to Bolivia at the end of the Andes extending to north Argentina. The cultivated groundnut belong to the

section *Arachis* and series amphiploidies and family fabaceae. The species A. *hypogaea*" consist of two subspecies, ssp hypogaea and ssp fistigiata. Groundnut is the second most important leguminous crop the world over after soy beans as it provides food for human and livestock and form valuable dietary protein component in the absence of meat. Groundnut kernel contains 47-53% oil and 25-36% protein. Groundnut is the third most abundantly cultivated oilseed in the world and plays an important role in the economy of these West African countries, including the Gambia, Nigeria Ghana and Senegal. In Africa, groundnut is grown mainly in these countries, Nigeria, Gambia, Sudan, Senegal, Chad, Ghana Congo and Niger. In 2007, the total harvested area for groundnut in Africa was 9.04 ha with a total production of 8.7 million metric tonnes. The average productivity index for Nigeria was reported to be1720kg/ha, 500kg/ha was reported for Sudan and 700kg/ha was given for Senegal. Up till now Groundnut is the major export product for Senegal and the Gambia, it was the major export commodity for Nigeria before the discovery of petroleum in the Niger delta area **[6].**

The solubility of oils in various solvents is a constant, depending on the nature of the glycerides composing the oil. Fryer and Weston found that a mixture of equal volume of 92% ethyl alcohol and pure amyl alcohol used as a solvent for turbidity. In Valenta test, acetic acid was used as a solvent, the results are affected by the presence of moisture in the oil and free fatty acid which lower the turbidity temperature, increasing the solubility of the oils, which raises the turbidity temperature **[10]**.

The modified BTT test has been used by Ever for judging the purity of oils and has been found simple, rapid and fairly accurate for routine analysis as compared to the results obtained by Valenta test. Moreover, it can be conveniently used in the analysis of soap and commercial fatty acids and also for determining the % of two mixed oils. Others workers have also successfully used the same test for determining adulteration of groundnut oil in some edible oils and also suggested its analytical importance. Besides the turbidity temperatures obtained with fatty acids by the method of fryer and Weston are different from those for the respective oils, depending on the difference in the solubility of the glycerides of the oil and its fatty acids in the same solvent[4].

Krishnamurthy *et al* (1985) studied and investigated that BTT test is useful to check purity of groundnut oil. BTT values for arachis (groundnut) oil depend on the relative insolubility of arachidic acid (C20:0) in 70% ethyl alcohol (1:2). The high BTT values of groundnut oil compared with the other vegetable oils is due to the insolubility of arachidic acid but due to the lignoceric acid (C24:0) present in the groundnut oil. They concluded that there is no direct relationship between the added lignoceric acid in groundnut oil which is responsible for the high BTT value. However, higher concentrations of lignoceric acid present in oil improve the perception of turbidity [8]**.**

MATERIAL AND EXPERIMENTAL PROCEDURES

Materials

All the chemicals and reagents used in present research work are analytical grades.Four varieties of groundnut oilseeds viz. Chitra (Cr), Prakash(Ps), Kuber(Kr) and Chandra (Cd) were gathered from local markets of different places of India. Since these four seed varieties are used often by Oil Millers Association of different regions in India for expelling and filtration/ refining, the seeds were easily available for procurement. These different groundnut varieties are used in this research study. The groundnut seeds of different places were assessed for extraction of seed oil, moreover these seeds differ in oil content.

Experimental procedures

Soxhlet Extraction of groundnut seeds

From each dried mature and healthy seeds sample, 500g seeds were weighed and crushed using commercial grinder. The ground mass was fed to a soxhlet extractor and equipped with thimble and fitted with a 2 L round bottomed flask. Hexane was used as the extraction solvent. The extraction was carried out for a period of 8 hours. At the end of the extraction period, the solvent was recovered by using a rotary vacuum evaporator and the residual oil was dried at 75^0C for one hour. The extract was transferred to the desiccators and then stored in air tight container until needed for further analysis [11]. The amount of groundnut oil extracted was determined as follows: Oil content (%) = (weight of oil extracted x100)/ weight of seed.

Determination of Bellier turbidity temperature acetic acid Method

Pipette out one ml of the filtered sample of oil in a flat-bottom 100 ml round flask, add 5ml of 1.5 N alcoholic potash heating over a boiling water bath using an air condenser After complete saponification cooling, neutralized by adding carefully dilute acetic acid and then add an extra amount of 0.4 ml of accurately measured dilute acetic acid using phenolphthalein indicator. Add 50 ml of 70% alcohol and mixed well. Heat and allow the flask to cool in air with frequent shaking. Note the temperature by using calibrated thermometer at which the first distinct turbidity appears which is the turbidity temperature. This turbidity temperature is confirmed by a little further cooling which results in deposition of the precipitate. Dissolve the precipitate by heating the contents to 50°C over water bath, again cool as desiccated above and make a triplicate determination of the turbidity temperature[3,5,7].

