International Journal of Basic and Applied Biology
p-ISSN: 2394-5820, e-ISSN: 2349-2539, Volume 3, Issue 2; April-June, 2016, pp. 136-141

http://www.krishisanskriti.org/Publication.html

The Shelf Life Estimation of *Ayurvedic* Cardiotonic: *Arjuna Ghrita*

Anjali Daverey[1], Usha Sharma[2] and Vipin Kumar Sharma[3]

[1]Department of Rasa Shastra & Bhaishjya Kalpana Rishikul Campus, Haridwar, Uttarakhand Ayurved University
[3]Department of Pharmaceutical Sciences Faculty of Medical Sciences Gurukul Kangri Vishwavidyalaya
E-mail: [1]bhishakanjali@gmail.com, [2]kripayanam@yahoo.com, [3]sharmadibru@gmail.com

Abstract—*Ayurveda, the holistic science of prevention and cure has mentioned numerous formulations for both prophylactic and therapeutic purposes for many diseases. Among such vast literature, only a few are till now tested providing a big ground for good pharmaceutical and clinical research. Arjuna ghrita is a semi solid oleaginous formulation of least ingredients mentioned in Ayurveda for all types of cardiac disorders which is still unleashed under scientific light due to usage of cow's ghee in it as main ingredient which is for a long time considered to be unhealthy for cardiac patients. The coherence for using Ghrita (cow's ghrita/ghee) in a dosage form is to extract the lipid soluble active principle of herb used in the formulation providing the many nutritive and curative health benefits of Ghrita to the patient in specific condition. In this study, the Arjuna ghrita samples were studied for stability at 40±2^{0}C /75±5%RH in stability chamber for 6 months under accelerated stability protocol (ICH, 2003.). The results obtained indicate no remarkable changes in organoleptic characters such as color, odor, taste and appearance among different samples of Arjuna ghrita. There is no any significant change observed in the worked out values of Specific gravity, Refractive index, Acid value, Saponification value, Peroxide value, and Iodine value. Hence it is concluded that the sample got no any type of deterioration for the worked out standards thus said to be stable for the period of observation. The shelf-life of all samples was found more than 2 year for countries of climate zone I and II and less than 2 year in climate zone III and IV. The estimated shelf life for prepared Arjuna Ghrita sample 1, 2 and 3 are 1.7434, 1.980 and 1.6154 year respectively which comes in the range of recommended shelf-life of Ghrita preparations which has been mentioned from 6 month to 2 year in various Ayurvedic literatures.*

Keywords*: Arjuna ghrita, shelf life, refractive index, specific gravity, peroxide value, saponification value, iodine value*

1. INTRODUCTION

Ayurveda, the holistic science of prevention and cure has mentioned numerous formulations for both prophylactic and therapeutic purposes for many diseases. Among such vast literature, only a few are till now tested providing a big ground for good pharmaceutical and clinical research. *Arjuna ghrita* is a semi solid oleaginous formulation of least ingredients mentioned in Ayurveda for all types of cardiac disorders which is still unleashed under scientific light due to usage of cow's ghee in it as main ingredient which is for a long time considered to be unhealthy for cardiac patients.

Ayurvedic system comprises of five basic *kalpanas* (dosage forms) viz; *Swarasa* (juice), *Kalka* (paste), *Shrita* (decoction), *Sheeta* (cold infusion) and *Phanta* (hot infusion)[1]. These dosage forms are light to digest in successive order in which *Shrita* is the most useful as it lies just in mid of heavy to light range of digestion. From these dosage forms many other like *Churna* (powder), *Vati* (tablet), *Asava* and *Arishta* (alcoholic/ fermented formulation), *Sneha kalpana* (oleaginous formulation) can be prepared. Amongst theses, *Sneha kalpana* is a profound pharmaceutical procedure in Ayurvedic pharmacies to obtain oleaginous semi solid dosage form used in different ailments. This formulation is prepared by subjecting *Sneha* (cow's ghee/ various oils) to a particular heat pattern with *kalka* and *drava* (any liquid medium, whether it could be juice, decoction, cold or hot infusion, milk etc.) in prescribed formula[2]. The coherence for using *Ghrita* (cow's *ghrita/ghee*) in a dosage form is to extract the lipid soluble active principle of herb used in the formulation providing the many nutritive and curative health benefits of *Ghrita* to the patient in specific condition.

