Shelf Life Evaluation of Shirishavaleha and its Granules: A Preliminary Study

Dilip Kumar D Prajapati¹, Galib Ruknuddin², Prashant Bedarkar³, Biswajyoti Patgiri⁴, Pradeep K Prajapati⁵

ABSTRACT
Background: Shelf life is the length of time, after which all substances start to degrade in their qualities and become unsuitable for consumption or sale. Every product has a definite shelf life, which depends on various physical, chemical, environmental, and biological factors. Shelf life of various compound formulations was clarified in the classical text. So there is a need to revalidate and establish the shelf life of individual formulation. As the Government of India made it mandatory to display in the labels the shelf life of all products, it becomes essential to evaluate the actual shelf life of individual products by following the specified guidelines.

Aim: To evaluate the shelf life of Shirishavaleha (SHA) and its granules prepared with Khanda Sharkara through accelerated stability parameters.

Materials and methods: Physicochemical parameters of SHA and Shirishavaleha granules (SHG) were calculated by maintaining 40°C ± 2°C temperature and 75 ± 5% relative humidity at the intervals of 0, 1, 3, and 6 months. Based upon the observations, intercept, slope, 10% degradation of the sample, and finally the shelf life were calculated.

Results: Accelerated stability study reveals the shelf life of SHA as 5.9 years, while that of the granules as 5.3 years. Similar R values obtained in high-performance thin-layer chromatography (HPTLC) analysis of both samples initially and after 6 months showed minimum deterioration of the product. Microbial count and heavy metals were below the permissible limits in both the samples.

Conclusion: Guidelines specified in the Drugs and Cosmetics Act, 1940, mentions 3 years as the shelf life of Avalehas and granules. This time period is general, and different formulations may have different shelf lives based upon the factors such as their composition, etc. The samples tested in the current study, i.e., SHA and SHG, are found to have a shelf life of 5.9 and 5.3 years, respectively, through accelerated stability study that are almost double the average time specified in the guidelines.

Keywords: Accelerated stability, Khanda Sharkara, Shelf life, Shirishavaleha.

INTRODUCTION
Shelf life of pharmaceutical products is defined as the capability of formulations in a specific closure system to remain within its physical, chemical, microbiological, therapeutic, and toxicological specification.¹ In Ayurveda, it is discussed under Savirjata avadhi that is the time period during which the potency (Virya) of a drug remains unaffected due to environmental or microbial factors.² Information regarding the concept of Savirjata avadhi is scattered in Brihatrayi. During medieval period, authors attempted to compile the available information on Savirjata avadhi and mentioned in their respective texts.³⁻⁵

A number of dosage forms are explained in Ayurveda, which have different shelf life, depends on various physical, chemical, environmental and biological factors. A few Kalpanas have very short life, such as Swarasas (juice), Kalka (paste), Kwatha (decoction), etc., while a few have longer shelf life like Asava (self-generated alcohol), Bhasma (calcined metals/minerals), etc. Average shelf life of formulations under different categories has been specified through the gazettes of Government of India and it is an essential component to be displayed in the labeling.⁶

Avalehas are semisolid dosage forms prepared with the addition of jaggery or sugar or sugar candy and boiled with prescribed juices or decoctions. They are familiar in Ayurveda therapeutics. Savirjata avadhi of Avaleha in Ayurveda classics is 1 year, while the gazette of the Government of India mentions it as 3 years.⁴⁻⁷ As the available information on shelf life is general, it becomes essential to evaluate shelf life of individual formulations by following the standard guidelines. Considering this, an attempt has been made to evaluate the shelf life of Shirishavaleha (SHA) and Shirishavaleha granules (SHG) prepared in the presence of sugar through accelerated stability study.

MATERIALS AND METHODS
Test Drugs
SHA and SHG
Shirishavaleha is a poly herbal formulation (Table 1), which consists of dried powders of nine herbal drugs in equal proportion, with decoction of Shirisha and Khanda Sharkara.

