International Journal of Research in Engineering, Science and Management
Volume-3, Issue-8, August-2020
journals.resaim.com/ijresm | ISSN (Online): 2581-5792 | RESAIM Publishing

Analytical Criteria for Identification of Purity of Safflower (*Carthamus tinctorius* L.) Oil

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***Abstract*: The qualitative tool for identification of purity of different variety of oils using BTTT which is cheaper, easier, requires little laboratory infrastructure. In this research study BTTT is applied on safflower oils which are collected from different places of market and found that BTTT can be easily used as qualitative tool for identification of purity of safflower oil. In the present investigation, four different brands of safflower oil such as sf (14.9), sf1(14.4), fsf (15.9) and cpsf (15.7) were analysed for BTT using standard procedures. The BTT values were in the ranged between 14.4 to 15.9^{0}C. From experimental results, it is concluded that all the different brands of safflower oils found that within norms as per the Food Safety Standards and Act 2006 of (Food Products Standards and food additives) Regulation 2011.**

***Keywords*: BTTT, Safflower seed oil, Vegetable oil.**

1. Introduction and Objective

Edible oils are derived from a wide variety of plants and plant seeds and are used in many aspects of domestic and world-wide food production. Once the oil has been extracted from a plant seed, it is refined as needed for use in foods such as salad dressings, margarine, shortenings, snack foods and frying oil. Edible oils are extracted and processed world-wide and hence are important domestic and international commodities. Edible oils are very important food for word. The human body uses oils and fats in the diet for three purposes, as an energy source, as a structural component and to make powerful biological regulators. Oils and fats also play an important role in metabolic reactions in the human body. Oils and fats contain fatty acids, which are susceptible to attack by light, oxygen, metals, etc. [1]-[3].

Vegetable oils are triglycerides extracted from plants. Edible vegetable oils are used in food, both in cooking and as supplements. The worldwide application of vegetable and seed oils for both domestic use (cooking oil) and as industrial raw materials is on the increase. Pharmaceutical industries use oils as either additive or as raw material in drug production. Oils are used as raw materials in paint production while the cosmetic industries use oils for different products. Safflower (*Carthamus tinctorius* L.) is an important *Rabi* oilseed crop of Maharashtra and belongs to the family of Asteraceae. It contains a small amount of oleic acid, linoleic acid, linolenic acid, flavonoids, amino acids and polysaccharides. India ranks first in area (51 %) and production (37 %) in the world. Safflower originated in the Fertile Crescent region over 4000 years ago and was domesticated in the Far East, India, Pakistan, the Middle East, Egypt, Sudan, Ethiopia and Europe [4]. Kostik *et al*., (2012) studied that safflower is a traditional crop of India, primarily grown for extraction of edible oil from seeds. It also has variety of other uses including poultry feed, extraction of natural dye from petals and preparation of industrial and pharmaceutical products. Standard safflower oil is healthy oil with high amount of polyunsaturated fatty acid (PUFA), linoleic acid and high ratio between polyunsaturated and saturated fatty acids among edible oils. Safflower is also a good source of monounsaturated fatty acid (MUFA) and oleic acid (monounsaturated, MUFA) which is more stable and preferred for deep frying applications in the food industry [5].

The characterisation of vegetable fats and oils is determine by physicochemical and oxidative parameters such as texture, density, specific gravity, viscosity, colour, refractive index, melting point ,Flash point, fire point, acid value, iodine value, saponification value, ester value, peroxide value, P-anisidine test, Totox test, unsaponifable matter and BTT are dependent on several factors including the plant variety, the degree of its maturation, pedoclimatic factors, farming practices, the oil-extraction method utilised and the storage conditions. Safflower oil has been characterised in different regions of the world, and several experiments have demonstrated variability in its composition due to the soil and climatic conditions. In present research work on characteristics of safflower oil, the identification of purity of safflower oil can must assess quantitatively by using Bellier Turbidity Temperature Test (BTTT) (acetic acid method), based on insolubility of saturated acid is used as a qualitative method for identification of pure safflower oil. The solubility of oils in various solvents is a constant, depending on the nature of the glycerides composing the oil. Moreover, safflower seed from different geographical locations differs in oil content (27-32%).

The aim of the present work was to investigation focused on BTTT and analyse different brands of commercial safflower oils obtained from different parts of India and BTTT as analytical tool for identification of purity of safflower oil, to assess the quality and compared the assessed value with existing standards.

A. Related Work

Worldwide the primary use for safflower is edible seed oil for use in cooking, salad oils and margarine. The meal left over after extraction of oils from seeds can be used as a stock feed for cattle and other livestock. The meal is unsuitable for monogastric animals such as swine and poultry, due to hulls not being removed resulting in a high fibre content (30–40%).Cultivated varieties of safflower range in seed oil content from 20–45% of the whole seed. Public awareness about the health benefits of certain fatty acids has already made safflower an important crop for the vegetable oil market[6].There are two groups of safflower cultivars differing in seed oil composition, characterised by high linoleic acid (70–75% of total fatty acids) and high oleic acid (70–75%)[7].Commercial safflower cultivars grown in Australia are either those high in the monounsaturated fatty acid, oleic acid or those high in the polyunsaturated fatty acid, linoleic acid. The safflower varieties that are high in oleic oil are used as heat stable cooking oil, cosmetics and infant food formulations. The linoleic oil varieties contain nearly 75% linoleic acid which is used for edible oil products such as salad oils and soft margarines [8].

