International Journal of Current Pharmaceutical Research

ISSN- 0975-7066 Vol 11, Issue 1, 2019

Original Article

EVALUATION OF STABILITY OF HERBAL ANTI-ACNE GEL FORMULATION

KAJAL L. JAIN*, P. K. CHOUDHURY, MAYA SHARMA

Department of Pharmaceutical Sciences, New Campus, Mohanlal Sukhadia University, Udaipur 313001(Rajasthan), India
Email: kajaljain@hotmail.com

Received: 15 Oct 2018, Revised and Accepted: 10 Dec 2018

ABSTRACT

Objective: The present study was aimed to evaluate the physical and chemical stability of prepared gel formulations at various intervals for a period of one year.

Methods: The amount of total flavonoids was analysed using aluminium chloride colorimetric assay using rutin as standard. Gels were dissolved in distilled water and then analysis was carried out and flavonoids quantified by U. V at a wavelength of 415 nm.

Results: Flavanoid content were examined at various time intervals and rate of drug degradation was calculated graphically and by using arrhenius equation. The shelf life of the prepared gel F1, F2, F3, and F4 was found to be 291.76, 460, 184 and 148.39 d.

Conclusion: In the present study an attempt has been made to evaluate the shelf life of herbal gel formulations and to generate scientific database for formulation and evaluation of herbal products.

Keywords: Stability, Shelf life, Herbal gel, Evaluation

DOI: http://dx.doi.org/10.22159/ijcpr.2019v11i1.31990

INTRODUCTION

Skin covers entire body and protects it from the outer environment. Acne is a skin condition which every individual comes across in his lifetime. Mild acne is never treated and is neglected most of the time.

Ayurvedic and herbal medicines apparently looks similar but there is a minor difference between the two which is being misunderstood by the layman. Ayurvedic medicines has specific drugs with a specific method of preperation while in herbal medicines drugs of plant origin is used with modification in its preparation. In ancient times people used to consume herbs or plant parts in their raw form or their freshly prepared extracts. Lack of knowledge and time constraints hindered formulation of fresh preparations. It then becomes a duty of pharmacist to convert the active plant material into a suitable dosage form that can be preserved for a long time without compromising on efficacy.

The actives have been converted to suitable non-oily gel formulations for topical application. Gel formulations for this condition is more suitable compared to oral administration of drugs as it is directly applied to an affected site, bypass liver biotransformation. Avoidance of first pass mechanism with the skin being the only barrier to be crossed to achieve the desired effects. Preparation of topical formulations like ointments and emulsions requires more than 10% of oil, which can adversely affect the acne prone skin. So gel formulations have been prepared and evaluated.

MATERIALS AND METHODS

Drug

The actives for preparing gels were chosen from plants *Butea monosperma* flowers, *Nigella sativa* seeds and V*itex agnus castus* leaves. Extracts of these plants were prepared and dried. Flavaoid analysis by U. V. Spectroscopy revealed that plants contained 2.58 %, 0.92 %, and 1.6 5% flavaoid respectively calculated as rutin. Minimum Inhibitory Concentration of these plants were 100, 250 and 12.5 mcg/ml respectively [1].

Preparation of gel

Gels are semisolid systems consisting of solute dispersed as either small inorganic particles or large organic molecules enclosed and interpenetrated by a liquid solvent. Besides the actives, it consists of a gelling agent, preservatives, moisturizer etc. Polymers are used either as a gelling agent or viscosity imparting substances to provide the structural network to gels.

Gels were prepared by coagulation method. Polymers were presoaked for 24 h. The additives and actives were added in various quantities and agitated. Additives change the viscosity of formulation and at times the pH of the formulation changes due to increase or decrease in concentration of the active or additive. Finally, triethyleneamine was added to form the gel matrix at pH 7. Table 1 depicts various combinations for formulated gels [2].