1.² Department of Rasashastra and Bhaishajya Kalpana, Institute for Postgraduate Teaching and Research in Ayurveda, Jamnagar, Gujarat, India
2.² Department of Rasashastra and Bhaishajya Kalpana, All India Institute of Ayurveda, New Delhi, India
Corresponding Author: Dilip Kumar D Prajapati, Department of Rasashastra and Bhaishajya Kalpana, Institute for Postgraduate Teaching and Research in Ayurveda, Jamnagar, Gujarat, India, Phone: +91 9723407045, e-mail: vdddpg2309@gmail.com
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Conflict of interest: None

1.² Department of Rasashastra and Bhaishajya Kalpana, Institute for Postgraduate Teaching and Research in Ayurveda, Jamnagar, Gujarat, India
2.² Department of Rasashastra and Bhaishajya Kalpana, All India Institute of Ayurveda, New Delhi, India
3.² Department of Rasashastra and Bhaishajya Kalpana, Institute for Postgraduate Teaching and Research in Ayurveda, Jamnagar, Gujarat, India, Phone: +91 9723407045, e-mail: vdddpg2309@gmail.com

Original Article
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Conclusion: Guidelines specified in the Drugs and Cosmetics Act, 1940, mentions 3 years as the shelf life of Avalehas and granules. This time period is general, and different formulations may have different shelf lives based upon the factors such as their composition, etc. The samples tested in the current study, i.e., SHA and SHG, are found to have a shelf life of 5.9 and 5.3 years, respectively, through accelerated stability study that are almost double the average time specified in the guidelines.

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Table 1: Formulation composition of Shirishavaleha and its granules

| Ingredient | Botanical name      | Part                | Classical | Quantity |
|------------|---------------------|---------------------|-----------|----------|
| 1          | Shirisha            | Albizia lebbeck     | Dried bark | 50 Pala  |
| 2          | Pippali             | Piper longum        | Dried fruit| 1 Pala   |
| 3          | Priyangu            | Callicarpa macrophylla | Dried flower| 1 Pala   |
| 4          | Kushtha             | Saussurea lappa     | Dried root| 1 Pala   |
| 5          | Ela                 | Elettaria cardamomum | Dried seed| 1 Pala   |
| 6          | Nilini              | Indigofera tinctoria | Dried root| 1 Pala   |
| 7          | Haridra             | Curcuma longa       | Dried rhizome| 1 Pala   |
| 8          | Daruharidra         | Berberis aristata   | Dried stem| 1 Pala   |
| 9          | Shunthi             | Zingiber officinale | Dried rhizome| 1 Pala   |
| 10         | Nagakesara          | Mesua ferrea        | Dried stamen| 1 Pala   |
| 11         | Khanda Sharkara     | Sugar candy         | –         | 200 Pala |
| 12         | Jala                | Potable water       | –         | 2 Drona  |

Table 2: Pharmaceutical details of Shirishavaleha and its granules

| Item       | Avaleha | Granules |
|------------|---------|----------|
| Shirisha Kwatha (L)                           3.20       3.32
| Khanda Sharkara (kg)                          5.00       5.00
| Total duration (hour)                         6:46       7:21
| Temp. at Asanna poka (°C)                     95–100     95–100
| Prakshepa added at (°C)                       60–65      75–80
| Total yield (kg)                              6.158      5.296

Storage Conditions

Accelerated stability study was conducted per the International Council for Harmonisation (ICH) guideline Q1A (R2). Temperature maintained in the study was 40°C ± 2°C, while the relative humidity was 75 ± 5%.

Frequency of Withdrawal of the Samples

Samples were withdrawn from the chamber at an interval of 0, 1, 3, and 6 months.

Parameters for Evaluation

Both the samples were studied for changes in organoleptic parameters such as color, odor, taste, and physicochemical parameters like pH value, moisture content, total ash, water-soluble extractive value, methanol-soluble extractive value, total fat, total solids, and total sugar in the intervals mentioned above. Total saponin, total alkaloids, total tannins, and tests for microbial contamination were done initially and at the end of 6 months by following standard guidelines. Results obtained at different stages (0, 1, 3, and 6 months) were analyzed to calculate intercept, slope (Figs 1 to 11), and finally 10% degradation of the compound under experiment. Ten percent degradation was set as the acceptable point to extrapolate the accelerated stability data. The mean obtained of these months was multiplied with real-time aging factor. As India comes under climatic zone III countries, the real-time aging factor is 3.33, which was used to extrapolate the shelf life. Number of months taken to achieve 10% degradation was calculated using the following formula:

\[
\text{Months when 10\% degradation occurs} = \frac{[0\text{ month assay value} - 0\text{ month assay value} \times \text{Slope}]}{10\%} - \text{Intercept}
\]

