Effect of Temperature Change on the Physicochemical Properties of Taila Preparations with Special Reference to Masha Taila

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Abstract: Taila preparations (medicated oils) are one of dosage forms used in Ayurveda with tila taila as base in maximum cases. In Masha taila, tila taila (sesame oil) works as base. Tila taila contains 14% saturated fatty acids, 33-54% oleic acid and 35-59% linoleic acids. Temperature affects the quality of oil by interfering with physical, chemical and compositional compositions. 1.5-2% of total saturated fatty acids are observed converted to alkanes at temperature of 140-160°C for 8 hours.

Materials and Methods: *The Masha Taila was heated separately at 40°C, 80°C, 120°C, 160°C and 200°C. This was done for 10 samples. Each sample was evaluated for refractive index, specific gravity, saponification value, acid value, ester value and iodine value.*

Result and Discussion: *The color of oil was noted darker with increasing temperature with burnt smell. The means of moisture percentage, refractive index, saponification value, ester value and iodine values revealed decreasing trends with increasing temperature while the mean of acid value of samples was noted increasing with temperature increase.*

The saponification value changes from 188.15 (40°C) to 157.25 (200°C). The saponification value is related with neutral fats and free fatty acids. High temperature causes degradation of saturated fatty acids and that is reflected in saponification value and ester value. The degradation process is also related to ester bond cleavage.

Conclusion: *The results revealed changes in physicochemical properties with increasing temperature.*

Key Words: Taila preparations, medicated oil, masha taila, physicochemical properties....................

Taila preparations (medicated oils) are specific dosage form used in Ayurveda with boiling of prescribed decoctions and fine paste of drugs (kalka) in selected oil[1]. Specific vegetable oils used in preparations work as vehicle to carry the phytochemicals of used decoctions and fine paste. Other than that, these vegetable oils also have specific medicinal properties. Vegetable oils are comprised of triacylglycerols (92-98%), polar lipids (phospholipids and galactolipids), monoacylglycerols, diacylglycerols and minor amounts of free fatty acids and polyisoprenoids[2]. Triacylglycerol means three fatty acid esterified to a glycerol[3]. The physical properties of triacylglycerol are dependent upon specific fatty acids and the actual position occupied by them with the glycerol moiety[3].

Screening of *The Ayurvedic Formulary of India* reveals sesame oil as frequently used oil with some exceptions of other vegetable oils. Sesame oil contains around 14% saturated fatty acids, 33-54% oleic acid and 35-59% linoleic acids[4]. Among the saturated fatty acids, stearic acid and palmitic acids are dominant. Oleic acid and linoleic acid are long chain unsaturated fatty acids[5]. 1.5-2% of total saturated fatty acids are observed converted to alkanes at temperature of 140-160°C for 8 hours, but thermal hydrolysis did not affect unsaturated long chain fatty acids[6].

Thermal treatment is important part of medicated oil preparation. As decoction and paste of medicinal plants and minerals are added in oil depending upon individual medicated oil preparation. Water portions are evaporated and compounds from decoction and paste are trapped in between oil molecules. According to uses, three types of heating treatments are suggested viz., mridu, madhyam and khara[7]. Characteristics of prepared medicated oil based on these heating treatments are suggested. Standardized temperature range is still lacking in official documents. So, uniform practice is lacking while preparing the medicated. The temperature affects the quality of oil[8]. The physico-chemical changes take place at higher temperature. So, in present study *Masha taila* is taken to examine the changes in physicochemical after heating at different temperature range. The reference of *Masha taila* preparation is *Charak Chikitsasthana* 28/98. In *Masha taila, tila taila* (sesame oil) works as base. Other ingredients are decorticated seeds of *Vigna mungo* (Linn.) Hepper and *Saindhav lavana*.

Materials and Methods

The *Masha taila* was procured from pharmacy of ALN Rao Memorial Ayurvedic Medical College (ALNRMAMC). The chemicals used in analysis was from *Nice Chemicals*, Cochin, Kerala. The heat treatment was given using controlled digestor. The *Masha Taila* was heated separately at 40°C, 80°C, 120°C, 160°C and 200°C for 1 hour. This was done for 10 samples. Then, they were cooled and stored in amber colored bottle for chemical analysis. The organoleptic characters were noted for color, odor and appearance. The analysis of samples was done in quality control laboratories, ALNRMAMC, Koppa. Refractive index at 25°Cof all samples were measured using Abbe Refractometer following AOAC[9] method. The moisture percentage, specific gravity at 25°C, saponification value, acid value, ester value and iodine value were determined with procedures mentioned with AOAC (2000)[9]. Ester value was determined from the difference in values of saponification values and acid values[10].

Result and Discussion

The evaluated organoleptic characters were noted based on average color and odor. The appearance was noted as viscous in all the cases. The noted color and odor are as shown in Table Number:1. Mean and standeviation of observations of physico-chemical parameters are shown in Table Number: 2.

