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Evaluation of aqueous extract of Soapnut as surfactant in cosmetics

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Abstract
The fruits of *Sapindus mukorossi* (Family-Sapindaceae) also called as soapnuts, contain Saponins about 6-10 % by weight. Soapnut has been traditionally used for cleansing purposes and owes detergent action due to its saponin content. Use of synthetic surface active agents like sodium lauryl sulphate (SLS) has been found to show adverse actions on the skin like irritation and inflammation. Soapnut extracts is traditionally used in household remedies and is documented to have beneficial effects on skin. Hence the objective of the work was to formulate a cream replacing SLS by soapnut extract.
The present work deals with use of dried aqueous extract of *S. mukorossi* to formulate an o/w cream. The creams are formulated using SLS as an emulsifier and by replacing SLS with aqueous extract of soapnut. The formulations prepared with soapnut exhibited good texture and spread ability vis a vis SLS cream. The properties like pH and particle size were better or comparable over SLS containing cream. Hence it can be concluded that the soapnut extract can be used as emulsifier in creams which is biocompatible and has beneficial effects on skin.

Keywords: Sapindus, emulsifying agent, cream

Introduction
Synthetic surfactants such as sodium lauryl sulphate which are widely used in cosmetics are associated with several adverse effects [1] owing to this, use of natural and biocompatible surfactants in cosmetic formulation is being explored [2]. These include sugar-based non-ethoxylated emulsifiers (Sugar esters such as sucrose palmitate, sucrose distearate) with a very wide HLB range so they can work in both phases and are considered natural [3]. Acacia gum is a multifunctional natural emulsifier and stabilizer. Other examples of natural emulsifiers are carrageenan, alginates, lecithin (a phospholipid) and lanolin from the wool grease of sheep. Many natural surfactants recently developed include Coco-Glucoside (APG), sodium coco-sulphate (SCS) cocamidopropyl betaine (CAPB) [4]. Sophorolipids, rhamnolipids and mannosyl erythritol lipids are glycolipids which are used as biosurfactant in cosmetics [5].
Sapindus mukorossi (family: Sapindaceae), commonly known as soapnuts is a popular ingredient in Ayurvedic shampoos and cleansers, it is used in Ayurvedic medicine for treatment of eczema, psoriasis, and for removing tan, oily (whitening effects) secretions and freckles from the skin and is Hypo-allergenic [6].
It finds therapeutic use as an expectorant, emetic, contraceptive, and for treatment of excessive salivation [7]. Recently many of the pharmacological actions of this plant has been explored which includes the antimicrobial activity, use in neurodermatits, hepatoprotective, insecticidal & piscidal activity [8].
One of the important ingredient of soapnut is saponins which include triterpenoidal saponins, and triterpen saponin hederagenin [9]. When they come in contact with water, they provide surface activity and form soap-like foaming solutions. These saponins provide the functionality of surfactants, the ability to wet, emulsify, solubilize foam, disperse, clean, and condition.
Creams are semisolid preparations in either a w/o or an o/w emulsions, o/w cosmetic creams are formulated for their washability. Many saponins are added to formulations as both an emulsifier and as a foaming agent. [10]
The aim of present work is to determine the utility of the dried aqueous extract of *S. mukorossi* as emulsifier for skin creams which will not only provide biocompatible skin friendly cosmetic preparations but also reduce the environmental pollution because of its biodegradable nature.

Materials and Methods
Preparation of soapnut extract: Weighed quantity of fruit of Soapnut (100 g) was dried in oven at 60 ^{0}C for 1h, if in case it was moist. The seeds were separated from the fruit and ground in

"Multimill" (Make: Gem Pharma Machineries) to powder of 14 mesh size. A definite quantity of powder (50g) was taken and boiled with 100 ml water with continuous stirring & filtered. This filtrate was then placed in hot air oven (Make:Biomedica i-therm AI-7981) at 55 - 60^{0}C till completely dry.

Formulation of Creams [11]

A standard cream formula (F1) of composition as in table 1 was prepared, by melting cetyl alcohol glyceryl monosterate and propyl paraben in liquid paraffin at 60^{0}C to form oil phase. Water phase containing sodium lauryl sulphate (for standard cream) and methyl paraben heated at 60^{0}C was added to this phase with constant stirring. The test cream (F2) was prepared similarly by replacing sodium lauryl sulphate by soapnut extract.

Evaluation of Creams

The creams were evaluated using different parameters at an interval of 7, 14 and 21 days respectively. The evaluation parameters for the prepared creams is summarized in table 2

pH: Accurately weighed quantity of cream was dissolved in water to prepare 1% w/v solution. The pH was measured using calibrated pH meter (Make: EI, DELUXE-101).