(sugar candy) as the sweetening agent. It is a modified formulation of Shirisharishta. The stem bark of Shirisha (Albizia lebbeck (L.) Benth.) was collected from Botanical Garden, Gujarat Ayurved University, Jamnagar. Nagakesara (Mesua ferrea L.) was procured from the markets of Udupi, Karnataka. Nilini (Indigofera tinctoria L.) was collected from the periphery of Jamnagar and sugar candy was purchased from the local markets of Jamnagar, Gujarat. All other raw materials including Pippali (Piper longum L.), Priyangu (Callicarpa macrophylla Vahl), Kushtha (Saussurea lappa (Decne.) C. B. Clarke), Ela (Elettaria cardamomum (L.) Maton), Haridra (Curcuma longa L.), Daruharidra (Berberis aristata DC.), and Shunthi (Zingiber officinale Roscoe.) were procured from the pharmacy, Gujarat Ayurved University, Jamnagar. All the herbal drugs were authenticated at the Pharmacognosy Laboratory, Institute for Post Graduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar. The drugs were cleaned and shade dried before usage.

Method of Preparation

Yavakuta (coarse powder) of Shirisha was added with 10 times of potable water in a stainless steel vessel and soaked over the night. Next morning, it was heated on mild flame until the volume of the liquid (Kwatha) was reduced to one fourth. Khanda Sharkara (sugar candy) was added to Kwatha and it was boiled till the appearance of Avaleha Siddhi Lakshana. After this, heating was stopped and it was allowed for self-cooling (60 to 65°C). Later on, the fine powder form of Prakshepa Dravya (ingredients numbered 2 to 10 in Table 1) was added. The pharmaceutical procedure of granules is similar to Avaleha. The difference is only the heating duration required, which is more than that of Avaleha. After adding Prakshepa Dravya, the solid mass was passed through sieve no. 10 to obtain its granules. Details are shown in Table 2.

Packing

Both SHA and SHG were packed in airtight food-grade plastic containers of 150 g capacity.

Sample Quantity

Four containers of the final products of both the samples (SHA and SHG) of 100 g each were packed and stored in accelerated stability chamber.
The HPTLC Analysis
The high-performance thin-layer chromatography (HPTLC) fingerprint profile of methanolic extract of both samples was taken on aluminum plate precoated with silica gel 60 F254 (E. Merck) as adsorbent and employing CAMAG Linomat 5 applicator. The mobile phase used was toluene–ethyl acetate–formic acid (7:3:0.1). For derivatization, anisaldehyde sulfuric acid reagent was followed by heating at 100 ± 5°C till the spots appeared. The plate was dried and visualized under ultraviolet (UV) 254, 366, and 540 nm. The HPTLC finger prints were taken initially (0 month) and after 6 months.

Results and Observations
No significant changes were noticed in color, odor, and taste of both the samples up to the storage of 6 months under accelerated conditions (Tables 3 and 4). Observations in other analytical profiles at regular intervals and intercept, slope, 10% degradation, and shelf life are provided in Tables 5 to 9. After these calculations, it was found that the shelf life of SHA was 5.9 years and that of SHG was 5.3 years.

