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Development and evaluation of antiaging herbal topical formulation

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Abstract

The research project was aimed to developed and evaluated the anti-aging herbal topical formulation. The extracts of Aloe vera and Papaya fruit has been used in the formulation to improve as well synergize the cosmetic properties compared to individual extracts and evaluated for the several parameters like pH, spreadability, Total antioxidant activity, viscosity, *in vitro* drug release. The cream prepared from Aloe vera and Papaya fruit extract showed significantly better anti-aging efficacy as compared to the marketed formulation. The formulation was an ideal oil-in-water cream with good consistency, smooth and shining texture, good stability and may prove to be an anti-aging preparation and can be used for retarding the symptoms of ageing and showing skin-renewal activity. The optimized F9 formulation showed 62.34% (Aloe vera) and 64.56% (Papaya fruit) cumulative percent release. Thus**,** the research successfully exploited the use of herbal extracts like Aloe vera and Papaya fruit and antioxidant effect of the extracts was observed which is necessary to treat ageing signs. The developed cream was found with positive results of every evaluation parameter, which is necessary for a good formulation.

Keywords: anti-aging, herbal extracts, spread ability, viscosity

Introduction

Ageing is one of the most common problem that arises in the human being and it gives a great impact to the society. Skin ageing is visible and also represents an ideal model organ for investigating the ageing process. Ageing is the process of growing older; it includes a reduction in strength, endurance, speed of reaction, agility, basal metabolism, sexual activity and hearing acuity [1]. There are five criteria for aging which are given in Table 1[2]. While aging can be of two types, (i) Intrinsic ageing and (ii) Extrinsic ageing [3].

Table 1: Criteria for Ageing

Criteria for Ageing	Characteristic
Cumulative	Effects of ageing increase with time
Universal	All members of a species display signs of ageing.
Progressive	Ageing is a series of gradual changes.
Intrinsic	Changes would take place even in a perfect environment.
Deleterious	Changes which occur compromise normal biological functions.

1. **Intrinsic Ageing:** Intrinsic ageing is also known as biological or chronological ageing. Because it depends on genetics and time. Various expressions of intrinsic aging (Figure 1.1) include smooth, thinning skin with exaggerated expression lines [4].

Fig 1: Example of Intrinsic Ageing

2. **Extrinsic Ageing:** Extrinsic ageing is caused by the external factors. Mostly, it depends on degree of sun exposure and skin pigmentation [5]. Extrinsic aging (Figure 2) develops due to several factors, such as, ionizing radiation, severe physical and psychological stress, alcohol intake, smoking, poor nutrition, overeating, environmental pollution and exposure to UV radiation. Amongst all these factors, it has been observed that environmental factors and UV radiation contributes up to 80 % [6].

Fig 2: Example of Extrinsic Ageing

Materials and Methods

Aloevera and papaya extracts were obtained as a gift samples from Sirmour herbolife. These extracts were evaluated and used for formulation development purpose. Stearic acid, cetyl alcohol, sodium metabisulphite, Mannitol, liquid paraffin from nice chemical Pvt. Ltd, propylene and glycerol from Molychem Limited Mumbai (India) were purchased. All other laboratory chemicals used in the study were of analytical reagents grade and several equipments employed in the formulation of herbal cream were Magnetic stirrer, Petridish, Ultrasonic cleaner, Electronic balance, pH meter, UV-visible spectrophotometer, FTIR, Tray drier and Hot air oven.

Characterization of Herbal Extracts

Herbal Extract Identification

Herbal extracts was obtained from Sirmour Herbolife Pvt. Ltd, H.P India. Obtained drug sample was identified according to standard procedures.

Physical appearance

Physical appearance of procured drug was noted by visual observation.

Active Component-Excipient Interaction Study

IR study was performed for identification and structural analysis of the herbal extracts using Fourier Transformed Infrared (FTIR) Spectrophotometry. The KBr disc technique was employed using 1 mg of herbal extracts powder in 100 mg of spectroscopic grade dried KBr. Mixture was grounded into a fine powder using an agate mortar/pestle and compressed into KBr disc under a hydraulic press at 10,000 psi. Each KBr disc was scanned 32 times at 4 mm s^{-1} at a resolution of 2 cm^{-1} over a wave number region of 4000-400 cm^{-1} and characteristic bands were recorded. Further results were compared with standard peaks available in literature [7, 8].