Table 1: Additives added in the formulations

Formulation code	Gelling agent	Butea extract (µg/ml)	Nigella extract (µg/ml)	Vitex extract (µg/ml)	Methyl paraben (ml)	Glycerine (ml)
F1	Carbopol 940	125	200	10	0.5	5
F2	Carbopol 940, Methyl cellulose	125	250	12.5	0.5	10
F3	Carbopol 940	100	100	50	0.5	5
F4	Carbopol 940	250	500	25	0.5	10

Procedure for the determination of total flavonoids

The total flavonoid in the gel formulations were measured using the Aluminium chloride colorimetric method. 1 gram of gel was dissolved in 20 ml of distill water. To 0.5 ml of this dissolved gel, 1.5 ml of 80 % methanol, 0.1 ml potassium acetate (1M) and 0.1 ml of 10% aluminium chloride was added. Distilled water was then added to make volume up to 5 ml. Then the solution was incubated for 30

min at room temperature. The absorbance was measured at λmax 415 nm using UV spectrophotometer against a blank. A standard curve was prepared by dissolving rutin in methanol followed by serial dilution. By placing the absorbance value in the regression equation, the amount of flavanoid in gels was calculated [1].

Freeze-thaw cycle

All samples were analyzed for their flavanoid content before the initiation of freeze-thaw studies and stability studies. The flavanoid content in these formulations varied because the amount of extract added were different. In the first cycle, formulations were kept at+4 °C in 25 ml glass bottles for 24 hr and then thawed at 25 °C for 24 hr. In the second cycle, samples were kept at+4 °C for another 24 hr and were then thawed at 40 °C for 1.5 hr. Finally, samples were equilibrated under room conditions for 1 hr and their content analysis and other studies were performed [3].

Storage condition and evaluation parameters

These samples were stable after freeze-thaw cycles in terms of flavanoid content have been further tested at repeated intervals for stability predictions. (table 3–6. fig. 1–4). The purpose of chemical stability testing is to provide evidence regarding the quality and quantity of an Active Pharmaceutical Ingredient or Finished Pharmaceutical Product with respect to time under the influence of varied environmental factors like temperature, pH, humidity and light. The prepared gels were kept at three different storage conditions.

- 30 °C±2 °C/65% RH±5% RH for 12 mo
- 40 °C±2 °C/75% RH±5% RH for 12 mo
- 70 °C±2 °C in an oven for 1 mo

These gels were stored at different conditions as mentioned earlier and analysed for their organoleptic characteristics and flavanoid content at time intervals of 0, 7, 14, 28, 70, 140, 280 and 365 d.

RESULTS AND DISCUSSION

The total flavonoid in the gel formulations were measured using the Aluminium chloride colorimetric method (table 2). A standard curve was prepared using rutin as the standard by dissolving it in methanol followed by serial dilution. Absorbance is measured for the concentration range of 1–50 µg/ml and plotting these values in graph gave a straight line with a slope of 0.017 and y-intercept of 0.003. The equation of line being y = 0.017x+0.003.

Table 2: Flavanoid concentration in various formulations

Formulation	Flavanoid (µg)/100 g
F1	1228.126
F2	1476.892
F3	1328.105
F4	1413.671

Quantitative results after freeze-thaw study showed that the decrease in flavanoid concentration after the study was lesser than 10 % of initial flavanoid concentration. Long term and accelerated stability studies were carried out. In first order degradation graph plot of the logarithm of % unchanged drug v/s time is shown where the rate of degradation is concentration dependent and slope of an equation is equal to-2.303/K.

