Stability Analysis for Polyherbal Formulation Shringyadi Syrup

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ABSTRACT

Background- The concept of the shelf life of Syrup needs appraisal following a well-drafted stability protocol in the current scenario. Stability testing of pharmaceutical products is a complex set of procedures involving considerable cost, time consumption and scientific expertise to build in quality, efficacy and safety in a drug formulation. The objective of the present study is to evaluate the out-turn of accelerated storage conditions on freshly fabricated formulation *Shringyadi* syrup, along with the prediction of shelf life at which 10% degradation will occur.

Methods- Accelerated stability study as per ICH guideline QA1 (R2) was conducted for six months. Vicissitude in organoleptic and physico-chemical attributes viz. pH, Specific gravity, Viscosity, Total solids and Total sugar was noted at four-time points of 0, 30, 90 and 180 days.

Results- Noticeable changes were observed in organoleptic as well as physico-chemical parameters. Extrapolated Shelf life of Syrup Sample from physico-chemical parameters as per the climatic conditions, climatic zones III and IV, **India** lies, came out to be 44.672 Months or 3.72 Year.

Conclusion- Syrup possesses a better shelf life in accelerated conditions.

Keywords- Accelerated Study, Stability Study, Syrup, *Shringyadi* syrup, Shelf life

INTRODUCTION

The conservation of herbal product attributes during storage is censorious for undertaking therapeutic efficacy. Stability testing is deployed to evaluate how herbal medicines keep their properties under defined storage conditions stressed by light, moisture, heat, oxygen, various physical and chemical conditions (e.g., vibration or freezing), and container-related factors.[1] The Syrup is important preparation for children and non-responsive patients. It is accessible to palatable, and regarding the efficacy, it is proven that liquids are faster acting than solids due to their fast absorption[2]. It has been assigned a shelf life of 3 years concept by Drugs & Cosmetics Amendment Rules 1945, published in Gazette of India (extraordinary) Part-II, section 3, sub-section (i), vide G.S.R. 789(E), dated 12th August 2016.[3] At present, pharmaceutical products are generally assayed using validated stability signifying analytical method, and expiry date is marked based on the established period from the date of manufacture when it would show more than 10% deterioration in the active contains.[4] By following the ICH guideline Q1A (R2) in consideration, an attempt is made hereby to evaluate

the effect of six months accelerated storage conditions on various organoleptic and physico-chemical parameters of the product and to predict the shelf life at which 10% degradation will occur taking *Shringyadi* Syrup as the test drug.

MATERIALS AND METHODS

1) **Test Drug-** One sample were taken for the present study viz. Freshly prepared *Shringyadi* Syrup (Mfg date- JUNE 2020**)** prepared at Department of RSBK, Rishikul Campus, UAU, Haridwar) and were packed in good quality polypropylene containers containing 100ml Syrup in the bottles.
2) **Storage conditions and Evaluation parameters-** The present study was conducted at Vasu research centre, Vadodara, Gujarat, as per ICH guideline Q1A (R2). Organoleptic characteristics and Physico- chemical parameters viz. pH, Specific gravity, Viscosity, Total solids and Total sugar were evaluated. The study was conducted at 40±2°C/75±5% RH for six months with sample time points, i.e. 0, 30, 90 and 180 days.

RESULTS

Table.1 Organoleptic character of the sample of *Shringyadi* Syrup

Time period (In Months)	Colour	Taste	Touch	Consistency
0	Brown	Sweet Taste	Sticky	Viscous liquid
1	Brown	Sweet Taste	Sticky	Viscous liquid
3	Brown	Sweet Taste	Sticky	Viscous liquid
6	Brown	Sweet Taste	Sticky	Viscous liquid

Table.2. Self-life estimation of *Shringyadi* Syrup: -

Parameter	Results at initial month	Intercept	Slope	Results at 10% of degradation	Months at 10% of degradation
pH	4.71	4.6352381	-0.038095	4.239	10.401315
Specific Gravity	1.264	1.263214286	0.002214286	1.1376	56.729025
Viscosity	117.05 cp	117.894	2.534048	105.345	4.952155622419
Total solids	40.51%	48.49428571	2.509285714	36.459	4.796299457989
Total sugar	61.26%	59.56571429	-0.93428571	55.134	4.74342508249
Reducing sugar	37.63%	36.82833333	-0.32333333	33.867	9.1587628857
Non-reducing sugar	23.63%	29.85642857	-2.15857142	21.267	3.97921905877
Mean months at accelerated conditions					13.537171729624
Climate Zone I & II					67.68585864812 Month or 5.64 years