Melting Point Determination

Melting point was determined by using digital capillary apparatus. A small amount of drug was filled into one sided sealed capillary and was placed in the melting point apparatus along with calibrated thermometer. This test was performed in triplicate to observe the melting point range [9].

UV-Vis Spectrophotometric for Herbal Extracts Containing Mixture of Aloe Vera and Papaya

Estimation of herbal extracts in pharmaceutical formulation was done by plotting its calibration curve in PBS (pH 7.4).

Sample Preparation

1) **Preparation of Phosphate Buffer Saline (PBS) (pH 7.4):** It was prepared by dissolving 2.7 gm of potassium dihydrogen phosphate and 0.8 gm of sodium chloride in 100 ml of distilled water.
2) **Preparation of Standard Stock Solution:** 1 mg/ml stock solutions of herbal extract was prepared in PBS (pH 7.4) which was further diluted to100 µg/ml.
3) **Preparation of Working Solutions:** Working solution was prepared in the range of 1-6 µg/ml in PBS (pH 7.4). Absorbance of these solutions were recorded at λ_{max} of 220 nm of Aloevera and 204 nm of Papaya against blank using UV – Visible spectrophotometer [10].

Preparation of Cream Formulation

The formulation components used are listed in Table 1. Moisturizer conditioner was a mixture of propylene glycol: glycerine: sorbitol (2:1:1). All the aqueous soluble components, sodium metabisulphite, EDTA, moisturizer conditioner, triethanolamine, methyl paraben, propyl paraben and water were mixed in a beaker. On the other hand the oil soluble components that were stearic acid, cetyl alcohol, mineral oil, almond oil were mixed in another beaker. Both beakers were kept on water bath for maintaining the temperature 75±5°C and when the temperature was maintained then aqueous phase was added to oil phase with continuous stirring until it cool.

Composition of Developed Formulation

Table 2: List of Various Ingredients for Preparation of Cream

Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
Almond oil	4	4	4	4	4	4	4	4	4	4	4
Mineral oil	3	3	3	3	3	3	3	3	3	3	3
Moisturizer	12	12	12	12	12	12	12	12	12	12	12
Sodium metabisulfite	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
EDTA	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Methyl paraben	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Propyl paraben	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Triethanolamine	1.35	1.35	1.35	1.35	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Papaya Fruit Extract	5	5	5	5	5	5	2.5	10	2.5	10	-
Aloe vera extract	0.5	0.5	0.5	0.5	1	2	2	2	0.5	0.5	-
Stearic acid	12	10	9	8	8	8	8	8	8	8	8
Cetyl alcohol	1	1	1	1	1	1	1	1	1	1	1
Water, QS = 100 gm	QS	QS	QS	QS	QS	QS	QS	QS	QS	QS	QS

Evaluation Parameter of Prepared Cream

The cream was evaluated for various parameters such as appearance, pH, antioxidant activity, Viscosity, Spreadability, homogeneity, after feel, removal, skin irritation studies, *In vitro* skin permeation studies and *In vivo* studies.

1. Type of Emulsion

Dye Method: A portion of the product was taken in a watch glass. To that water soluble dye (methylene blue) was added, mixed properly and observed under microscope [11, 12].

2. Organoleptic Evaluation

The cream thus obtained was evaluated for its organoleptic properties like colour, odour, and state. The appearance of the cream was judged by its colour and roughness and graded [13].

3. pH of the Cream

The pH meter was calibrated using standard buffer solution. About 0.5g of the cream was weighed and dissolved in 50 ml of distilled water and its pH was measured [14].

4. Determination of Total Antioxidant Capacity

The antioxidant activity of the extract was evaluated by the phosphomolybdenum method according to the procedure described by Prieto *et al*. [15]. The assay is based on the reduction of Mo (VI)–Mo (V) by the extract and subsequent formation of a green phosphate/Mo (V) complex at acid pH. A 0.3 ml extract (25µg/ml, 50µg/ml, and 100µg/ml) was

combined with 3 ml of reagent solution (0.6 M sulfuric acid, 28 mM sodium phosphate and 4 mM ammonium molybdate). In case of blank 0.3 ml of methanol was used in place of extracts. The tubes containing the reaction solution were capped and incubated in a boiling water bath at 95 °C for 90 min. After cooling to room temperature, the absorbance of the solution was measured at 695 nm using a spectrophotometer. The antioxidant capacity of each sample was expressed as ascorbic acid (A.A) equivalent using the following linear equation established using ascorbic acid as standard: [A = 0.0037C + 0.0343; R^2 = 0.991] where A is the absorbance at 695 nm and C the concentration as ascorbic acid equivalent (µg/ml). The values are presented as the means of triplicate analysis [16].