Johnson et al. (1999) studied that oil content of the safflower accessions in the USDA germplasm collection ranged from 13 to 46% and the linoleic or oleic levels ranged from 11 to 83.1% and 6.2 to 81.9%, respectively. Seed oil content and quality is influenced by various correlated seed traits. For instance, hull content is an important factor that influences the seed oil content in safflower [9]. Rangarao et al. (1977) reported that safflower oil content is negatively correlated [10]. Hu *et al*. (2013) studies clearly demonstrate that a detailed understanding on the relationships among various seed traits in relation to oil content would help to identify a combination of traits that could be used in crop improvement programme for selecting plants with high oil content without compromising other desirable agronomic attributes. However, the morphological, protein, fatty acids and physiological traits are highly influenced by the environments, which is a major limitation of using these correlated traits in plant selections [11].

2. Material and Experimental Procedures

A. Procurement of Materials

Different brands of safflower oils such as safflower oil (sf, Annapurna), safflower oil (sf1, Govinda), filtered safflower oil (fsf, Harakh) and cold pressed safflower oil (cpsf, Smart swad) were procured from local market of different places of India. Most of the brands of oils have mentioned label as per the food safety guidelines such as food safety authority license numbers, nutritional values, green vegetarian logo, best before used in between 6-12 months, free from argemone on their packs. In this research study, Bellier turbidity temperature test is used for analytical criteria for identification of purity of different safflower oils. All the chemicals and reagents used in this research work are of analytical grade.

B. Experimental procedures [12]-[14]

1) Measurement of Bellier turbidity temperature acetic acid method

One ml of the filtered sample of oil of safflower oil taken in a flat-bottom 100 ml round flask, dissolved in 5ml of 1.5 N alcoholic potash heating over a boiling water bath using an air condenser for complete saponofication. After cooling, using phenolphthalein indicator neutralised by dilute acetic acid (1:2) and add extra amount of 0.4 ml. Add 50 ml of 70% alcohol and mixed well. Heat and allow the flask to cool in air with frequent shaking. 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. Triplicate determination of the turbidity temperature can be carried out.

3. Experimental Results of BTT Values of Different Brands of Safflower Oils

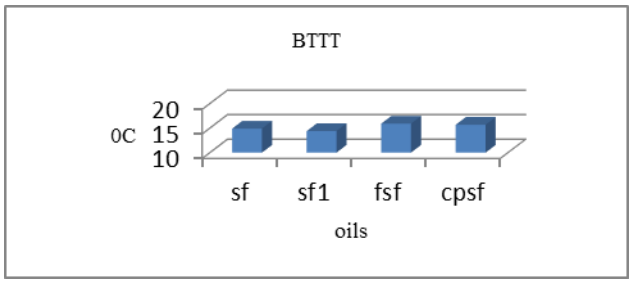

Fig. 1. Plot of different safflower oils against obtained BTT values

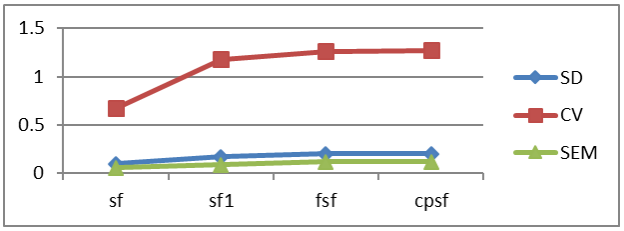

Fig. 2. Graphical representation of obtained statistical values for different safflower oils

4. Result and Discussion

All results of BTT values determined are shown in Table 1. When the different brands of safflower oil samples obtained from the local markets have been examined for identification of purity using BTT. The obtained results of average of triplicate

Table 1
The obtained experimental results of BTTT of different safflower oils

S. No.	Oil Code	BTTT*	Standard BTT value	Standard Deviation	Coefficient of Variance	Standard mean error
1	Sf	14.9	Not more than 16^0C	0.1	0.67	0.06
2	sf1	14.4		0.17	1.18	0.09
3	Fsf	15.9		0.2	1.26	0.12
4	Cpsf	15.7		0.2	1.27	0.12

reading of BTT of the different safflower oil samples are compared with standard BTT value. All the BTT values had slightly lower are illustrated in Table 1and statistical accuracy for the safflower oils are shown in figures 1-2. In this study, it is seen that, the results showed that in the range of 14.4-15.9(±0.1-0.2).

The data obtained for safflower oil code such as sf 14.9 (±0.1), sf114.4 (±0.17), fsf15.9 (±0.2) and cpsf15.7(±0.2) are exhibited BTT not more than 16 ^{0}C.

5. Conclusion

The present study concludes with experimental results that the majority safflower oils available in the market of India in pouch or bottle are pure in nature and also conforms to the food safety standards on the basis of BTT values and also indicates that there is no possibilities of adulteration of other vegetable oils in the given safflower oils. The present investigation helps in identification of purity of safflower oils. Hence BTT is the analytical criteria for identification of specific oils.

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