Climate Zone III & IV	44.672666707759 Months or 3.72 Year

DISCUSSION

Stability is the probability of a specific preparation in a specified container/closure system to persist within its physical, chemical, microbiological, toxicological, therapeutic specifications. It is always expressed in terms of shelf life.[5] The chemical reactions viz. reduction, oxidation, racemization etc. which took place in the pharmaceutical formulation may lead to the beginning of degradation product, reduction in strength of active pharmaceutical components (API), loss of excipient activity like antimicrobial preservative action and antioxidants etc.[6] Moreover, the data generated during the stability testing is a significant obligation for regulatory approval of any drug formulation.[7] The most common chemical reactions that influence the quality of Syrup are inversion reaction, Maillard reaction and Caramelization[8,9,10]. Table No. 1 shows no change in colour, Taste, order and consistency of samples during the whole duration of the study.

pH

During the stability of the liquid preparations containing sugar as a sweetening agent, it was analyzed that the pH of the sugar-containing liquid sample was found 4.71, 4.55, 4.45 and 4.45 at the initial time (0 days) and after 30, 90 and 180 days, respectively of the incubation in stability chamber in Fig. 1. This study indicated that the nature was acidic in the formulation, and the pH of all liquid formulations was decreasing on storage in the stability study. The acidic pH of the samples could be due to the active ingredients available in crude drugs present in the formulations, and another reason it may be mallard reaction in sugar syrup.[8,9,10] As sucrose, fructose, and galactose have aldehydes and ketones functional groups, which converts into acid or alcohol with time. The presence of sugar in the liquid preparation may produce an acidic content during storage that may lead to acidic pH. The main emphasis on this property could be only due to active ingredients present and formed in formulation, availability of liquid content in formulations and presence of crude drugs.

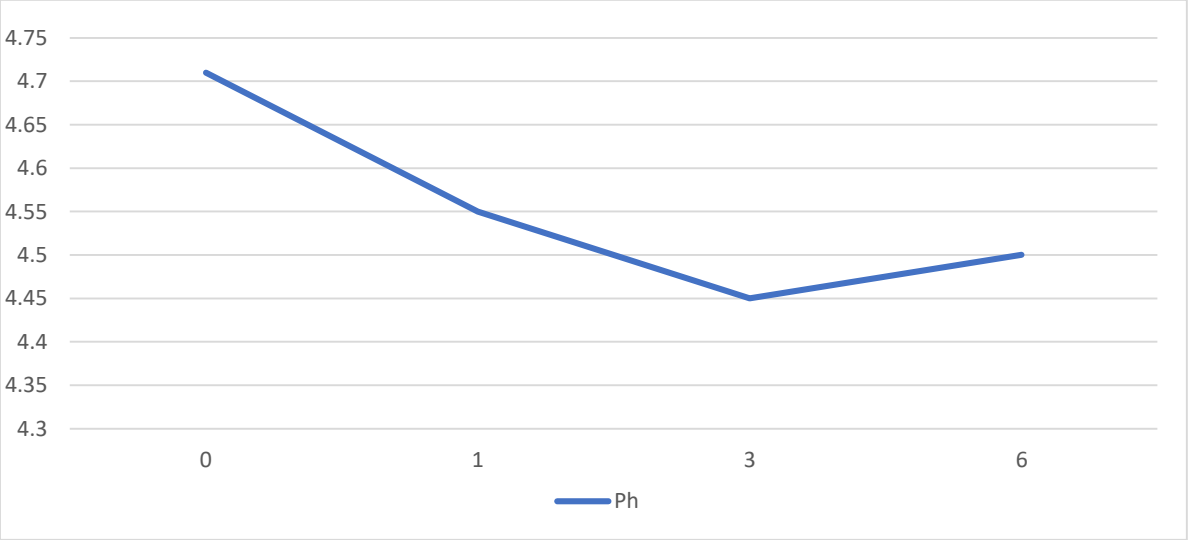

Fig.1- pH estimation of sample

Specific gravity

The presence of the solid content increases the consistency of the preparation, and consequently, the weight in unit volume also increases. The influence of gravitational force on the tiny particulate matter is not

significant as all of these are present in the Brownian movement. The formation of the aggregates/loose floccules results in settling, which affects the specific gravity.[11] The results are shown in Fig. 2. In the six-month stability study, the specific gravity of the sample was found 1.264, 1.265, 1.269 and 1.277. In the sample, the specific gravity was increased that indicated loss of some volatile matter and water due to the formation of vapours. So, water activity was highly important for extending the shelf-life stability of Syrup during storage.[12]

