

Investigations on Bellier Turbidity Temperature Test (BTTT) for Judging the Purity of Different Brands of Mustard Oil Available in Market of India

Dr. Shashikant Pardeshi

Scientific Officer, DPHL, Jalgaon, Maharashtra, India

ABSTRACT: 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. In this study an attempt has been made to investigate the applicability of BTTT to different brands of 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 used for analysis, such as Refined mustard oil (Rmu, Tez) , Mustard oil (Mu, Dabur), Mustard oil twice filtered (Mutf, Gold star), Mustard oil (Mu, Gulab) and Mustard oil (Mu, P-Mark) exhibited BTT in the range of 23.8 to 27.5 OC. The result have demonstrated the reproducibility through the analyzed data. Hence It is observed that Mustard oils fulfils BTTT values as per Regulation (Food Products and Standards) 2011 of Food Safety Standards and Act 2006. In case of BTTT, The standard mean error is in between 0.12-0.26.

KEYWORDS: Vegetable oil, Mustard oil, Purity, BTTT.

I. INTRODUCTION

Mustard Oil may provide a protective effect in connection with patients having acute myocardial infarction, possibly due to the presence of α -linolenic acid. It has been found that the omega-3 PUFA present in rapeseed/mustard oil reduces the risk of chemically induced cancer^[9]. However; higher levels of erucic acid are unsuitable for human consumption. Oils having low erucic acid are recommended for human consumption because oils high in erucic acid may cause an accumulation of triacylglycerol in the hearts of animals. The major source of erucic acid is seed oils of the Crucifereae family, which includes rapeseed, mustard, crambe and wallflower. The erucic acid is known very crucial raw material for oleo chemical industry. Erucic acid and its derivatives possess varieties of superior properties in slipping, softening, antifoaming, emulsifying, and corrosion inhibiting. All these properties offer erucic acid and its derivatives wide applications in the production of pharmaceuticals, soaps, detergents, cosmetics, plastics, lubricants, rubbers, coatings^[6].

The characterisation of fats and oils is dictated by several physical such as texture, density, specific 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 mustard oil, **Bellier Turbidity Temperature Test (BTTT)** (acetic acid method), is used as a qualitative method for identification of pure mustard oil. Mustard oil has distinctive pungent taste, characteristic of all plants in the mustard (Brassicaceae) family. It can be produced from black mustard *B. nigra*), brown Indian mustard (*B. Juncea*) and white mustard (*B. hitra*). The characteristic pungent flavour of mustard oil is due to allyl isothiocyanate. Mustard oil has about 60% monounsaturated fatty acids, 42% erucic acid and 12% oleic acid. it has about 21% polyunsaturated fats (6% omega-3 alpha Linolenic acid and 15% omega-6 linoleic acid and it has about 12% saturated

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fats. 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 different variety of oils and admixture of oils. In most cases the Bellier figure increases with the % of vegetable oil in the mixture. The increase is not proportional and there is a steep rise for the % of the respective oil below 25 %^[5].

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

II. RELATED WORK

Rapeseed-mustard (Brassica species) is the major rabbi oilseed crop of India. Mustard seed is the second most important oil seed crop in India after soyabean accounting for nearly 20-22% of the total oilseeds produced in the country. India is the fourth producer of mustard seed contributing to around 11 % of world's total production. Rajasthan is the most giant mustard growing state and alone contributes 43% of the total mustard seed production in India^[7].(Mustard crop Survey Report 2014-15). The Indian agriculture is considered to be the backbone of Indian economy. The agricultural sector is the largest employer in India's economy and employed 49% of its total workforce in 2014 but contributes to a declining share of its GDP (17% in 2013-14).A large number of important industries like jute, textiles, edible oils, tobacco, sugar, etc receives the raw materials produced by agriculture sectors. Edible oilseeds are an essential part of Indian agriculture and contribute more than 10percentto agriculture GDP. Soybean, mustard and rapeseed-mustard are the major oilseed crops in India contributing nearly 79% and 88% to its total acreage and production, respectively. During 2012-13, rapeseed-mustard contributed 24.2 % to the total oilseeds production. Globally, India account for 19.29 % and 11.27% of the total area and production of mustard^[8]. (USDA 2013).Edible Oil production in India has increased at a 2.6% over past six years led by growth in Soybean Oil (3.4%) and Rapeseed Oil (3.8%).

