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Formulation and evaluation of wild apricot kernel oil based massage cream

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Abstract
Apricot oil extracted from wild apricot kernels with low acid value, rich in vitamin E and fatty acid was selected as the base material for the optimization of formulations of apricot based massage cream. The massage cream was developed by different concentration of oil and was compared with the commercially available apricot cream, on the basis of quality characteristics, functional properties, sensory and any adverse effects on skin. The massage cream containing 10 to 15 per cent of oil as a base material was found better on the basis of quality characteristics i.e. viscosity (28001 & 37350 cps), total fatty matter (13.90 &15.01 per cent), vitamin E (32.195 & 35.145mg/100g) and sensory qualities i.e. good spread ability and medium emollient and functional properties i.e. thermal stability and oil-in-water emulsion as per the BIS standards. Thus, on the basis of present studies, the formulation of 10-15% vitamin E rich wild apricot kernel oil can be utilized for the development of massage cream.

Keywords: Wild apricots, kernel oil, massage cream, vitamin E, functional properties

Introduction
Wild apricot (*Prunus armeniaca* L.) is an important tree borne oilseed of mid hills and dry temperate regions of the country (Kate et. al. 2014) [15] It belong to the family *Rosaceae* and sub-family *Prunoidea.* In the Himalayan region of the country, local communities known it by different vernacular names viz. "Chulli", "Shara", "Khurmani","Chulu", Khubani and Chuari (Yadav 2015) [33]. In India, it is mainly grown in the temperate regions of Jammu and Kashmir, Himachal Pradesh and Uttrakhand ranging from 2000 to 2500 metres above mean sea level (Parmar and Sharma, 1992; Sharma, 2000) [20, 26]. The wild apricot is unfit for table purpose due to high acids and low sugars. The remaining part of the fruit is the stone which contains two types of kernels; with sweet kernel known as *Nyarmo* and bitter kernel known as *Khante* (Yadav *et al*., 2011) [32]. The bitter kernels are rich source of oil (38-45%), protein (17.75 to 22.56%), carbohydrates (21.16 to 35.26 %), crude fibre (0.84 to 4.71%) and dietary fibre (6.03 to 22.24 %). The oil contains 13.70 per cent saturated and 86.00 per cent unsaturated fatty acid (Femenia *et al*., 1995). It contains 60.00-70.90 per cent oleic acid, 20.00-30.00 per cent linoleic acid, 4.00-4.50 per cent palmitic acid, 1.00-1.24 per cent stearic acid, 0.08-0.13 per cent linolenic acid, and 0.10-0.12 per cent arachidic acid (Ozkal *et al*., 2006; Ramadan *et al*., 2011; Sharma *et al*., 2012) [18, 21, 28].
Cosmetics are the substances applied to the human body for cleansing, beautifying, perfuming or changing the appearance and must not cause damage to human health (Chanchal and Swarnlata, 2008) [8]. The oil is the major constituent in cosmetic products and among different cosmetic products; the demand for personal care products is increasing in day to day life of people. The apricot kernel oil is reported to be good for all skin types including the aged skin and skin that is dry or irritate, since it does not leave any oily film on the skin due to its fatty acid composition (Anonymous, 2003b) [3]. Oil has been reported for medicinal and pharmaceutical preparations and is having good anti-microbial, anti-septic, anti-oxidant, anti-ageing, anti-bacterial and emollient characteristics. Thus, the cosmetics and pharmaceutical industries have come up with tremendous utilization of natural oils like apricot oil, almond oil, coconut oil etc. The utilization of this medicinal valued oil in cosmetic is one of the latest approaches made to increase its economic value in the market and providing boost to the growers in the latest emerging cosmetic world.

Materials and Methods
Raw Materials
The Apricot kernel oil is extracted from the bitter kernels as per the standard procedure (Gupta and Sharma, 2009) [12]. The commercial massage cream used as reference and packaging material (PET jars) were procured from the local market.

Other raw materials like shea butter, stearic acid, GMS, emulsifying wax, EDTA, glycerine, and preservatives were also procured from the local market.