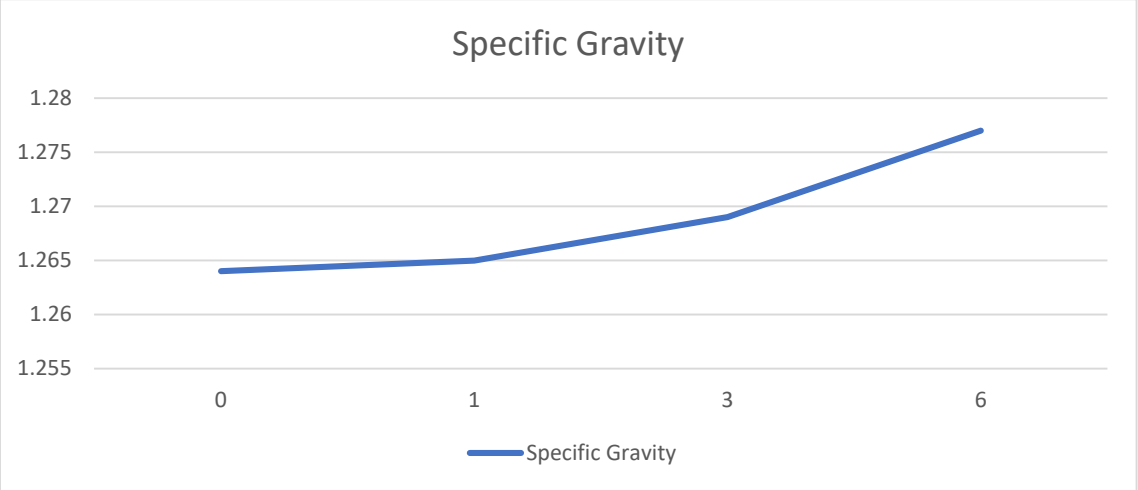

Fig.2- Specific Gravity estimation of sample

Viscosity

In Syrup, the liquid content in the form of vehicle is much more as compared to the crude drugs after filtration, but some particles still remain in the finished formulation that increases their consistency. Sugar increases the viscosity of any liquid. The consistency of the preparation is also affected by temperature; hence the viscosity was determined immediately after taking out the samples from the stability chamber[13,14] .Viscosity was changed 17.05cP, 18.73cP, 30.03cP and 31.01cP respectively in 0,1,3 and 6 months. The results of viscosity analysis reinforced the influence of temperature and sugar on viscosity. The viscosity of the sample at different time intervals during the stability study has been shown in Figure 3. The increment in viscosity may be due to extraction and commination of crude drugs in small particles, and these may develop the suspension form resulting in more viscosity of the preparation. The homogenous dispersion of the liquid dosage form imparts the aesthetic values, patient compliance and dose uniformity during dispensing of the medication. Moreover, the improved viscosity of the Syrup shall be fruitful during the shelf-life of the dosage form. In the sample, the viscosity was increased due to polymerization of mono or disaccharide sugar into complex sugar, recrystallization of sugar within the syrup[8] and water activity, which was highly important for extending the shelf-life stability[12].