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^[2].

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^[5].

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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 table 2 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^[10]

Sr. No	Name of Oil	Prosecution name	Year	Under PFA/FSSA Parameter to fail	BTT
1	Mustard oil	Bichitrananda nayak verses state of Orrisa	1977	BTT and others	Exceed the maximum requirement
2	Rapeseed oil	Murtuza ali mehboobali merchant verses State of Gujrat	2001	BTT and others	Exceed the maximum requirement
3	Mustard oil	State of Delhi adminisrtation verses sh.Kailash chand	2012	BTT and others	Exceed the maximum requirement
4	Mustard oil	Girish Mohan stores vreses , New Delhi administration	2016	BTT and others	Exceed the maximum requirement
5	Mustard oil	Mukesh verses State of Haryana	2017	BTT and others	Exceed the maximum requirement
6	Mustard oil	Mukeshkumar agrawalverses states of Bihar	2018	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 falls above the maximum requirement of 27.5⁰C.

III. MATERIAL AND METHODS

Materials

All the chemicals and reagents were analytical grade and used as received. Five mustard oils of different brands such as refined mustard oil (Rmu, Tez) , mustard oil (Mu, Dabur), Mustard oil twice filtered (Mutf, Gold star), Mustard oil (Mu1, Gulab) and Mustard oil (Mu2, P-Mark) 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 oils were easily available for procurement. These different mustard oils are used in the investigations on BTTT in this research study as per the Food product Standard and food additives Regulation 2011.

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Experimental Methods

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].

IV. EXPERIMENTAL RESULTS

Table 3: BTTT of different mustard oils with accuracy on BTT

Sr.No	Name of oil	Code	Brand name	BTTT*	SD	CV%	SEM
1	Refined Mustard oil	Rmu	Tez	23.8	0.24	1.03	0.2
2	Mustard oil	Mu	Dabur	27.5	0.2	0.73	0.12
3	Mustard oil twice filtered	Mutf	Gold star	27.1	0.26	0.98	0.15
4	Mustard oil	Mu1	Gulab	27.2	0.2	0.74	0.12
5	Mustard oil	Mu2	P-mark	26.7	0.26	0.99	0.15

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

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^[10]. 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.

V. 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. Fig.1shows the BTT values and Fig.2 shows the accuracy, the standard deviation and coefficient is in between 0.2 -0.26 and 0.73-1.03.

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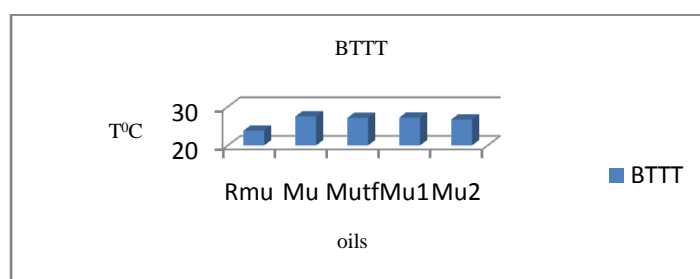


Fig.1 shows the BTTT values for different Mustard oil

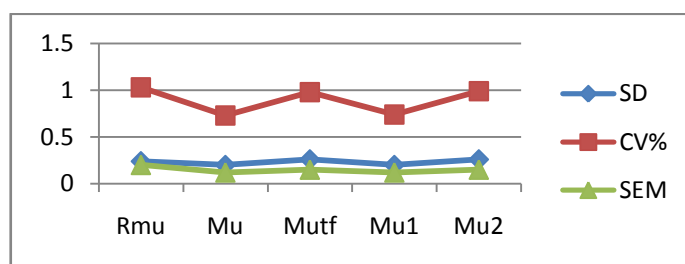


Fig.2 shows the statistical values for different Mustard oil

VI.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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