Discussion
Insignificant differences were observed in the preliminary physicochemical profiles of both the drugs. Approximate months required for the degradation in total sugar and total ash may have an effect on the stability period of SHG sample (Table 8). Based on the overall observation of all the parameters, SHA was found to be more stable than SHG. Normally, it is assumed that the stability of granules is more than Avaleha. Stability of granules prepared...
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**Fig. 4** Slope and intercept of alcohol-soluble extractive of both the samples

**Fig. 5** Slope and intercept of water-soluble extractive of both the samples

**Fig. 6** Slope and intercept of total fats of both the samples

**Fig. 7** Slope and intercept of total solid content of both the samples
Fig. 8: Slope and intercept of total sugar estimation of both the samples

Fig. 9: Slope and intercept of total alkaloids of both the samples

Fig. 10: Slope and intercept of total tannin of both the samples

Fig. 11: Slope and intercept of total saponin of both the samples
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Sugar candy is commonly made from a combination of sucrose and glucose syrups which is typically about 98% or more of the solid sugar. The concentrated sugar solution is the protector which does not allow early deterioration of the Avaleha formulation. Sugar candy contains approximately 2 to 5% water content which is less as compared to jaggery which contains 8 to 10% water content. Shelf life is largely determined by the amount of moisture content present in the sweetening agent, i.e., jaggery.

Table 3: Organoleptic characteristics of Shirishavaleha at different intervals

| Parameters          | Initial (October 5, 2016) | 1st month (November 5, 2016) | 3rd month (January 5, 2017) | 6th month (April 5, 2017) |
|---------------------|---------------------------|-----------------------------|---------------------------|---------------------------|
| Form                | Brownish black with spongy consistency | Brownish black with spongy consistency | Brownish black with spongy consistency | Brownish black with spongy consistency |
| Taste               | Bitter and astringent     | Bitter and astringent       | Bitter and astringent     | Bitter and astringent     |
| Color               | Blackish brown           | Blackish brown              | Blackish brown           | Blackish brown           |
| Odor                | Characteristic           | Characteristic              | Characteristic           | Characteristic           |
| Consistency         | Sticky paste             | Sticky paste (a thin film of liquid was observed on the upper surface) | Sticky paste (a thin film of liquid was observed on the upper surface) | Sticky paste (a thin film of liquid was observed on the upper surface) |

Table 4: Organoleptic characteristics of Shirishavaleha granules at different intervals

| Parameters          | Initial | 1st month | 3rd month | 6th month |
|---------------------|---------|-----------|-----------|-----------|
| Form                | Chocolate brown granular | Chocolate brown granular | Chocolate brown granular | Chocolate brown granular |
| Taste               | Bitter and astringent     | Bitter and astringent     | Bitter and astringent     | Bitter and astringent     |
| Color               | Chocolate brown           | Chocolate brown           | Chocolate brown           | Chocolate brown           |
| Odor                | Characteristic            | Characteristic            | Characteristic            | Characteristic            |

Table 5: Physicochemical profile of Shirishavaleha and Shirishavaleha granules at different intervals

| Parameters                        | Initial (October 5, 2016) | 1st month (November 5, 2016) | 3rd month (January 5, 2017) | 6th month (April 5, 2017) |
|-----------------------------------|---------------------------|-----------------------------|---------------------------|---------------------------|
| pH (1% w/v sol.)                  | SHA | SHG | SHA | SHG | SHA | SHG | SHA | SHG | SHA | SHG | SHA | SHG |
| Moisture (%) (K/F)                | 5.16 | 2.73 | 6.55 | 2.77 | 6.97 | 2.79 | 7.01 | 3.47 |
| Total ash (%)                     | 0.19 | 0.46 | 0.20 | 0.39 | 0.19 | 0.29 | 0.20 | 0.34 |
| Alcohol-soluble extractive (%)    | 53.07 | 51.49 | 45.21 | 45.76 | 45.43 | 48.86 | 48.67 | 47.24 |
| Water-soluble extractive (%)      | 82.23 | 94.37 | 82.99 | 93.04 | 78.73 | 91.56 | 76.84 | 90.64 |
| Total fats (%)                    | 0.05 | 0.15 | 0.06 | 0.08 | 0.06 | 0.11 | 0.06 | 0.14 |
| Total solids (%) (10% solution)   | 6.25 | 12.37 | 6.28 | 11.74 | 6.18 | 11.91 | 6.30 | 12.21 |
| Total sugar (%)                   | 57.31 | 61.75 | 57.35 | 60.38 | 58.42 | 60.14 | 57.86 | 60.01 |
| Total tannins (%)                 | 2.44 | 2.51 | 0.25 | 0.17 | 2.07 | 1.97 | 0.21 | 0.12 |
| Total alkaloids (%)               | 18.03 | 16.03 | 16.34 | 14.67 |
| Total saponins (%)                | 18.03 | 16.03 | 16.34 | 14.67 |