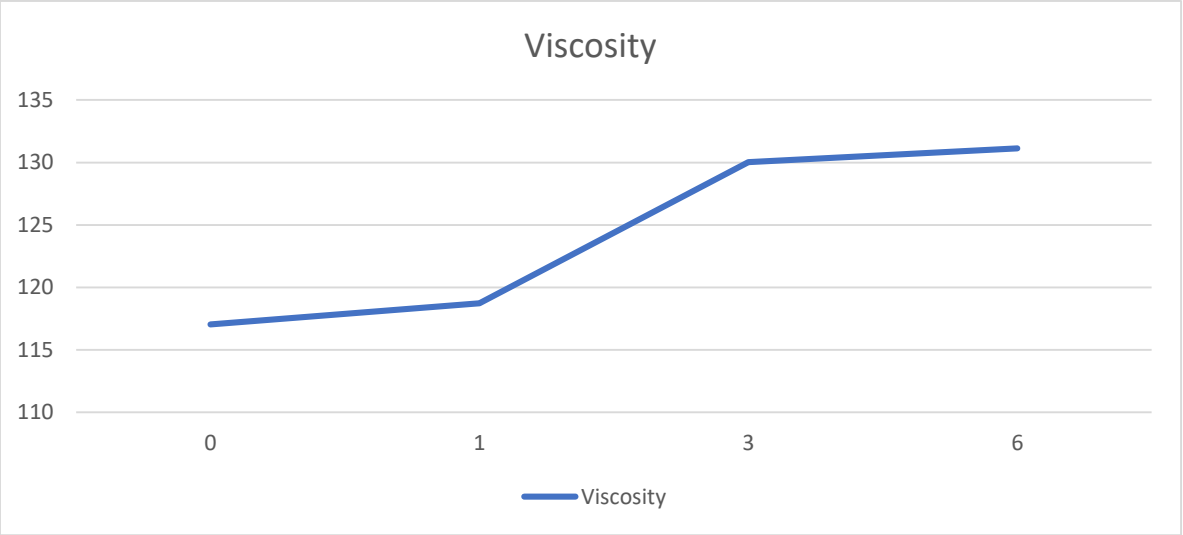

Fig.3- Viscosity estimation of sample

Total solids

The total solid means the residue obtained when the specific amount of the preparation is dried to constant weight under specified conditions. Fig 4 illuminates that total solid content was found in the samples of Syrup, almost equivalent, i.e., 40.51%, 58.06%, 60.23% and 60.27% at initial, 0, 30, 60 and 90 days of the study, respectively. The continuous increment was seen in the values during this period, but this increase is not much significant for a syrup formulation. The increase in TSS contents could be attributed to the rapid evaporation of water. [8,15]

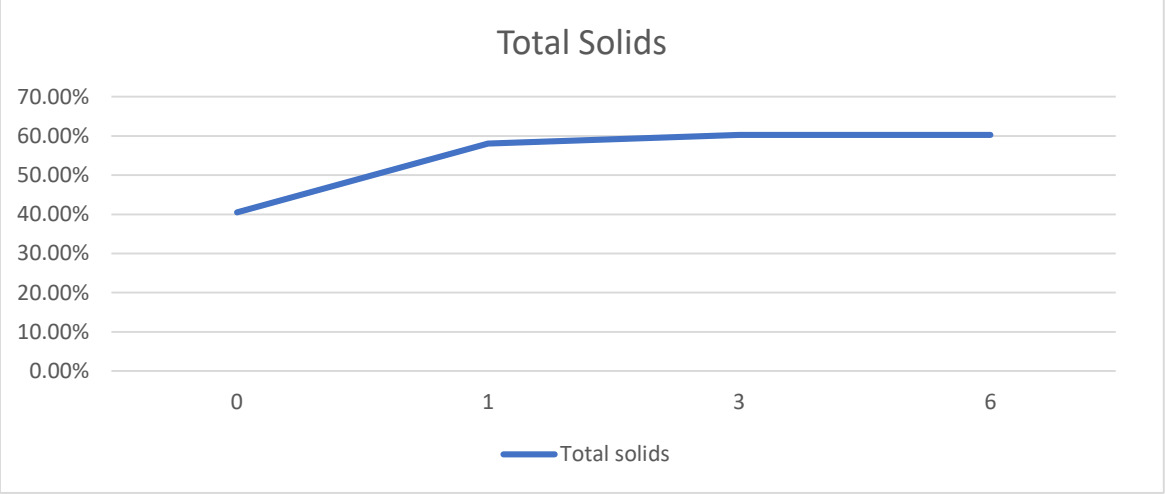

Fig.4- Total Solids estimation of sample

Total sugar content

Total sugar is the combination of two forms reducing and non-reducing sugars. Due to the storage instability study, the composition of both types of sugars may change. Also, some of the chemical processes may lead to the formation of by-products from sugars. Hence, the quantification of total sugars was performed for the sample of formulation during the stability study. It was observed that the total sugar percentage of the sample was 61.26%, 57.23%, 55.71% and 54.72%, respectively in 0, 30, 90 and 180 days of the storage of the sample, percentage of reducing sugars found in sample 37.63%, 35.74%, 35.53% and 35.18% respectively in 0, 30, 90 and 180 days of the storage of the sample and percentage of non-reducing sugars found in sample 23.63%, 21.49%, 20.18% and 19.54% respectively in 0, 30, 90 and 180 days of the storage of the sample. The data

