IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 6, Issue 7, July 2019

Scientific Evaluation of Identification of Mustard Oils of Different Brands Available in Markets of India Using Bellier Turbidity Temperature Test (BTTT)

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Abstract: In this study an attempt has been made to investigate the applicability of BTTT to mustard oils obtained from different parts of India and thereby examine the influence of geographical variations on BTTT. In the present work, the mustard oils of different brands used for analysis, such as Kacchi ghani mustard oil (Kgmu, Dalda), Kacchi ghani mustard oil (Kgmu1, Mahakosh), Kacchi ghani mustard oil (Kgmu3, Dhara), premium kacchi ghaani mustard oil (Pmukg, RRO Mustdil) and refined mustard oil (Rmu, Dhara) exhibited BTT in the range of 19 to 21.0 0C. The result have demonstrated the reproducibility through the analyzed data. Hence It is observed that mustard oil fulfils BTTT values as per Regulation (Food Products and Standards) 2011 of Food Safety Standards and Act 2006. The coefficient of variation is in between 0.24-0.43 in case of BTT. 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.

Keywords: Vegetable oil, mustard seed oil, Purity, BTTT

I. INTRODUCTION AND OBJECTIVE

Mustard seed is the second most important oil seed crop in India after soybean. It accounts for nearly 20-22% of the total oilseeds produced in the country. Mustard seed is grown with a different consumption pattern in the country. Indian mustard is mainly used for extraction of mustard oil while black mustard is mainly used as a spice. White mustard is used as fodder crop or as green manure. India is the fourth producer of mustard seed contributing to around 11 % of world's total production. The production in India has been witnessing an increasing trend since the 2001-2014 decade due to increasing usage of mustard seed oil in food. Moreover, strong domestic demand for mustard seed oil was also one of the reasons for rise in production. European Union (27) is the leading producer of mustard seed in the world accounting for 35% of the world production - followed by Canada (21%), China (22%) and India (11%) (Mustard crop Survey Report 2014-15).In India, mustard seed is mainly grown in North West parts of India. Rajasthan and Uttar Pradesh are the major producing States in the country. The production from Rajasthan is highly monsoon dependent. The other significant producers are Madhya Pradesh, Haryana, Gujarat, West Bengal and Assam [7].

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, unsaponifable 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 mustard oil, Bellier Turbidity Temperature Test (BTTT) (acetic acid method) is used as a qualitative method for identification of pure mustard oil. Sometimes it is observed that mustard oil fulfils all specifications of refined oil but fails to pass BTTT. Moreover Mustard from different geographical locations differs in oil content. The Bellier figure or the temperature at which turbidity appears in a specified and neutralised 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. 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 % [5].

The objective of the present studies was to investigate the applicability of BTTT to different brands of mustard oils available in Indian markets obtained from different parts of India and thereby examine the influence of geographical variations on BTTT as tool for identification of mustard oil.

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1.2 Literature review

The area and production of mustard seed have been increasing consistently. Being an important source of oil and protein meal, mustard seed is grown across the world. The area of mustard seed has decreased from 36.30 million hectares to 36.15 mil-lion hectares in 2013-14. It has decreased by 0.5% as compared to previous year while the production has increased from 62.91 million tons to 67.92 million tons with a CAGR of 11% during the period 2013-14. European Union (27) is the leading producer of mustard seed in the world accounting for 35% of the world production followed by Canada (21%), China (22%) and India (11%). EU, China and Canada all together account for 82% of the world mustard seed production during 2013-14.

Edible Oil production in India has increased at a CAGR of 2.6% over past six years led by growth in Soybean Oil (3.4%) and Rapeseed Oil (3.8%) Mustard oil processing in India is an unorganized business. There is 7,000-9,000 oil extracting units out of which only 20 per cent are registered in the organized sector. The industry has an installed capacity to process 23 lakh tonnes annually. Mustard oil consumption is increasing at a rate of 20 per cent every year. Demand for mustard oil comes from rural areas and is consistent owing to its multi-uses.

The rapeseed-mustard varieties/hybrids contain 40-45 per cent oil. But its recovery, realized by the mechanical crushing processor (oil expeller) the largest segment of edible oil processing industries, is up to 35 per cent only. Under this process of oil extraction, substantial amount of oil (5-10 per cent) is left in the rapeseed-mustard seed meal. Even if 3-4 per cent of this leftover oil can be extracted by modernizing the mechanical crushing units, then at least 2-2.5 lakh tonnes additional edible oil could be made available.

The industry requires modern technology and also appropriate technology to reduce the content of erucic acid and pungency to make the oil more acceptable among consumers and tap export potential. For the record, production of mustard/rapeseed, a winter crop cultivated in the northern States was 8.028 million tonnes last year with the crop sown on 6.362 million hectares. Rajasthan is the major producer contributing up to 47 per cent of the domestic production, followed by Madhya Pradesh (11.44 per cent), Haryana (12 per cent) and Uttar Pradesh (10.41 per cent)[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 [5].

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 mustard 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 [2].

Table-1 Shows BTT standards/values for some edible vegetable oils under 2.2: Fats, oils and Fat emulsions as per FSSA 2006[3]

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 FSSA2006

The following table2 shows that the imposition of BTT values to raise the issue pertaining to the discrepancy in BTT for the presence of other vegetable oils (Admixtures of oils) in mustard oil[7].