5. Spreadability Studies

Spreadability is expressed in terms of time in seconds taken by two slides to slip off from the formulation, placed between, under the application of a certain load. Lesser the time taken for the separation of the two, better the spreadability. Two glass slides of standard dimensions were selected. The formulation whose spreadability had to be determined was placed over one of the slides. The other slide was placed on top of the formulations was sandwiched between the two slides across the length of 5 cm along the slide. 100 g weight was placed up on the upper slide so that the formulation between the two slides was pressed uniformly to form a thin layer. The weight was removed and the excess of formulation adhering to the slides was scrapped off. One of the slides was fixed on which the formulation was placed. The second movable slide was placed over it, with one end tied to a string to which load could be applied by the help of a simple pulley and a pan. A 30g weight was put on the pan and the time taken for the upper slide to travel the distance of 5.0cm and separate away from the lower slide under the direction of the weight was noted. The spreadability was then calculated from the following formula:

$$\text{Spreadability} = m * l/t$$

Where; m = weight tied to the upper slide (30 g); l =length of glass slide (5 cm); t =time taken in seconds [17].

6. Homogeneity

The formulations were tested for the homogeneity by visual appearance and by touch [18].

7. Feel after Application of Cream

Emolliency, slipperiness and amount of residue left after the application of fixed amount of cream was checked [19].

8. Viscosity

Viscosity of selected creams was determined by Anton Paar's Rheolab QC with spindle number CC/27/SS/QC-Ltd at different rpm. A calibrated viscometer was used. The sample container, temperature and quantity should be approximately the same as for the calibration Standard. The speed of the instrument was set without attaching spindle. Then spindle was immersed into the sample to the groove on the spindle shaft. Unit were chosen by pressing the desired unit key (CPS for centipoises). The speed was set and viscometer was started. Constant reading was noted. After reading, turned off the motor and powered off. Spindle was then cleaned and placed in spindle holder.

9. Removal

The ease of removal of the cream applied was examined by washing the applied part with tap water [16].

10. *In vitro* Drug Release

For the study of drug release, various membranes were used which can be natural or synthetic. These natural membranes like inner layer of egg, peach, tomato and onion are used for drug permeation studies. Egg membrane is collected by placing an egg in concentrated 3M solution of HCl. Once the foam disappears and bubbling stops left over substance is egg shell with yolk. Remove the egg shell membrane from the HCl solution and washed the membrane with PBS (pH 7.4) [20]. This membrane is used for the *In vitro* studies. Exact amount (1 gm) of formulation was placed on egg membrane. Egg membrane was sealed and placed into 50 ml of PBS in a beaker. The whole set up was placed on a magnetic stirrer at 37 °C at 100 rpm. At predetermined time intervals, 5 ml of the sample was taken out and replaced with fresh PBS. The drug concentration was determined by UV – Visible spectroscopy (Shimadzu UV-1700) at 200-400 nm [21].

11. Irritancy Test

Mark an area (1sq.cm) on the left hand dorsal surface of goat. The cream was applied to the specified area and time was noted. Irritancy was checked if any for regular intervals up to 24 hrs and reported [16].

Results and Discussion

Characterization of Herbal Extract

Herbal Extract Identification

Herbal Extracts were identified on the basis of its physical appearance, melting point and IR spectra. Based on the results of characterization study of the herbal extracts was confirmed.

Physical Appearance

Herbal extracts of Aloe vera and Papaya fruit was visually observed and both were found to be brown coloured powder.

Active Component-Excipient Interaction Study

IR spectrum of Aloe vera is shown in Figure 3 and Papaya fruit is shown in Figure 4. Observed peaks in IR spectrum were found to be concordant with functional groups of Aloe vera and Papaya fruit. Table 3 and 4 shows frequency of observed bands and its interpretation. Purity of procured sample was confirmed from its IR spectrum. Thus, all the results of identification and characterization confirmed identity and purity of both procured extracts.