obtained for the sample was found to decrease slightly with time, as sucrose tends to crystallize with time and simple sugar is tends to converts into complex sugar, which is not reacting with the regent. Also, the moisture content is lost gradually with time in accelerated conditions. Results suggested that the decrease in Total sugar during storage was due to them acted as a substrate for the Maillard reaction.[16]

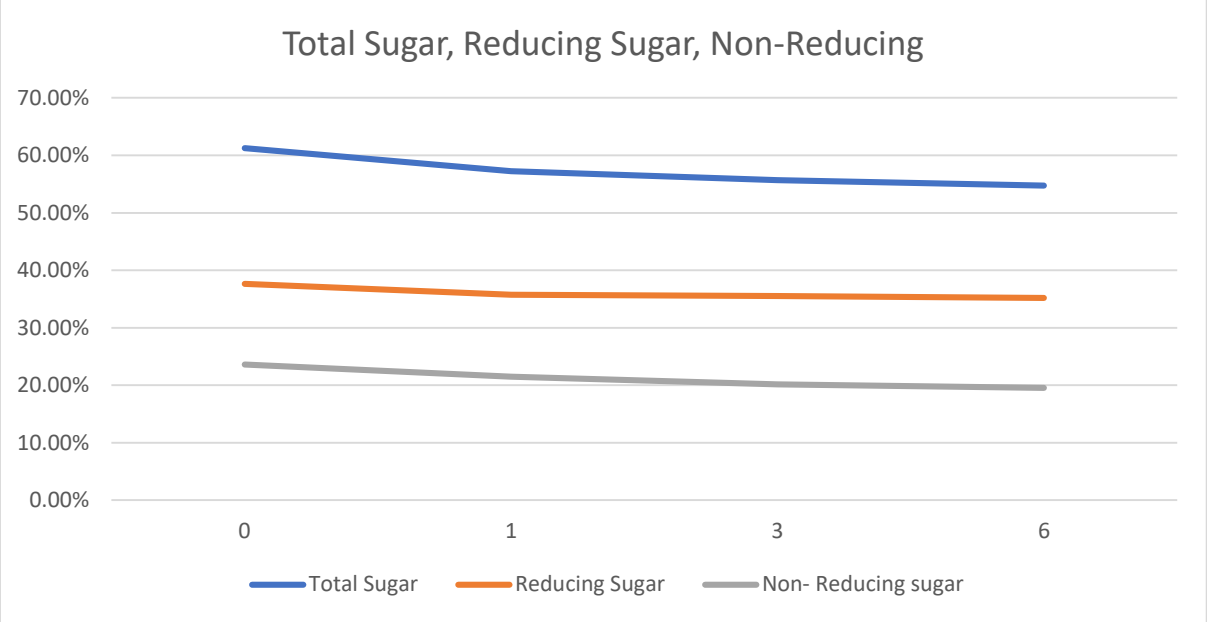

Fig.5- Total Sugar, Reducing Sugar & Non-Reducing estimation of sample

Shelf-life prediction

Considering all these above-cited parameters, mean months at which 10% degradation will occur at accelerated conditions as shown in Table No. 2 expected shelf life came out to be 67.685 months or 5.64 years for Climatic zones I and IV and Climatic zones III and IV, in which **India** lies, came out to be 44.672 Months or 3.72 Year.

CONCLUSION

The present work was carried out for the stability of polyherbal formulation *Shringyadi* Syrup. The prepared formulation was screened for various standardization parameters as per Ayurvedic pharmacopeial standards. The research parameters were used for evaluating the quality and purity of the formulations. Slight changes occur in the Accelerated stability of Syrup which was significant. We developed an effective herbal syrup, which is found stable, effective and safe as per international guidelines and standards.

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