Sr No	Name of Oil	Prosecution against	Year	UnderPFA/FSSA Parameter to fail	BTT
1	Mustard oil	Netai Chandra and others verses Corporation of Calcutta of W.B.	1965	BTT and others	Exceed the maximum requirement
2	Mustard oil	Santosh kumar Datta verses Chairman sapatgram small town	1974	BTT and others	Exceed the maximum requirement

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3	Mustard oil	Jitamal maheshawari& others verses State of Assam	1993	BTT and others	Exceed the maximum requirement
4	Mustard oil	Santosh kumar verses municipal corporation Calcutta	2000	BTT and others	Exceed the maximum requirement
5	Mustard oil	Sh. Natturam verses the state of New Delhi administration	2012	BTT and others	Exceed the maximum requirement
6	Mustard oil	Ramkumar verses state of Haryana	2016	BTT and others	Exceed the maximum requirement

All the above mustard oil samples did not conform to the standards laid down for the mustard oil under Prevention of food Adulteration Act 1954 and rules and Food safety standards Act2006 and rules and regulations, thereof, in that BTT values exceeds the maximum requirement of 27.50C.

1.3. Material and Experimental procedures

1.3.1 Materials

All the chemicals and reagents were analytical grade and used as received. Five mustard oils of different brands such as Kacchi ghani mustard oil (Kgmu,Dalda), Kacchi ghani mustard oil (Kgmu1,Mahakosh), Kacchi ghani mustard oil (Kgmu3,Dhara), premium kacchi ghaani mustard oil (Pmukg, RRO Mustdil) and refined mustard oil (Rmu,Dhara) were gathered from super market of different places of India. all these brands were in different forms of packaging while some were in poly packs ,jar, tin and tetra pack. Since these five mustard mustard oils were easily available for procurement. These different mustard oils are used in the investigations on BTTT in this research study.

1.3.2 Experimental procedures

1.3.2.1 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, neutralised 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 [1,4].

Table 2: BTTT of different mustard oils with accuracy on BTT

Sr.No	Name of oil	Brand name	Code	BTTT*	SD	CV%	SEM
1	Kacchi ghani mustard oil	Dalda	Kgmu	26.9	0.26	0.98	0.15
2	Kacchi ghani mustard oil	Mahakosh	Kgmu1	27.2	0.26	0.97	0.15
3	Kacchi ghani mustard oil	Dhara	Kgmu2	27.4	0.17	0.63	0.1
4	Premium Kacchi ghani mustard oil	RRO Mustadil	Pmukg	27.5	0.16	0.57	0.1
5	Refined mustard oil	Dhara	Rmu	24.8	0.26	1.06	0.15

***Each value is averages of 3 measurements, SD-standard deviation, CV-coefficient of variance, SEM-standard mean error**

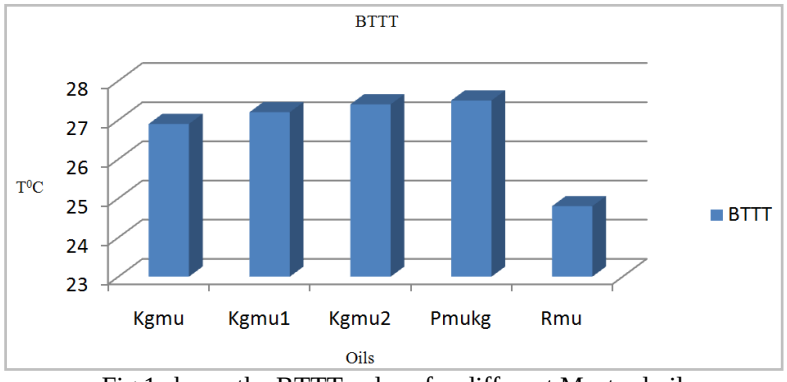

Fig.1 shows the BTTT values for different Mustard oil

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Vol. 6, Issue 7, July 2019

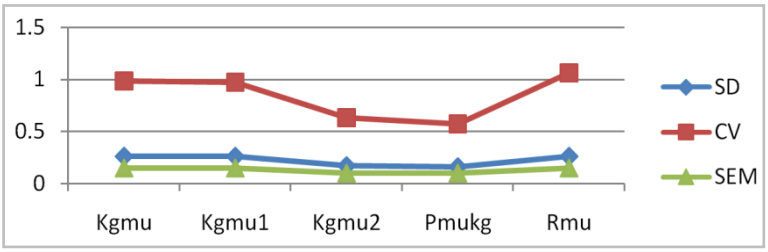

Fig.2 shows the statistical values for different Mustard oil

II. STATISTICAL ANALYSIS

The data obtained from the experimental measurements and accuracy of BTTT for different brands of mustard oils 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 mustard varieties from different parts of India as shown in figure1 and 2.

III. RESULT AND DISCUSSION

The results obtained for BTTT from the mustard oils obtained from different places of India are shown in Table3.The prescription of the BTT test created some example of prosecution under prevention of food adulteration act 1954 and food safety act, rules and regulations 2011 and shows that the imposition of BTT values to raise the issue pertaining to the discrepancy in BTT for the presence of other vegetable oils (Admixtures of oils) in mustard oil [6]. The results obtained for BTTT for the mustard oils from five different brands of mustard oil from different places of India are shown in Table3. The data obtained from the Rmu (23.8), Mu(27.5),Mutf (27.1),Mu1(27.2) and Mu2(26.7) were displayed BTT in the range of 23.8 to27.5°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 the five mustard oils. Table 3 also shows the accuracy, the standard deviation and coefficient is in between 0.2 -0.26 and 0.73-1.03.

IV. CONCLUSION

The BTTT method is cheaper, easier, requires little laboratory infrastructure and recognised as a convenient qualitative tool for identification of different variety of oils. In this study BTTT is applied on mustard oils and found that BTTT can be easily used as qualitative tool for identification of purity of mustard oils from different seed varieties. The present investigations prove with due certainty about applicability of BTTT to all five mustard oils. In particular, high oil yielding varieties were also observed to follow BTTT. This study also confirms prove reliability, reproducibility and diverse applicability of BTTT. 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 mustard oils.

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