Statistical analysis

The data obtained from the experimental measurements and accuracy of oil content and BTTT for different varieties of Groundnut seeds have been analyzed and the Statistical parameter like standard deviation, coefficient of variance and standard mean error were calculated for both the parameters. All the experiment was carried out in triplicate and the results are presented as the mean SD, CV and SEM. Descriptive Statistics of different groundnut varieties from different parts of India as shown in figure1.

RESULT AND DISCUSSION

As per Regulation (Food Products and Standards) 2011 of Food Safety Standards and Act 2006, BTT standards/values for some edible vegetable oils under 2.2: Fats, oils and Fat emulsions as per FSSA 2006 shown in Table1.The results obtained for the % oil content and BTTT for the groundnut oils

obtained from four different seed varieties are shown in Table 2 and Fig 1.

Table 1 Shows BTT standards/values for some edible vegetable oils under 2.2: Fats, oils and Fat emulsions as per FSSA 2006[5].

Sr.no	Item no	Vegetable oil	BTT limits
1	2.2.1.2	Cotton seed oil	19.0 -21.0^{0}C
2	2.2.1.3	Groundnut oil	39.0-41.0^{0}C
3	2.2.1.6	Rape seed oil /mustard oil (toria oil)	23.0-27.5 ^{0}C
4	2.2.1.7	Rape seed oil or Mustard oil-Low erucic acid	Not more than 19.0^{0}C
5	2.2.1.8	Virgin olive oil	17.0^{0}C Max
		Refined olive oil	17.0^{0}C Max
6	2.2.1.10	Safflower seed oil (barrey ka tel)	Not more than 16.0^{0}C
7	2.2.1.12	Til oil (Gingelly/sesame oil)	Not more than 22.0^{0}C
8	2.2.1.13	Niger seed oil (sargiya ka tel)	25.0-29.0^{0}C
9	2.2.1.17	Almond oil	Not more than 60.0^{0}C

Source-FSSA 2006

Table 3 Accuracy on % oil content, BTTT values for different varieties of Groundnut

Groundnut Variety		%Oil Content*	S.D	C.V. %	SEM	BTT*^{0}C	S.D	C.V. %	SEM
High Oil Yielding varieties	Cr	43.79	1.07	2.39	0.62	40.8	0.1	0.24	0.06
	Cd	42.73	0.5	1.16	0.29	40.5	0.17	0.43	0.1
Low Oil Yielding varieties	Ps	36.72	1.01	2.6	0.58	39.6	0.1	0.26	0.15
	Kr	37.95	1.01	2.89	0.58	39.4	0.1	0.26	0.1

* Each value is averages of three measurements, SD-Standard deviation, CV-coefficient of variation, SEM-standard mean error

Descriptive statistics of different groundnut varieties from different parts of India as shown in figure1

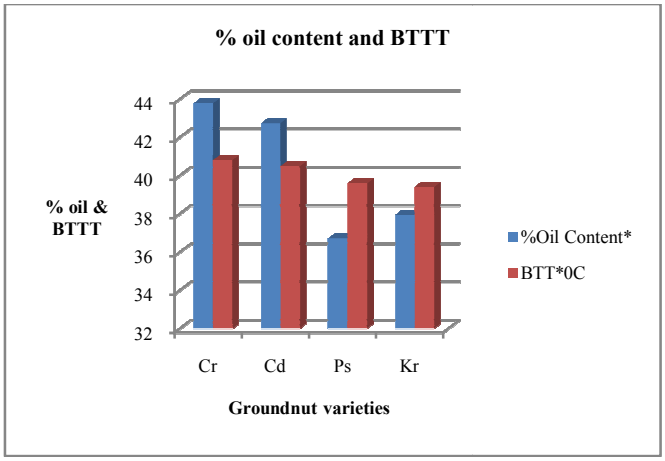

Figure 1 shows the oil content and BTTT values for different groundnut varieties

Low oil yielding groundnut seed varieties (% oil content: 35-40%) such as Ps and Kr exhibited BTT in the range of 39.4 to 39.6°C. High oil yielding groundnut seed varieties (% oil content: 41-44%) such as Cr and Cd displayed BTT in the range of 40.5 to 40.8°C.As all the reported BTTT values are average of three readings, the results have demonstrated the reproducibility of the analysis data. Thus the present investigations prove with due certainty the applicability of BTTT to all four groundnut seed varieties. In particular, high oil yielding varieties were also observed to follow BTTT. Table 2 shows the accuracy, In case of oil yield, G10G, the standard deviation and coefficient is in the range of 0.5-1.07 and 1.16-2.89 while in case of BTTT it is 0.1-0.26 and 0.24-0.67.

Future prospects ahead

Further investigations may be required to analyses the influence of seasonal variations on BTTT. Wherever required, BTTT analysis can be easily supplemented with GC and HPLC analysis, which provide the quantitative data on presence of high molecular weight fatty acids in groundnut oils.

CONCLUSION

In this study BTTT is applied on groundnut oils and found that BTTT can be easily used as qualitative tool for identification of purity of groundnut oil from different seed varieties. because BTTT method is cheaper, easier, requires little laboratory infrastructure and recognized as a convenient qualitative tool for identification of different variety of oils. This study also confirms reliability, reproducibility and diverse applicability of BTTT.

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