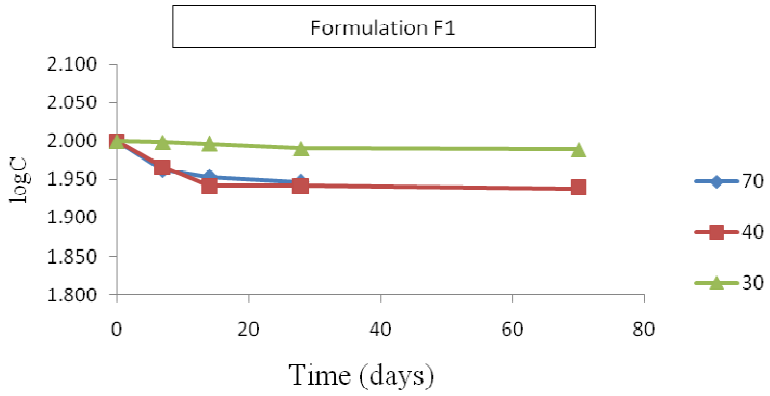

Fig. 1: First order graph of formulation F1

Flavanoid analysis for gel formulation F1, F2, F3and F4 were done at 0, 7, 14 and 28 d for samples kept at 70 °C, while for samples kept at 30 °C and 40 °C flavanoid analysis was done at 0,7, 14, 28, 70, 140, 280 and 365 d. The results upto 70 d for these samples kept at various temperatures are graphically represented (fig. 1,2,3,4). The regression line was obtained. The drug degradation equation and shelf life were calculated (table 3, 4, 5, 6). A shelf life of formulation F1 estimated from results upto 70 d by using Arrhenius equation was found to be 383.33 d. Analysis of flavanoids was done at 140, 280 and 365 d for samples stored at 30 °C which contained 96.22, 95.54 and 94.92 % of flavanoid respectively.

Table 3: First order degradation profile for formulation F1

Temperature	70 °C	40 °C	30 °C
Drug equation	y = 0.001x+1.986	y = 0.000x+1.972	y = 0.000x+1.998
Slope	0.0017	0.00062	0.00016
Shelf life	27.12	73.64	291.76

Shelf life of formulation F2 estimated from results up to 70 d by using Arrhenius equation was found to be 821.43 d. Analysis of flavanoids was done at 140 and 280 d for samples stored at 40 °C which contained 91.59 and 89.97 % flavanoid respectively. Analysis of flavanoids was done at 140, 280 and 365 d for samples stored at 30 °C which contained 96.54, 95.28 and 94.66 % of flavanoid respectively.

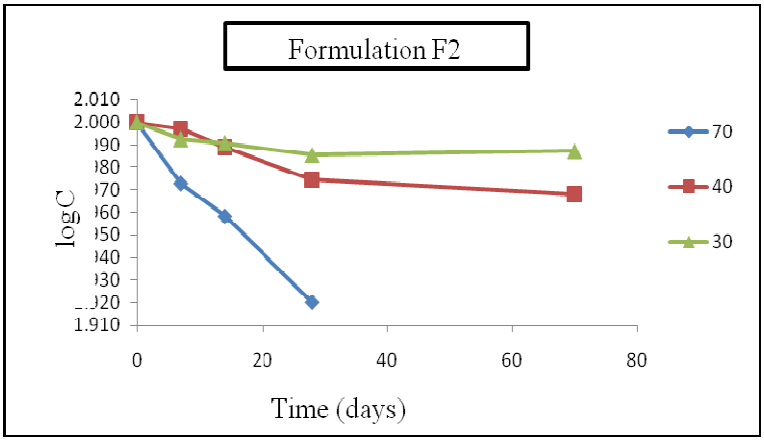

Fig. 2: First order graph of formulation F2

Table 4: First order degradation profile for formulation F2

Temperature	70 °C	40 °C	30 °C
Drug equation	y =-0.002x+1.996	y =-0.000x+1.996	y =-0.000x+1.994
Slope	-0.003	-0.0005	-0.0001
Shelf life	15.33	92	460

Shelf life of Formulation F3 estimated from results up to 70 d by using Arrhenius equation was found to be 272.19 d. Analysis of flavanoids was done at 140, 280 and 365 d for samples stored at 30 °C which contained 94.37, 91.48 and 86.77 % of flavanoid respectively.