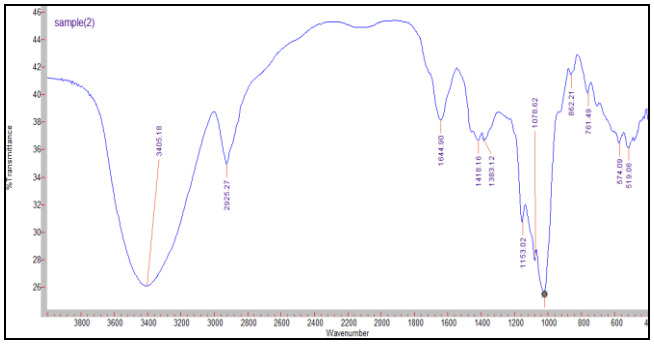

Fig 3: IR Spectra of Aloe Vera Extract

Table 3: FTIR Signals of Aloe vera Extract

Sr. No.	Observed Wave No. (cm^{-1})	Functional Group
1	3405.18	O-H
2	2925.27	C-H stretching (alkyl)
3	1644.90	C=C Stretching
4	1383.12	C-O bonding
5	1078.62	SO3 symmetric stretching
6	761.49	C-Cl stretching

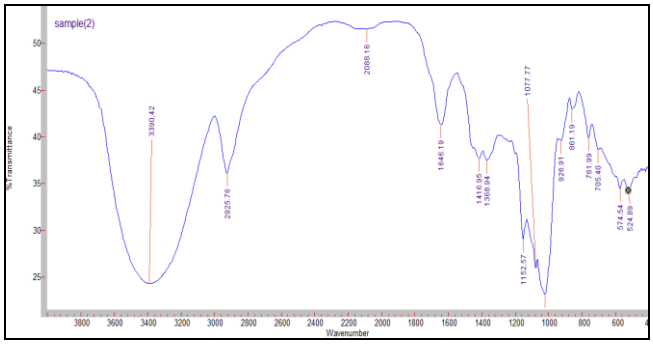

Fig 4: IR Spectra of Papaya Fruit Extract

Table 4: FTIR Signals of Papaya Fruit Extract

Sr. No.	Observed Wave No. (cm^{-1})	Functional Group
1	3390.42	O-H Stretching
2	2925.76	C-H Stretching (methyl and methylene)
3	1646.19	C=C Stretching (aromatic ring)
4	1416.95	Aliphatic and Aromatic (C-H)
5	1368.94	C-H bending

Melting Point Determination

The melting point of Aloe vera herbal extract was found 146 °C and Papaya fruit extract was found 118°C.The results found to be in compliance with the earlier reported melting point. The details of observed melting point is given in Table 5.

Table 5: Melting Point of Herbal Extracts

Sr. No.	Extract Name	Reference Standard	Experimental
1	Aloe vera	148°C	146°C
2	Papaya Fruit	121°C	118°C

UV-Vis Spectrophotometric for Herbal Extracts Containing Mixture of Aloe vera and Papaya Fruit

To obtain calibration curve, different concentrations of Aloe vera and Papaya Fruit was dissolved in PBS (pH 7.4) and absorbance was measured. Table 6 and 7 shows absorbance values for different concentration of Aloe vera and Papaya in PBS (pH 7.4). Figure 5 and 6 explains calibration curve of Aloe vera and Papaya in PBS (pH 7.4) with correlation coefficient r^2 = 0.9987(Aloe vera) and r^2 =0.9982 (Papaya fruit). Results inferred that Beer's law was obeyed in concentration ranges from 2-10 µg/ml for Aloe vera and Papaya fruit extract**.**

Table 6: Absorbance Values for Different Concentrations of Aloe Vera Extract

Concentration (µg/ml)	Mean* Absorbance (nm)	SD*
2	0.052	0.001
4	0.119	0.000
6	0.169	0.002
8	0.236	0.001
10	0.295	0.004

*Mean and SD of no of determination n, = 3

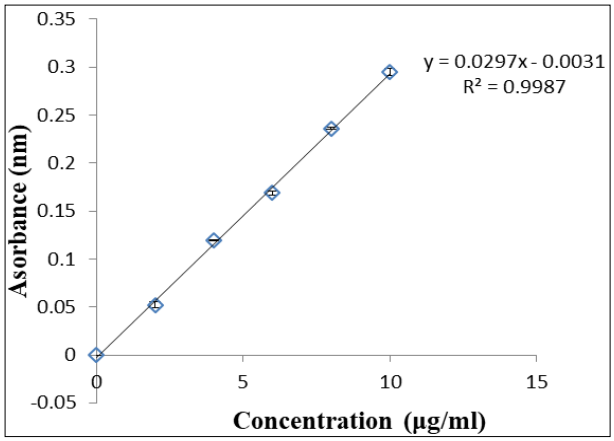

Fig 5: Calibration Curve of Aloe Vera in PBS (PH 7.4)