Methodology

The oil phase contained of oil soluble raw material (apricot oil, stearic acid, shea butter, GMS and emulsifying wax) whereas; water phase contained of water soluble raw material (water, EDTA and glycerin). Cold phase was also prepared containing preservatives. These oil and water phases were separately heated over water bath till 70ºC and both the phases were blended till a cream of desired consistency was obtained. At last, the cold phase was added and mixed properly. The prepared cream was filled in PET jars. The apricot massage cream was prepared by using different concentrations of oil as 5% (T_1), 10% (T_2), 15% (T_3), 20% (T_4), 25% (T_5) and commercial apricot based cream was taken as reference.

Quality characteristics

The apricot oil was analysed for different quality characteristics. The colour of oil was measured in a Lovibond Colour Tintometer Model PFXI-880/F. The refractive index was calculated from the butyro-refractometer reading (40ºC) as per the standard method (FSSAI, 2015) [10]. The specific gravity of oil was measured by using specific gravity bottle, according to the standard method (Ranganna, 2009) [22]. The polar material in the oil was determined by using Fri-check (Tilakratne, 2007) [30]. Iodine value was estimated according to Wijs (Carbon tetrachloride-acid solvent) method whereas; saponification value and unsaponifiable matter of apricot kernel oils was estimated according to the standard method (AOAC, 2000) [4]. Acid value of kernel oils was estimated by titrating a known weight of sample (10g) containing 50 ml neutral solvent against 0.1N KOH solution using phenolphthalein as an indicator (Thimmaiah, 1999). Peroxide value was estimated by mixing the sample (5g) with 30 ml acetic acid- chloroform (3:2) solution containing saturated KI solution and titrated against 0.1N sodium thiosulphate using starch as an indicator and calculated as milli equivalent peroxide per kg sample (AOAC, 2000) [4]. The viscosity of the sample was analysed by using Brookfield viscometer at 60 rpm using UL adapter with cylindrical spindle (Neuwald, 1966) [17]. Concentration of vitamin E (µM) was calculated in the sample, using standard prodecure (Rutkowski and Grzegorczyk, 2007) [23]. The residual matter and moisture content were evaluated as per the standard procedure by drying 5g of the material to constant mass at 105ºC (BIS, 2014) [7].

The quality characteristics like pH, moisture, residual matter, viscosity, spreadability, total fatty matter and vitamin E of apricot massage cream were evaluated. The pH of the. suspension at 27ºC was measured using the Mettlor Toledo pH meter (BIS, 2014) [7]. The residual matter and moisture content were evaluated as per the standard procedure by drying 5g of sample to constant mass at 105ºC (BIS, 2014) [7]. The viscosity of the formulation was determined by Brookfield viscometer at 100rpm using the spindle no. 7 (Mishra *et al*., 2014) [16]. The spread ability was evaluated by using glass slides as per the standard method (Akelesh *et al*., 2015) [2]. Total fatty matter was evaluated by using hydrochloric acid and petroleum ether followed by filtration with sodium sulphate and drying in an oven (BIS, 2014) [7]. Functional properties including type of emulsion and thermal stability were evaluated. Type of emulsion was determined by using scarlet red dye or methylene blue dye by observing under microscope (Mishra *et al*., 2014) [16]. Thermal stability of massage cream was judged by placing the samples inside the incubator at 45 ºC for 48 hours (BIS, 2014) [7].

The sensory qualities of massage cream were judged on the basis of appearance, homogeneity, type of emulsion, spreadability, type of smear, after feel, removal and patch test by the semi trained panel of judges (Sahu *et al*., 2011) [24]

Statistical analysis

The data pertaining to the quality characteristics of apricot based massage cream for optimization were analyzed statistically by following Completely Randomized Design (CRD) and the sensory qualities were analyzed statistically by following Randomized Block Design (RBD).

Results and Discussion

Apricot kernel oil and oil based massage cream were analyzed for different quality characteristics, sensory qualities, functional properties and the adverse effects on skin etc and were compared with the reference product. On the basis of these quality parameters, the best treatment was selected.