Table 6: Microbial growth in Shirishavaleha and its granules

| Organism                | Initial | 6th month | Permissible limits |
|-------------------------|---------|-----------|--------------------|
| Total plate count (cfu/g)| SHA | SHG | 61 | <10 | 108 | 34 | <100 cfu/g |
| Total fungal count (cfu/g)| 22 | Absent | 42 | Absent | Absent per 10 g |
| Escherichia coli         | Absent | Absent | Absent | Absent | Absent per 10 g |
| Pseudomonas aeruginosa   | Absent | Absent | Absent | Absent | Absent per 10 g |
| Staphylococcus aureus    | Absent | Absent | Absent | Absent | Absent per 10 g |
| Salmonella spp.          | Absent | Absent | Absent | Absent | Absent per 10 g |

with Khanda Sharkara is reported to be more in comparison to Avaleha prepared with Guda (jaggery). If Avaleha is prepared by using Khanda Sharkara, its shelf life will be more than that of its granules. As in Avaleha, the concentrated sugar solution is the protector which does not allow early deterioration of the Avaleha formulation.
Table 7: Intercept and slope of Shirishavaleha and Shirishavaleha granules

| Parameters                | Intercept | Slope |
|---------------------------|-----------|-------|
| SHA                       |           |       |
| pH (1% w/v)               | 5.99      | 0.118 |
| Moisture (%)              | 5.79      | 0.252 |
| Total ash (%)             | 0.193     | 0.001 |
| Alcohol-soluble ext. (%)  | 48.98     | 3.54  |
| Water-soluble ext. (%)    | 82.79     | 1.036 |
| Total fat (%)             | 0.05      | 0.001 |
| Total solids (10% soln.)  | 6.24      | 0.005 |
| Total sugars (%)          | 57.45     | 0.115 |
| Total alkaloids           | 0.25      | 0.007 |
| Total tannin              | 2.44      | 0.617 |
| Total saponin             | 18.03     | 0.282 |

| SHA                       |           |       |
| SHG                       |           |       |
| Intercept                 | 5.81      | 0.052 |
| Slope                     | 0.126     |       |
| Intercept                 | 0.41      |       |
| Slope                     | 0.019     |       |
| Intercept                 | 49.24     |       |
| Slope                     | 0.362     |       |
| Intercept                 | 93.89     |       |
| Slope                     | 0.594     |       |
| Intercept                 | 0.118     |       |
| Slope                     | 0.002     |       |
| Intercept                 | 12.04     |       |
| Slope                     | 0.007     |       |
| Intercept                 | 61.15     |       |
| Slope                     | 0.230     |       |
| Intercept                 | 0.17      |       |
| Slope                     | 0.0083    |       |
| Intercept                 | 2.51      |       |
| Slope                     | 0.09      |       |
| Intercept                 | 16.03     |       |
| Slope                     | 0.227     |       |

Table 8: Approximate period for 10% degradation in Shirishavaleha and Shirishavaleha granules

| Parameters                | Initial | 10% degradation | Approximate months required for 10% degradation |
|---------------------------|---------|------------------|-----------------------------------------------|
| SHA                       |         |                  |                                               |
| SHA                       | 5.95    | 5.36             | 1.03                                          |
| SHG                       | 5.16    | 4.65             | 4.55                                          |
| Total ash (%)             | 0.46    | 0.41             | 22                                            |
| Alcohol-soluble ext. (%)  | 51.49   | 47.77            | 3.44                                          |
| Water-soluble ext. (%)    | 94.37   | 74.01            | 8.42                                          |
| Total fat (%)             | 0.155   | 0.04             | 10                                            |
| Total solid (10% soln.)   | 12.37   | 11.13            | 123                                           |
| Total sugar (%)           | 61.75   | 55.57            | 51.05                                         |
| Total alkaloids           | 0.17    | 0.22             | 3.57                                          |
| Total tannin              | 2.51    | 2.26             | 0.39                                          |
| Total saponin             | 16.03   | 14.43            | 6.39                                          |
| Mean months               |         |                  | 21.26                                         |