Table 7: Absorbance Values for Different Concentrations of Papaya Fruit Extract

Concentration (µg/ml)	Mean Absorbance (nm)	SD
0	0	0
2	0.023	0.001
4	0.045	0.000577
6	0.07	0.001
8	0.092	0.001
10	0.121	0.000577

*Mean and SD of no of determination n, = 3

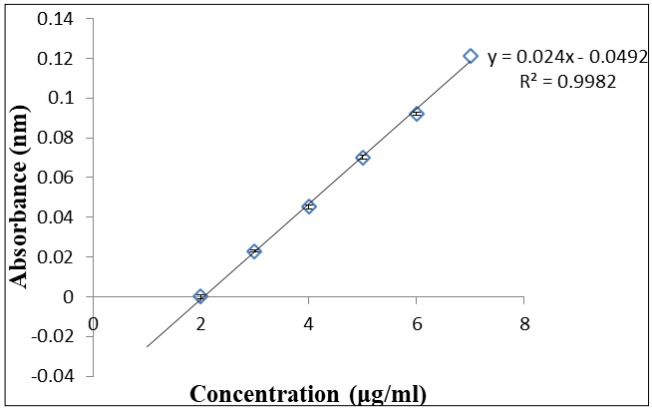

Fig 6: Calibration Curve of Papaya Fruit in PBS (pH 7.4)

Evaluation Parameters of Prepared Cream

All the developed eleven formulations were evaluated for all physical evaluation parameters such as dye method; appearance; pH and spreadability.

1. Type of Emulsion

Dye method: From dye method it was confirmed that all the developed formulations are oil in water type emulsion.

2. Organoleptic Evaluation

All the developed formulations were having brown/light brown colour which was due to variation in the concentration of extracts and pH modifier. Obtained colour for each formulations are described in Table 8.

3. pH of the Cream

The pH of each formulation is explained in Table 8. The acceptable pH range for the topical formulation as per literature is 5.5-6.5. Thus, formulations falling under suggested range (F6 and F9) were selected for final optimization.

Table 8: Appearance and pH of Different Developed Formulations

Sr. No.	Formulation	Appearance	pH
1	F1	Brown	6.84
2	F2	Brown	6.77
3	F3	Brown	6.74
4	F4	Brown	6.64
5	F5	Brown	6.70
6	F6	Cream colour	5.54
7	F7	Light brown	7.53
8	F8	Brown	7.48
9	F9	Light brown	5.51
10	F10	Brown	7.56
11	F11	White	5.62

4. Spreadability

The spreadability of developed different formulations was calculated and obtained results are explained in Table 9. The results show that the developed formulations have good spreadability and are within the acceptable range. It forms a smooth film on the surface of skin.

Table 9: Spreadability of Developed Formulations

S. No.	Formulation	Time (sec)	Spreadibility (gm. cm/ sec)
1.	F1	30	6.4
2.	F2	29	6.6
3.	F3	27	7.1
4.	F4	25	7.6
5.	F5	20	9.6
6.	F6	15	12.8
7.	F7	18	10.66
8.	F8	35	5.48
9.	F9	14	13.71
10.	F10	32	6
11.	F11	13	14.76

5. Determination of Total Antioxidant Capacity

Total antioxidant capacity of formulation F11 was not performed because it was a placebo i.e. without extracts. The total antioxidant capacity of the individual aqueous extracts (Aloe vera and Papaya fruit), optimized formulations (F6 and F9) and marketed formulation was found as 3.03 ± 0.04, 4.08 ± 0.17, 1.01 ± 0.03, 3.38 ± 0.08 and 8.37 ± 0.17 % (Mean ± S.D., n = 3) respectively. Ordinary one way ANOVA was applied and all the results were significant of each other with p value = < 0.0001. It was found in the results that total antioxidant capacity of marketed formulation was found maximum because it contains banana peel extract, pomegranate extract and jojoba oil which were also having antioxidant activity. Banana peel extract have 5.85 mm/g antioxidant activity, Pomegranate peel extract have 34.3 % antioxidant activity and Jojoba oil have 24.6 % antioxidant activity. It was observed that F9 has more antioxidant activity than F6. F9 contains 2.5% and 0.5 % while F6 contains 5 % and 2 % of Papaya fruit extract and Aloe vera extract respectively. Thus, these results indicates that the optimum concentration required for better antioxidant activity is 2.5 % and 0.5 % of Aloe vera and Papaya fruit extracts which is similar to previously reported optimal concentrations of these extracts for their antioxidant activity.