The *Arjuna ghrita*, comprising of *Terminalia arjuna* which is a proved cardio-protective[3] by many researches as main ingredient, can be a potentiate drug in the management of cardiac disorders while the other major ingredient i.e *ghrita* which is now proved to be benevolent for cardiac disorders as it increases good cholesterol in blood stream of the patient. The conjugate linoleic acid found in milk fat is a proved anticarcinogenic, antiallergic and anti inflammatory properties.[4] Therefore *ghrita* based preparation can combat easily with Hypercholesterolemia, obesity and oxidative stress are the important underlying risk factor for cardiovascular illnesses in human body. As the incidences of cvds are now prevailing day by day, the medicine which can serve curative and nutritive purposes would be a boon in the management of the same. The oleaginous preparation has a shelf life of sixteen months which is a big advantage for any dosage form to be used. In the present era of increased incidences of CVDs,

where more and more researches are going on in the field, here is an attempt at pharmaceutical level to evaluate the shelf life of an less explored drug *Arjuna Ghrita* using physicochemical variables.

2. MATERIAL AND METHODS

2.1. Pharmaceutical Study

The procurement of raw drug was done from local market of Haridwar, Uttarakhand while the laboratory chemicals and reagents were purchased from Loba Chemie, Mumbai and Rankem, New Delhi. The reference to prepare *Arjuna Ghrita* was taken from Ayurvedic text *Chakradutta*[5] while the method is followed as mentioned in definition of *Sneha* pharamceutics according to *Sharangdhar Samhita*.[2] In the pharmaceutical procedure of *Sneha*, first step is to perform *Murchhana* of raw *ghrita*. For this, the herbs indicated was taken in 240 gm amount (40 gm each) and cleaned properly. The coarse powder of these herbs were kept overnight with sufficient amount of water to make a *Kalka* (bolus like consistency). Next morning, *Ghrita* was poured in an ample mouthed stainless steel vessel and kept over fire to get rid of the water till foam and sound subsides in it. At the instance the temperature noted were 450^0 F or 140^o C for burner and *Ghrita* respectively. When a characteristic vapour having some smoke in heated *Ghrita* was observed then it is removed from fire and the *Kalka* (paste) obtained from fresh bark of *Arjuna* and water was added in the *Ghee* and the whole mass was then again kept over fire. Again the froth appears on the *Ghrita* & watery contents starts vaporizing. The *Ghrita* is allowed to keep on fire till the whole of the watery content get evaporated along with the disappearance of froth. The temperature remains constant at about 80^0 C. This stage of *Ghrita* is called the *Murchhita Ghrita*. Filter the *ghrita* by 4 layered cloths for preparation of *Arjuna Ghrita*. Make the *kalka* of 500 gm of fresh bark of *arjuna* by grinding it. Next, the swarasa (juice) is prepared by the alternate method of juice extraction by boiling method mentioned in classics. For this, 4 kg *Yavakuta churna* (coarse powder mesh size 44) of *arjuna* bark was poured with 32 liter water in a stainless steel vessel. *Swarasa* was prepared by heating on low flame till it was reduced to 1/4th of initial volume of water and was strained with a double layered cotton cloth and measured to 8 liter. Now, *Murchhita Go-Ghrita* was poured in a big wide mouthed stainless steel container and kept over fire for heating. *Ghrita* was heated till characteristic vapour having smoke on the heated *Ghrita* was observed. The vessel was then removed from fire and *Arjuna kalka* and juice was then added to the *Ghrita*. The whole mass was again kept over fire & heated on mild fire so as to evaporate the water content completely. During this process, stir the whole mass continuously with the help of ladle to avoid adhering of the material. This process was performed for 7 days on mild fire (15 hours).