| SHA                       |         |                  |                                               |
| SHG                       |         |                  |                                               |
| Total ash (%)             | 0.46    | 0.41             | 22                                            |
| Alcohol-soluble ext. (%)  | 51.49   | 47.77            | 3.44                                          |
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| Total alkaloids           | 0.17    | 0.22             | 3.57                                          |
| Total tannin              | 2.51    | 2.26             | 0.39                                          |
| Total saponin             | 16.03   | 14.43            | 6.39                                          |
| Mean months               |         |                  | 19.11                                         |

Table 9: Extrapolation of shelf life in Shirishavaleha and its granules

| Drug | Months | Multiplication factor | Shelf life |
|------|--------|-----------------------|------------|
| SHA  | 21.26  | 3.33                  | 70.80      | 5.9        |
| SHG  | 19.11  | 3.33                  | 63.63      | 5.3        |

or sugar candy. Thus, the shelf life of Avaleha prepared with sugar candy may be more than the sample prepared with jaggery.

In SHA due to more quantity of sugar candy as compared to its liquid form, a thin layer of sugar syrup was observed. This may be the layer of inverted sugar possibly produced by splitting of the disaccharide sucrose into glucose and fructose. The layer of inverting sugar provided more powerful preserving qualities as longer shelf life to products. 25

Previous works have reported more stability to granules in comparison to Avaleha when the samples are prepared with Guda (jaggery) as the sweetening media. 19 But, in the present study, both formulations were prepared by using Khanda Sharkara as the sweetening media, where shelf life was found to be significantly increased. 20

The HPTLC finger print studies of methanolic extract of both samples were carried out and chromatogram was developed and detected using the UV visible chamber, initially and after 6 months (Figs 12 to 23). All the spots identified in both the samples initially and after 6 months showed similar Rf values (Table 10), indicating minimum deterioration of the product.

Fig. 12: Comparative (0 month to 6 months) high-performance thin-layer chromatography plate at 254 nm (Shirishavaleha)
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**Fig. 13:** Comparative (0 month to 6 months) high-performance thin-layer chromatography chromatogram at 254 nm (*Shirishavaleha*).

**Fig. 14:** Comparative (0 month to 6 months) high-performance thin-layer chromatography plate at 366 nm (*Shirishavaleha*).

**Fig. 15:** Comparative (0 month to 6 months) high-performance thin-layer chromatography chromatogram at 366 nm (*Shirishavaleha*).

**Fig. 16:** Comparative (0 month to 6 months) high-performance thin-layer chromatography plate at 540 nm (*Shirishavaleha*).

**Fig. 17:** Comparative (0 month to 6 months) high-performance thin-layer chromatography chromatogram at 540 nm (*Shirishavaleha*).

**Fig. 18:** Comparative (0 month to 6 months) high-performance thin-layer chromatography plate at 254 nm (*Shirishavaleha* granules).
Shelf-life defined for Avaleha and Granules in Rule 161B of Drugs and Cosmetics Act–1940 is 3 years. In the current study, SHG were found to have shelflife of 5.3 years, while SHA was comparatively found to be more stable with a shelflife of 5.9 years. This observation may be specific to SHA and SHG prepared in presence of Sugar candy. The shelf life found in current study is almost double to the average time specified in the guidelines that may be due to the use of Khanda Sharkara in the formulation. Thus, change in sweetening agent helps in keeping the product more stable for longer duration.

**CONCLUSION**

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**ACKNOWLEDGMENT**

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Table 10: $R_f$ value of high-performance thin-layer chromatography

| $R_f$ value | Spots | SHA | SHG |
|-------------|-------|-----|-----|
| *Track 1* | *Track 2* | *Track 1* | *Track 2* |
| 254 nm | 1 | 0.51 | 0.51 | 0.35 | 0.35 |
| | 2 | 0.92 | 0.92 | 0.45 | 0.45 |
| 366 nm | 1 | 0.07 | 0.07 | 0.12 | 0.12 |
| | 2 | 0.37 | 0.37 | 0.35 | 0.35 |
| 540 nm | 1 | 0.67 | 0.67 | 0.78 | 0.78 |
| | 2 | 0.95 | 0.95 | 0.89 | 0.89 |
| | 3 | 0.99 | 0.99 | 0.97 | 0.97 |