Table 10: Total Antioxidant Activity of Extracts and Optimized Formulations

Extract and Formulation	% Mean Antioxidant Activity
Aloe vera	3.03
Papaya fruit	4.08
F6	1.01
F9	3.38
Marketed	8.37

No. of Determination, n = 3

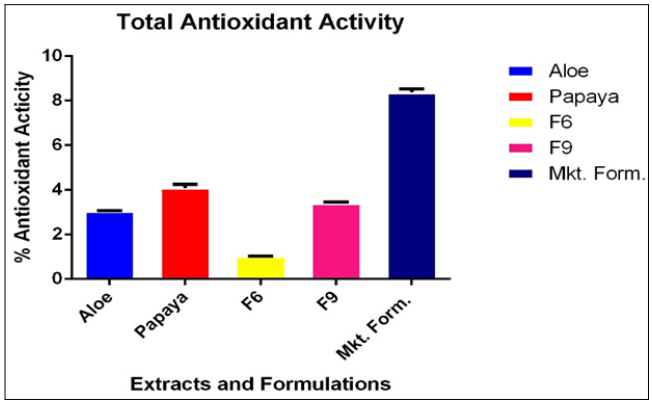

Fig 7: Total Antioxidant Activity of Extracts and Optimized Formulations

6. Homogeneity

All formulations produce uniform distribution of extracts in cream. This was confirmed by visual appearance and by touch.

7. Feel after Application of Cream

Emoluments, slipperiness and amount of residue left after the application of fixed amount of cream was found good.

8. Viscosity

The viscosity of developed formulations (F6, F9 and F11) was in the range of 17 to 0.502 Pa. s which indicates that the cream is easily spreadable by small amount of shear. The viscosity of developed formulations at different measuring points is described in Table 10. These results suggest each formulation have satisfactory flow property and have good consistency

Table 11: Viscosity of Developed Formulations at Different Measuring Points

Measuring Points	Viscosity (Pa. s)		
	F6	F9	F11
1.	17	10.6	15.2
5.	3.44	2.09	2.74
10.	1.86	1.19	1.65
15.	1.29	0.856	1.19
20.	0.996	0.680	0.909
25.	0.819	0.567	0.733
29.	0.720	0.502	0.637

9. Removal

The cream of F6, F9 and F11 applied on skin was easily removed by washing with tap water.

10. *In vitro* Drug Release

In vitro drug release of creams was performed using egg membrane and the formulation which was having maximum release was compared with marketed formulation (Table 14).

Table 12: *In vitro* Drug Release of Formulation F6

Time (min)	Cumulative % Release			
	Aloe vera		Papaya fruit	
	Mean	S.D.	Mean	S.D.
15	1.5	0.1	3.92	0.01
30	4.32	0.02	6.89	0.06
45	8.56	0.03	13.45	0.01
60	12.93	0.03	18.35	0.02
120	18.68	0.04	21.59	0.05
240	25.61	0.04	27.33	0.03
360	33.93	0.04	35.09	0.60
480	41.16	0.03	42.71	0.05
720	50.6	0.04	51.90	0.06
1440	60.35	0.02	62.49	0.08

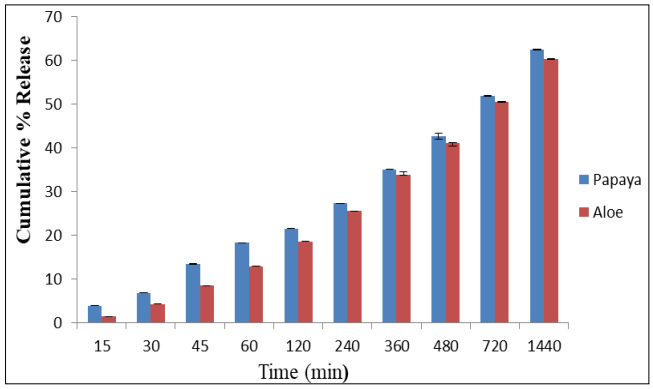

Fig 8: *In vitro* Drug Release of Formulation F6

Table 13: *In vitro* Drug Release of Formulation F9

Time (min)	Cumulative % Release			
	Aloe vera		Papaya fruit	
	Mean	S.D.	Mean	S.D.
15	1.7	0.03	4.51	0.02
30	4.2	0.01	7.54	0.04
45	8.93	0.04	15.53	0.01
60	13.4	0.06	18.85	0.05
120	19.2	0.09	22.59	0.04
240	26.72	0.07	28.56	0.06
360	34.92	0.08	36.73	0.08
480	43.34	0.02	43.89	0.07
720	51.52	0.05	53.9	0.04
1440	63.006	0.58	64.56	0.09