Quality characteristics of apricot oil

Table 2 shows the quality characteristics of apricot oil with tintometer colour unit as yellow (19.0 0± 0.20), red (3.10 ± 0.05) and on the basis of these units the oil seems to be deep yellow in colour. Earlier, Abd El-Aal *et al* (1986) also reported light yellow colour in apricot kernel oil with 35Y and 5R tintometer colour units (TCU). The CIE (L*A*B*) readings for apricot oil presented in Figure 1 were 75.16, 17.48, 68.68 respectively. The values represents the bright reddish-yellow colour of oil. The refractive index, specific gravity and polar materials were found 1.4723 ± 0.02, 0.9120 ± 0.01 and 5.60 ± 0.20 per cent respectively and all these values were within the range as reported by Gupta (2006), Tilakratne (2007) [30] and Sharma (2013) [27]. Further, the apricot oil exhibited high iodine value (100.46 ± 0.02 gI_2/100g) and saponification value (190.74 ± 0.03 mg KOH/g). The higher iodine value shows more unsaturation whereas; higher saponification value justifies the usage of the oil for soap production. The unsaponifiable matter of oil was 0.75 ± 0.01 per cent and which was similar to the values obtained by Bachheti *et al* (2012) [6]. The acid value of oil is an indicator of hydrolytic rancidity (Sandha and Swami, 2009) [25] and the apricot oil found to have low acid value i.e. 2.55 mgKOH/g whereas the peroxide value indicates the measure of oxidative rancidity (Sandha and Swami, 2009) [25] and the recorded value for oil was 5.21 ± 0.20 meq/Kg. The values obtained for the viscosity, residue matter and moisture content were 40.70 ± 0.30 cps, 99.20 ± 0.20 per cent and 0.79 ± 0.20 per cent respectively. Further, the apricot kernel oil is said to be vitamin E rich and the tocopherol (vitamin E) content in oil was found 58.95 ± 3.30 mg/100g. The results were found parallel to the findings of Velickoviska *et al* (2015) [31]. Thus, keeping in view the quality characteristics of apricot kernel oil, it was found optimum for utilization in preparation of cosmetic products.

Quality characteristics of apricot massage cream

The data presented in Table 3 shows the quality characteristics of apricot massage cream along with the reference product. The reference product was found to have pH 6.520 with a pH range of 6.420 to 6.790 in apricot oil based cream (T_1 to T_5). There was non-significant difference

found in between the pH values of the treatments but the pH increases with the increase in oil percentage. According to BIS standards, the pH values should be between 4 to 9 and all the values observed during present study were found well within the range. The moisture content was observed from 75.400 to 55.900 per cent and the residue matter from 24.600 to 44.100 per cent for the different treatments of the apricot massage cream as compared to 69.800 and 30.200 percent in reference, respectively. The residue matter was found within the acceptable range however increase in the residue matter was observed with increasing percentage of oil. Viscosity recorded for the reference product was 26560 cps with a range of 21090-52400 cps in treatments T_1 to T_5. Further, the viscosity was also found in increasing order with the increase in per cent of oil. The acceptable range for BIS standards for viscosity is 25000-39000cps and the cream having 10 per cent (T_2) and 15 per cent of oil (T_3) were found in this acceptable range of viscosity. The spread ability was 4.150 cm for reference product and was found in the range of 4.500 to 2.900 for different treatments. The decrease in spread ability was due to the increase in the viscosity. Further, the total fatty matter and vitamin E content for reference was 14.500 per cent and 40.390 mg/100g respectively with a range of 12.500-17.900 per cent and 29.250 to 41.037 mg/100g respectively in different treatments. As per the BIS standards, total fatty matter should be minimum 5 per cent and all the values during present studies were in the acceptable limit. The vitamin E content increases with increase in the oil content, which might be due to vitamin E present in oil and she a butter. Similar results were obtained by Mishra *et al* (2014) [16], Aswal *et al* (2013) [5] and Grace *et al* (2014) [11]. Juntawong *et al* (2010) [14] observed the similar and concluded that the cream viscosity increased as oil concentration increased from 5 to 35 per cent. The high oil concentration often led to an increase in particle size and viscosity of the system. On the basis of these quality characteristics the massage cream containing 10 per cent (T_2) and 15 per cent of oil (T_3) were found comparable with the BIS standards.