Table Number: 1: Color and Odor of *Masha taila* at different temperature

	40°C	80°C	120°C	160°C	200°C
Color	Transparent yellow	Dark transparent yellow	Medallion yellow	Dijon yellow	Dijon yellow
Odour	Characteristic	Characteristic	Slightly burnt	Burnt	Burnt

Table Number: 2: Observations of Physicochemical parameters (Mean ± Standard Deviation)

	40°C	80°C	120°C	160°C	200°C
Moisture percentage	0.44 ± 0.08	0.34 ± 0.06	0.17 ± 0.04	0.02 ± 0.01	0.0 ± 0.0
Specific gravity	0.917 ± 0.021	0.916 ± 0.019	0.912 ± 0.022	0.907 ± 0.032	0.899 ± 0.056
Refractive index	1.469 ± 0.0006	1.469 ± 0.0009	1.461 ± 0.0007	1.455 ± 0.0006	1.449 ± 0.0008
Saponification value	188.15 ± 0.64	187.92 ± 0.82	179.52 ± 0.58	171.11 ± 0.68	157.25 ± 0.88
Acid value	2.25 ± 0.05	2.47 ± 0.07	2.93 ± 0.05	3.18 ± 0.08	3.85 ± 0.08
Ester value	185.89 ± 0.69	185.39 ± 0.85	176.42 ± 0.61	167.94 ± 0.69	153.38 ± 0.89
Iodine value	99.24 ± 0.42	99.18 ± 0.47	97.45 ± 0.37	93.55 ± 0.42	89.68 ± 0.55