Determination of spreadability of creams [12]

The spreadability of formulation was determined by using an apparatus which was fabricated in house by using the given formula,

S = M*L/T

S = Spreadability

Where, M= weight tied to upper slide

L= length of glass slides

T= time taken to separate the slides

Particle size measurements

Mean globule diameter was determined by counting 100 globules in 1% solution of cream using ocular micrometer under light microscope.

Determination of viscosity

The viscosity was determined using RVDV Pro Plus viscometer (Make Brookfield) using ULE small sample adapter.

Results and Discussion

The yield of saponin extract:

For 50 gm of crude drug the yield of aqueous extract was 17.82 gm i.e. 35.54 % yield

1. **pH:** The pH of formulations standard, F1 and F2 was determined at regular intervals of 07 days to detect variations if any.
   The pH of creams needs to be slightly acidic to neutral and all the formulations showed pH in this range with very little variation and is important from stability of creams.
2. **Spreadability:** Of semisolids is an important parameter determined by the adhesion of cream with the spreading surface. The surface active agent has important role in spreading by causing reduction of advancing contact angle [13]. Multimer [14] has described the formula for calculation of spreading coefficient. The formulation F2 containing aqueous extract of *S. mukorossi* showed good spreadability (30, 38).
3. **Mean Globule Diameter:** The mean globule diameter of formulations remained similar to standard in F1 formula but decreased in formulation F2 (0.63 mic) which is indicative of better stability. This may be because of higher concentration of aqueous extract in F2.
4. **Viscosity:** The volume and size of internal phase has lot of impact on stability and viscosity of cream. The globule size of internal phase was least in F2 hence it displayed more viscosity than standard and F1 formulation. Small internal phase diameter also increases occlusive character of the cream.

Statistical Analysis of Data

Level of significance for all evaluation parameters was expressed as the arithmetic mean ± SEM and was analysed by One-way analysis of variance(ANOVA) followed by Dunnett's t test

Table 1: Formula for the cream

Ingredients	Standard Formula	Test formula F1	Test formula F2
Mineral oil	24.5 gm	24.5 gm	24.5 gm
Cetyl alcohol	7 gm	7 gm	7 gm
Sodium lauryl sulphate	2 gm	-	-
Soapnut extract	-	2 gm	4 gm
Glyceryl monosterate	0.5 gm	0.5 gm	0.5 gm
Water	67 gm	67 gm	67 gm
Perfume, preservative, color	q.s.	q.s.	q.s.

Table 2: Evaluation of prepared creams

	Evaluation Parameters											
Number Of Days	Ph			Mean Globular Diameter (Mic)			Viscosity (Cp)			Spreadability		
(n=3)	STD	F1	F2	STD	F1	F2	STD	F1	F2	STD	F1	F2
0	6.85	6.85	6.67	0.97	1.06	0.63	26000	24000	27000	2.431	17.36	30.38
7	7.15	7.22	6.92	0.98	1.18	0.68	26000	24500	27500	2.82	18.5	30.42
14	7.24	7.34	7.17	1.15	1.12	0.71	26500	24500	28000	3.285	20.25	30.61
21	7.32	7.28	7.23	1.16	1.14	0.72	26500	24500	28000	3.322	21.25	30.82

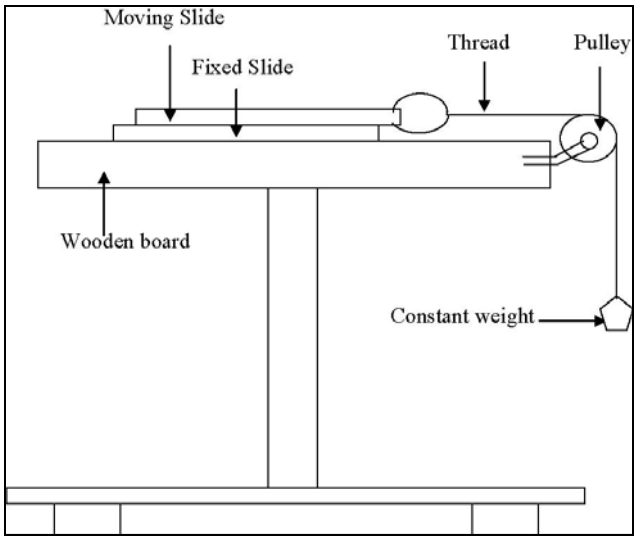

Fig 1: Schematic representation of apparatus for determination of spreadability

Conclusion

Hence it can be concluded that the aqueous extract of *S. mukorossi* can be successfully used to formulate the o/w cream instead of sodium lauryl sulphate. The prepared cream showed smaller particle size and better spreading compared with standard cream prepared with SLS. The soapnut extract by virtue of its natural origin and favourable effects on skin can be used to formulate skin preparations.

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