Functional properties of apricot massage cream

The table 4 represents the functional properties like type of emulsion and thermal stability of reference along with different treatments of the apricot massage cream. It was observed that all the treatments along with the reference product were oil-in-water emulsion. The most important quality of cream is thermal stability; the cream should be thermally stable and should pass the test of thermal stability as per the BIS standards. It was found that treatments T_1, T_2 and T_3 along with the reference product were thermally stable but the treatments with 20 per cent (T_4) and 25 per cent (T_5) of oil were found thermally unstable.

Sensory qualities of apricot massage cream

Table 5 depicts the sensory qualities of the apricot massage cream in which the sensory evaluation was done by the panel of judges of both the sexes of each age group. It was observed that all the treatments along with the reference product were having pearlescent appearance, good homogeneity, easy for removal and without irritation during patch test. The massage cream having 5 per cent (T_1), 10 per cent (T_2) and 15 per cent (T_3) of oil along with the reference showed good spread ability with good absorption over the skin. Whereas; a greasy smear was formed for treatments having 20 per cent (T_4) and 25 per cent (T_5) of oil. After application on skin, the treatments containing lowest per cent of oil (T_1) observed less emollient which was noticed to be increased with the increased oil emulsions and thus the treatments having 20 per cent (T_4) and 25 per cent (T_5) of oil were highly emollient in nature. Sahu *et al* (2011) [24] evaluated the four formulations of herbal facial cream on the basis of the similar sensory qualities and parallel results were found in the findings. Sensory evaluation of apricot massage cream concludes that the treatments containing 10 per cent (T_2) and 15 per cent (T_3) of oil were comparable with the reference product on basis of quality attributes.

Evaluation of adverse effect of apricot massages cream

All the treatments along with the reference product were evaluated for adverse effect over the skin in which treatments were analysed for irritant effect, erythema, edema or other adverse effects. The data in the table 6 reveals that there were no adverse effects of all the treatments alongwith the reference product over the skin. No irritation, no erythema, no edema and none of the adverse effect were noticed on skin after applicaion. Pal *et al* (2014) [19] and Aswal *et al* (2013) [5] also reported the similar results.

Conclusion

The present investigation concludes that the wild apricot kernel oil can be utilized for the development of quality massage cream. The formulation of 10-15 percent of kernel oil in the apricot massage cream results in better quality product within the BIS standards. This study gives a new direction for the utilization of wild apricot oil in cosmetic industry and can generate a new income source among the growers through entrepreneurship development.

Table 1. Quality characteristics of wild apricot kernel oil

	Parameters	Mean± S.E.
1.	Colour	
	Yellow	19.00± 0.20
	Red	3.10± 0.05
	Blue	0.00± 0.00
2.	Refractive index (40ºC)	1.4723 ± 0.02
3.	Specific gravity	0.912 ± 0.01
4.	Polar materials (% PM)	5.60 ± 0.20
5.	Iodine value (g I_2/100g)	100.46 ± 0.02
6.	Saponification value (mg KOH/g)	190.74 ± 0.03
7.	Unsaponifiable matter (%)	0.75 ± 0.01
8.	Acid value (mg KOH/g)	2.55 ± 0.02
9.	Peroxide value (meq/kg)	5.21 ± 0.20
10.	Viscosity (cp)	40.70 ± 0.30
11.	Residue matter (%)	99.20 ± 0.20
12.	Moisture content (%)	0.79 ± 0.20
13.	Tocopherol (mg/100g)	58.95 ± 3.30

Table 2: Quality characteristics of apricot massage cream

Parameters Treatments	pH	Moisture (%)	Viscosity (cp)	Residue Matter (%)	Spread ability (cm)	Total fatty matter (%)	Vitamin E (mg/100g)
R	6.520	69.800	26560	30.200	4.150	14.500	40.390
T_1	6.420	75.400	21090	24.600	4.500	12.500	29.250
T_2	6.510	71.800	28001	28.200	4.000	13.900	32.195
T_3	6.610	65.400	37350	34.600	3.700	15.010	35.145
T_4	6.700	60.500	44000	39.500	3.300	16.700	38.090
T_5	6.790	55.900	52400	44.100	2.900	17.900	41.037
C.D.	NS	0.828	18.428	0.654	0.488	0.921	0.353