Chart Number: 1: Trend of Temperature Effects on Moisture Percentage

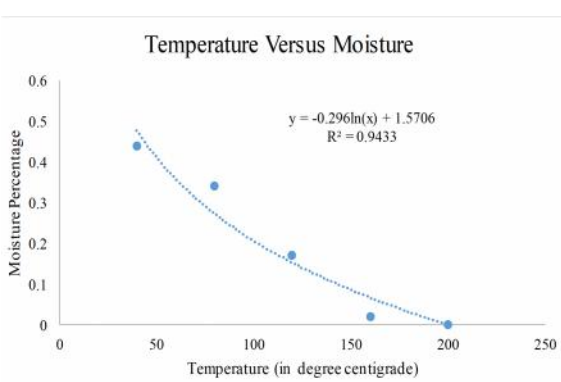


Chart Number: 2: Trend of Temperature Effects on Specific Gravity

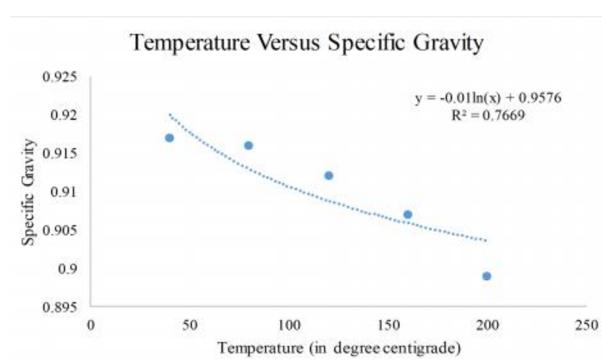


Chart Number: 3: Trend of Temperature Effects on Refractive index

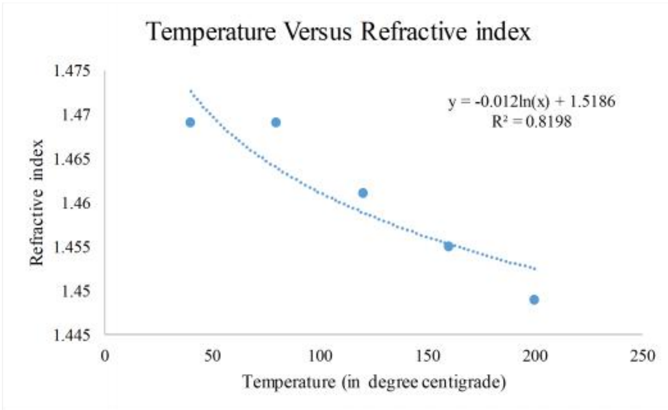


Chart Number: 4: Trend of Temperature Effects on Saponification value

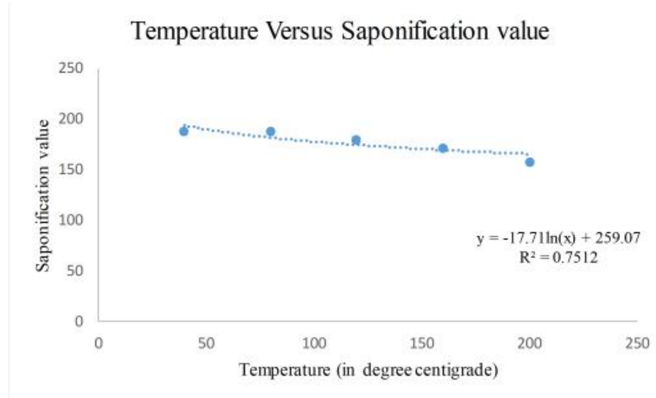


Chart Number: 5: Trend of Temperature Effects on Acid value

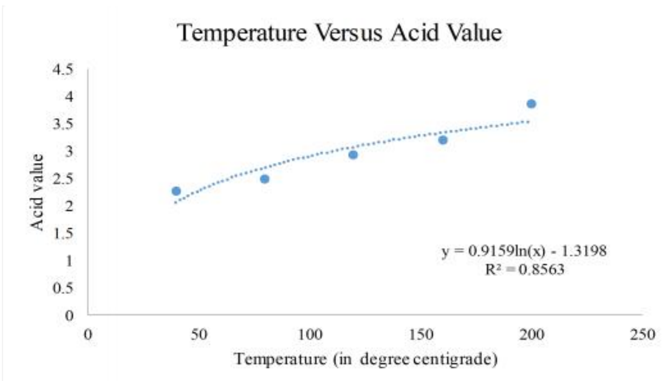
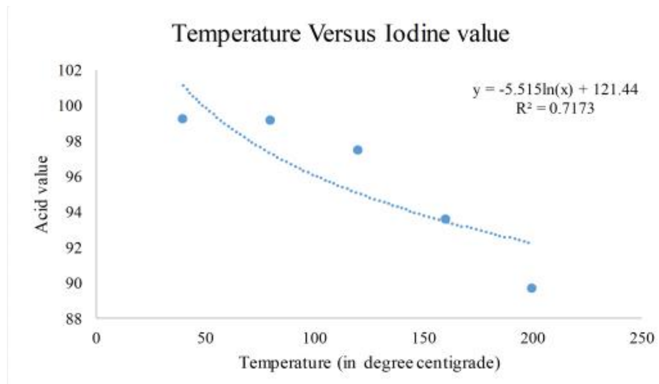


Chart Number: 4: Trend of Temperature Effects on Iodine value



The temperature is inversely related to moisture content of *Masha taila*. In present study 0.17% moisture content was noted at 120°C. The energy required to vaporize the amount of water in oil is more than same amount of free water. The additional energy is isoteric net desorption heat[11,12]. So, higher heat was required to make moisture 0%.

The specific gravity was observed decreasing with increasing temperature. At higher temperatures, the kinetic energies of molecules increase and molecule occupy a larger volume, this causes a decrease in specific gravity/density. Less density at higher temperature causes light to travel faster, this decreases the refractive index as it was noted in temperature relation with refractive index.

The trend of saponification value was observed decreasing with rise of temperature. The saponification value changes from188.15 (40°C) to 157.25 (200°C). Saponification value is related with neutral fats and free fatty acids. The value increases with decreasing average molecular weight of fatty acids[13]. It means shorter the chain length, higher is saponification value. High temperature causes degradation of saturated fatty acids[6] and that is reflected in saponification value and ester value. The degradation process is also related to ester bond cleavage[14]. So, ester value was also observed inversely related to temperature. Breaking of triglycerides increases the number of free fatty acids. The reason is evident for increased acid value with temperature increase as acid value corresponds to free fatty acids.

The iodine value of oils is measure of relative degree of unsaturation in oil components[15]. Saturated oils do not take iodine. Only double bond or triple bond unsaturated oils or fats become reactive to take iodine. Iodine value is percentage of halogen weight combining to fats[16]. The iodine value of *Masha taila* decreased from 99.24 (40°C) to 89.68 (200°C).

Sesame oil as base of *Masha* taila contains 33-54% monounsaturated fatty acid (oleic acid) and 35-59% polyunsaturated fatty acid (linoleic acids)[4,17,18]. As heating is started in process of preparation, the moisture from steam forms steam, which evaporates. A weak nucleophile of water also attacks the ester linkage[19,20]. 50kcal/mole is energy required to break carbon-hydrogen bond of carbon 11 in linoleic acid and 75 kcal/mole is required at carbon 8 or 11 oleic acid[20]. In medicated oil, various functional groups from compounds of decoctions and paste of added ingredients get attached. At higher temperature further weakening ester linkages and increasing hydrolysis (decreasing saponification value, ester value and iodine value) and peroxidation (increasing acid value) increases. This causes degradation of oil and bad smell. Degraded medicated oil and burnt smell are also a result of improper decoction, lack of temperature control, infrequent stirring etc.

Conclusion: The results revealed the changes in physicochemical properties of *Masha taila*. Moisture, specific gravity, saponification value, ester value and iodine value decreased with increasing temperature while acid value was noted increasing. A detailed study is required to find the chemical changes occurring at different temperature and to establish the medicinal effects relationship with those changes.

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Conflict of Interest: None

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