*Track 1—initial (0 month); **Track 2—after 6 months

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हिंदी सारांश

शिरिशवालेह और इसकी कणिकाओं का शेल्फ लाइफ मूल्यांकन : एक प्राथमिक अध्ययन

पूर्वरूपी: शेल्फ लाइफ समय की अवधि है, जिसके बाद सभी पदार्थ अपने गुणों में निर्बाही रहता है और उपयोग अथवा बिक्री के लिए अनुपयुक्त हो जाता है। प्रत्येक उत्पाद में निश्चित शेल्फ लाइफ होता है, जो विभिन्न भौतिक, रासायनिक, पदार्थविद्याओं और जैविक कारकों पर निर्भर करता है। शास्त्रीय ग्रंथ में विभिन्न वैज्ञानिक योग्यता के लिए शेल्फ लाइफ को स्पष्ट किया गया है। इसलिए विशिष्ट योग्यता के शेल्फ लाइफ को पुनर्विश्लेषण करने और स्थापित करने की आवश्यकता है। इसलिए अनुसंधान शेल्फ लाइफ को पुनर्विश्लेषण करने और स्थापित करने की आवश्यकता है। जैसा कि भारत सरकार ने सभी उत्पादों के शेल्फ लाइफ को लेख में प्रदर्शित करना अनिवार्य कर दिया है, यह निर्दिष्ट दिशानिर्देशों का पालन करने हेतु विशिष्ट उत्पादों के वास्तविक शेल्फ लाइफ का मूल्यांकन करने के लिए आवश्यक हो जाता है।

उद्देश्य: शिरिशवालेह (एसएचए) के शेल्फ लाइफ और इसकी कणिकाओं का मूल्यांकन त्वरित स्थिरता मापदंडों के माध्यम से खंड शरणार्थ के साथ तैयार किया गया है।

सामग्री और विधियां: एसएचए और शिरिशवालेह शेल्फ लाइफ के भौतिक रासायनिक मापदंडों की गणना 0, 1, 3 और 6 महीने के अंतराल पर 40°C ± 2°C तापमान और 75 ± 5% सापेक्ष आर्द्रता बनाए रखकर की गई थी। अलग-अलग अवस्थाओं, उत्तर, नमूनों के 10% क्षरण के आधार पर और अंतिम रूप से शेल्फ लाइफ की गणना की गई।

परिणाम: त्वरित स्थिरता अध्ययन एसएचए के शेल्फ लाइफ का 5.9 वर्ष दर्जाता है, जबकि शेल्फ लाइफ का 5.3 वर्ष है। इसी तथ्य से यह साबित होता है कि उत्पाद का विश्लेषण शुरू में प्राप्त किया और 6 महीने बाद उत्पाद की न्यूनतम गिरावट दर्जा है। माइक्रोबियल गणना और भारी धातु दोनों नमूनों में अनुसन्धान से नीचे थी।

निष्पक्षता: इस एंड कॉस्मेटिक्स एन्टल, 1940 में निर्दिष्ट दिशा-निर्देशों में अवलोह और शेल्फ लाइफ के शेल्फ लाइफ के रूप में 3 वर्षों का उल्लेख है। यह समयलगभग समान है, और विभिन्न बाजारों में उसकी वर्तमान, आदि जैसे काररों के आधार पर अलग-अलग शेल्फ लाइफ हो सकते हैं। वर्तमान अध्ययन में परीक्षण किए गए नमूने अभी अवश्य एसएचए और एसएचजी क्रम: 5.9 और 5.3 वर्ष की शेल्फ लाइफ पाए जाते हैं, त्वरित स्थिरता अध्ययन के माध्यम से जो दिशानिर्देशों में निर्दिष्ट औसत समय से लगभग दोगुना है।

मुख्य शब्द: त्वरित स्थिरता, खंड शरणार्थ, शेल्फ लाइफ, शिरिशवालेह।