R: commercial apricot oil based cream as reference; T_1: 5%; T_2: 10%; T_3: 15%; T_4: 20%; T_5: 25% apricot oil; NS-non-significant

Table 3. Functional properties of apricot massage cream

Parameters Treatments	Type of emulsion	Thermal stability
R	O/W	+ve
T_1	O/W	+ve
T_2	O/W	+ve
T_3	O/W	+ve
T_4	O/W	-ve
T_5	O/W	-ve

R and T_1 to T_5 as in table 2; O/W- oil-in-water emulsion; +ve – thermally stable; -ve – thermally unstable

Table 4: Sensory qualities of apricot massage cream

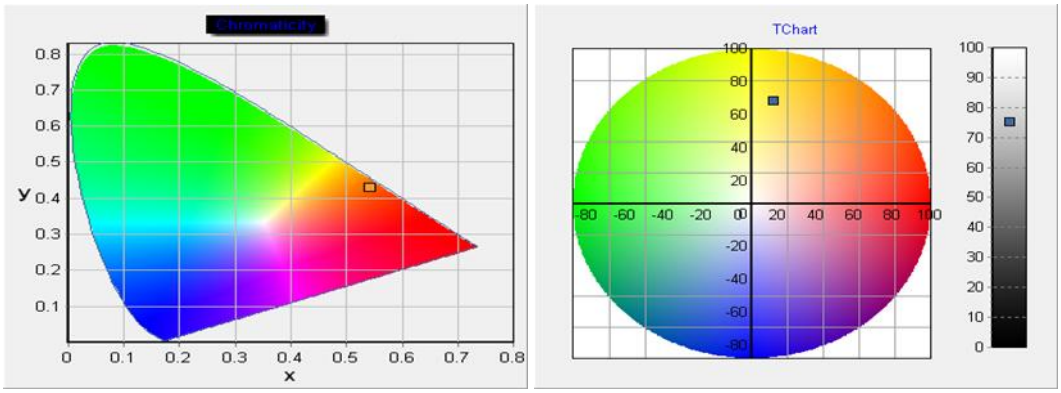
Parameters Treatments	Appearance	Homogeneity	Type of emulsion	Spreadibility	Type of smear	After feel	Removal	Patch test	Thermal stability
R	P (creamy white)	***	O/W	***	NG	ME	ES	-ve	+ve
T_1	P(creamy white)	***	O/W	***	NG	LE	ES	-ve	+ve
T_2	P(creamy white)	***	O/W	***	NG	ME	ES	-ve	+ve
T_3	P(creamy white)	***	O/W	***	NG	ME	ES	-ve	+ve
T_4	P (creamy white with yellowish tint)	***	O/W	**	G	HE	ES	-ve	-ve
T_5	P (creamy white with yellowish tint)	***	O/W	**	G	HE	ES	-ve	-ve

R and T_1 to T_5 as in table 2; P- pearlescent; ***Good, **satisfactory, *poor; O/W- oil-in-water emulsion; LE- less emollient; ME-medium emollient, HE- highly emollient; NG- non greasy, G- greasy, ES- easy.

Table 5: Evaluation of the adverse effect of apricot massage cream

Parameters Treatments	Irritant	Erythema	Edema	Other adverse effect
R	Nil	Nil	Nil	Nil
T_1	Nil	Nil	Nil	Nil
T_2	Nil	Nil	Nil	Nil
T_3	Nil	Nil	Nil	Nil
T_4	Nil	Nil	Nil	Nil
T_5	Nil	Nil	Nil	Nil

R and T_1 to T_5 as in table 2



x: 0.5406
y: 0.4318
Y: 48.54

L*: 75.16
a*: 17.48
b*: 68.68

Fig 1: CIE readings of apricot oil

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