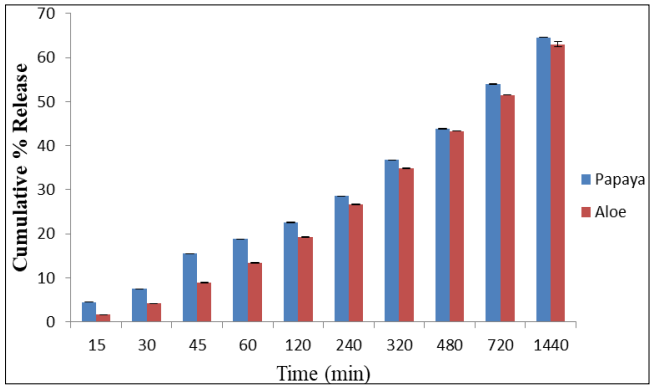

Fig 9: *In vitro* Drug Release of Formulation F9

Table 14: *In vitro* drug release of marketed formulation

Time (min)	Cumulative % Release			
	Aloe vera		Papaya fruit	
	Mean	S.D.	Mean	S.D.
15	4.89	0.09	5.3	0.03
30	9.56	0.06	14.72	0.02
45	15.9	0.01	18.85	0.05
60	21.5	0.05	22.59	0.09
120	28.31	0.1	28.56	0.06
240	37.56	0.02	36.73	0.03
360	45.7	0.03	44.59	0.07
480	50.3	0.06	57.49	0.04
720	61.04	0.02	69.60	0.06
1440	72.9	0.07	80.4	0.01

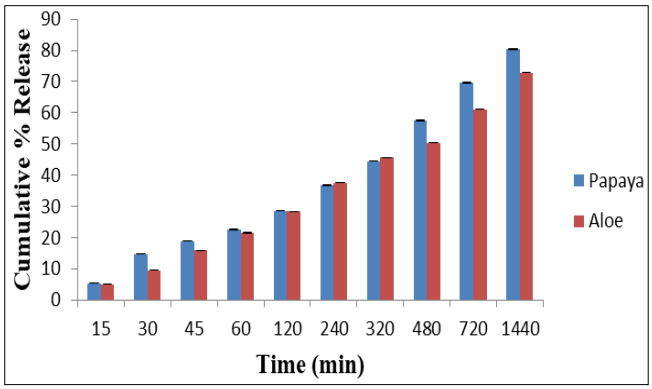

Fig 10: *In vitro* Drug Release of Marketed Formulation

For determination of statistical significance, all the results were incorporated in GraphPad Prism (version 6). Two way ANOVA with Dunnett's multiple comparisons test was applied. It was found that in both optimized formulations, F9 gave more release but it was not significant ($p > 0.5$). Whereas, release of both formulation F6 and F9 was significantly ($p < 0.0001$) less than the marketed formulation for both the extracts, Aloe vera and Papaya fruit. This could be due to presence of other ingredients in it. F9 formulation showed 62.34% (Aloe vera) and 64.56% (Papaya fruit) cumulative percent release.

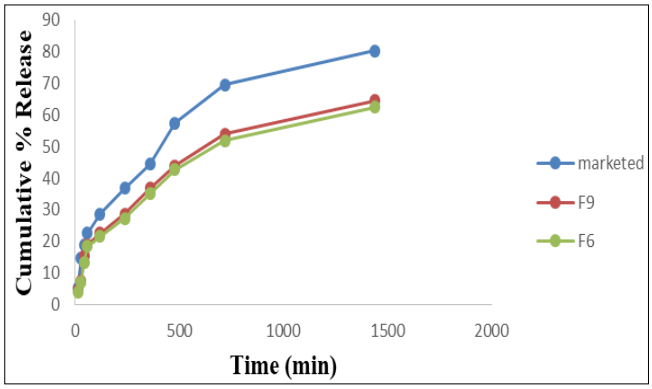

Fig 11: *In vitro* Cumulative % Release of F6, F9 and Marketed Preaprations

11. Irritancy Test

Skin of goat tolerated the applied cream and no signs of irritation like itchiness, inflammation, redness or burning sensation were noticed during the whole period of study that was 24 hrs.