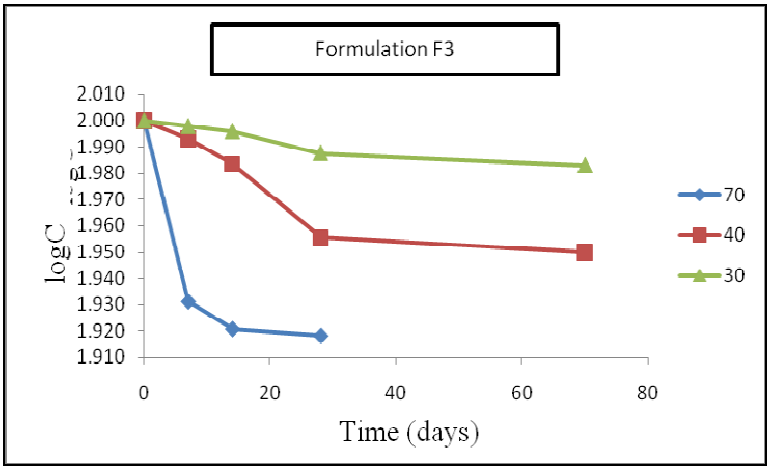

Fig. 3: First order graph of formulation F3

Table 5: First order degradation profile for formulation F3

Temperature	70 °C	40 °C	30 °C
Drug equation	y =-0.002x+1.972	y =-0.000x+1.993	y =-0.000x+1.998
Slope	-0.00249	-0.00072	-0.00025
Shelf life	18.47	63.819	184

Shelf life of gel formulation F4 estimated from results up to 70 d by using Arrhenius equation was found to be 235.89 d. Analysis of flavanoids was done at 140, 280 and 365 d for samples stored at 40 °C which contained 94.80, 92.57 and 90.51 % of flavanoid respectively. Analysis of flavanoids were done at 140, 280 and 365 d for samples stored at 30 °C which contained 92.18, 90.77 and 88.34 % of flavanoid respectively.

Table 6: First order degradation profile for formulation F4

Temperature	70 °C	40 °C	30 °C
Drug equation	y =-0.001x+2.004	y =-0.000x+1.991	y =-0.000x+1.996
Slope	0.004457	-0.00014	-0.00031
Shelf life	10.32	328.57	148.39

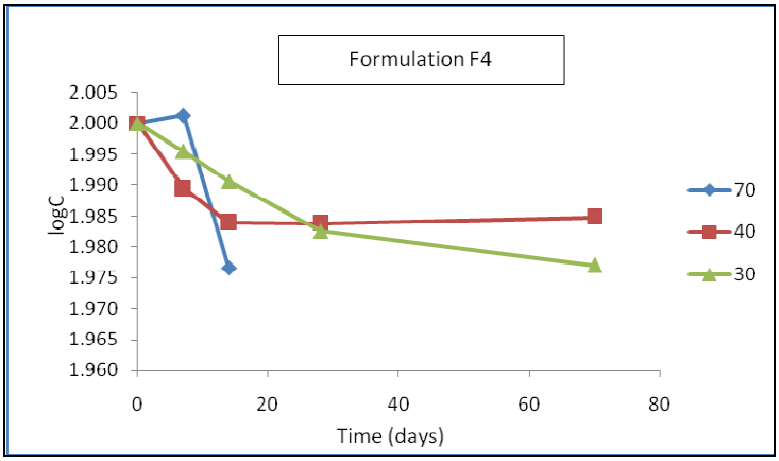

Fig. 4: First order graph of formulation F4

CONCLUSION

The stability study results showed that there were no change in organoleptic characteristics of the prepared gels and they were stable in terms of chemical content and had shelf life of 5 mo to 15 mo. The gels were microbiologically stable after the study period.

ACKNOWLEDGMENT

The facilities provided by the Department of Pharmaceutical Sciences, Mohanlal Sukhadia University is gratefully acknowledged.

AUTHORS CONTRIBUTIONS

All the author have contributed equally

CONFLICT OF INTERESTS

Declare none

REFERENCES

1. Jain KL, Choudhury PK, Sharma M. Total flavonoid quantification and to study antibacterial potency of extracts of butea monosperma flowers, nigella sativa seeds and vitex agnus castus leaves. Int J Curr Pharm Res 2017;9:71-4.
2. Jain KL, Choudhury PK, Sharma M, Dev S. Preparation and evaluation of anti-acne herbal gel. Eur J Biomed Pharm Sci 2017;4:578-81.
3. Yapar EA, Inal O. Design and *in vivo* evaluation of emulgel formulations including green tea extract and rose oil. Acta Pharm 2013;63:531-43.