Conclusion

From the studies discussed in thesis, we can conclude that on combining the extracts of Aloe vera and Papaya fruit in different ratios give antiaging effect on skin. As we know that it is not possible to increase the extent of efficiency of medicinal and cosmetic property of single plant extract, but by combining the different plant extracts it can be possible to increase the efficacy of extracts. In this context we combined the extracts of Aloe vera and Papaya fruit to improve as well synergize the cosmetic properties of prepared products compare to individual extracts.

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References

1. Singh S, Mishra S. A Review Article on Aging and Nutrition: IOSR Journal of Nursing and Health Science. 2013; 1(4):43-47.
2. Barja G. Free radicals, aging & antioxidants: Trends Neurosci. 2004; 27(10):595-600.
3. Mukherjee PK, Maity N, Nema NK, Sarkar BK. Bioactive compounds from natural resources against skin ageing: Phytomedicine. 2011; 19(1):64-73.
4. Puizina IN. A Review on Skin aging: Acta Dermatoven APA. 2008; 17(2):47-54.
5. Yaar M, Gilchrest BA. Photoaging: Mechanism, prevention and therapy: Br. J. Dermatol. 2007; 157(5):874-887.
6. Baumann L. Cosmetic dermatology. McGraw-Hill, Second edition, 2002.
7. Dorofeev VL. Infrared spectra and the structure of drugs of the fluroquinolone group: Pharm. Chem. J. 2004; 38(12):693-697.
8. Raut RW, Lakkakula JR, Kolekar NS, Mendhulkar ViD, Kashid SB. Photosynthesis of silver nanoparticle using Gliricidiasepium: Curr Nano Sci. 2009; 5(1):117.
9. Molla AH, Zakaria MG, Molla MTH, Alam MT, Ahsan MS. Chemical investigation and microbial activity of tinosporacordifoliamiers: J. bio-sci. 2012; 20:153-160.
10. Lyantagaye SL. Ethnopharmacological and phytochemical review of Allium species (sweet garlic) and tulbaghia species (wild garlic) from southern Africa: Tanz. J. Sci. 2011; 37:17-21.
11. Carstensen TJ. Drug Stability Principles and Practices. Marcel Dekker, Third edition, 1995.
12. Grimm W. Extension of The International Conference on Harmonization Tripartite Guideline for Stability Testing of New Drug Substances and Products to Countries Of Climatic Zones III and IV: Drug Development and Industrial Pharmacy. 1998: 24(4):313-325.
13. Matangi P, Mamidi AS, Gulshan MD, Raghavamma STV, Nadendla RR. Formulation and Evaluation of Anti-Aging Poly Herbal Cream: Int. J. Pharm. Sci. Rev. Res. 2014; 24(2):133-136.
14. Sekar M, Sivalinggam P, Mahmad A. Formulation and evaluation of novel antiaging cream containing rambutan fruits extract. Int J Pharm Sci Res. 2017; 8(3):1056-65.
15. Prieto P, Pineda M, Aguilar M. Spectrophotometric quantitation of antioxidant capacity through the formation of a phosphomolybdenum complex: specific application to the determination of vitamin E: Anal. Biochem. 1999; 269(2):337-341.
16. Basumatary S, Das AJ, Nanjian R, Sharma GD. *In vitro* Evaluation of Antioxidant properties of Hodgsonia heteroclite (Cucurbitaceae) fruit: Journal of Applied Pharmaceutical Science. 2015; 5(Suppl 3):080-083.
17. Kaur LP, Guleria TK, Topical Gel. A Recent Approach for Novel Drug delivery: Asian Journal of Biomedical and Pharmaceutical Sciences. 2013; 3(17):1-5.
18. Dhase AS, Khadbadi SS, Sabo SS. Formulation and Evaluation of Vanishing Herbal Cream of Crude drugs: American Journal of Ethnomedicine. 2014; 1(5):313-318.
19. Aswal A, Kalra M, Rout A. Preparation and evaluation of polyherbal cosmetic cream: Scholar Research Library. 2013; 5(1):83-88.
20. Nawale R, Mayee R. Behaviour of natural membrane on drug permeation International journl of pharmaceutical innovations. 2013; 3(3):45-54.
21. Miao ZM, Cheng SX, Zhang XZ, Wang QR, Zhuo RX. Degradation and drug release property of star poly (ε-caprolactone) s with dendritic cores: Wiley periodicals, 2006, 40-49.