After attaining the characteristics of well prepared *Sneha*, the fire was withdrawn and the *Ghee* was filtered by help of a new previously washed and dried cloth when it is lukewarm. The same process was adopted for preparation of three sample of *Arjuna Ghrita* taking different Cows ghee of different brand. The temperature ranges during complete process was fluctuating from 70-80 ^{o}C. while before adding *kalka* it was noted to be in range of 120 C to 130 ^{0}C and after adding *kalka* it was noted between 100- 110 ^{0}C. The drugs used for process of Murchhana were *Emblica officinalis, Terminalia chebula, Terminalia bellerica, Curcuma longa linn., Cyprus rotandus* and *Citrus medica.* The herb used for *Arjuna Ghrita* preparation was *Terminalia arjuna.* The three samples were tested afterward, for total 180 days. The 3 samples are coded as R1, R2, R3 at room temperature and S1, S2, S3 in stability chamber.

2.2. Assessment of organoleptic characters

For Appearnce: Official Ayurvedic compendia is referred. 1gm of prepared *Arjuna Ghrita* was taken into watch glass and placed to watch through naked eye to observe the color into white light.

For Odour: 2g sample was smelled for odour.

For Taste: Pinch of subject formulation is taken and its taste was estimated on taste buds of tongue.

ForTouch: 2g sample was taken and rubbed against thumb, index finger and middle finger gently.

2.3. Assessment of Physico-chemical Variables

1- **Specific Gravity**: A specific gravity bottle of 25 mL capacity was cleaned through with freshly prepared chromic acid, distilled water, dried and weighed. It was filled up with distilled water and weighed again. The water has withdrawn from the bottle, it was dried, cooled and filled with sample of ghee and weighed. The weighing process was performed in triplicate and from these three successive readings, the specific gravity of the ghee samples was calculated by following expression. The similar procedure was followed for analyzing the specific gravity of the samples at 40^0C of the stability study (Laboratory Handbook, 1997).[6]

$$\text{Specific gravity of ghee} = \frac{\text{Wt. of Ghee (in gms)}}{\text{Wt. of equal Vol. of distilled water (in gms)}}$$

2- **Refractive Index:** It was determined by Abbe refractometer (portable RA-130). For this, the sample of ghee was dropped over the prism after complete cleaning of the prism. The prism was filled with the sample liquid up to the line on sample stage. The measurement was made at that position on which the crossed horizontal line dissected the two half contrasts of a circle and aligned with the scale on refractometer. The refractive index of the stability samples was performed at frequent time intervals as per stability guidelines in which the measurement was performed at 40^0C. For maintaining the thermal conditions, the pre-warmed water

at 40^0C was circulated through tubing of the refractometer all-around the sample to be studied (Laboratory Handbook, 1997).[6]

3. Iodine Value: About 10 mL of the fatty sample was dissolved in chloroform, to an iodination flask and labeled as test. To this ample, a 20 mL of iodine monochloride reagent was added to this flask and mixed thoroughly. Afterwards, the flask was maintained in dark condition for half an hour for incubation. The blank was also prepared by applying the similar method using 10 mL of chloroform. To the blank, 20 mL of iodine monochloride reagent was added and the contents of the flask were mixed homogenously. Afterwards, the blank was also incubated for 30 min. After incubation, 10 mL of potasium iodide was added to the flasks containing test and blank. The stopper and the walls of the flasks were rinsed by adding 50 ml of the distilled water. The test solution was titrated against sodium thiosulphate until a pale straw colour was observed. About one ml of starch solution was added to the falsk and a purple colour was developed. The titration was continued until the purple colour of the flask was turned into colourless and it indicated the endpoint of the titration. Similarly, the end point for the blank was also determined.[7] The actual volume of sodium thiosulphate consumed by the sample was calculated: volume of sodium thiosulphate consumed by blank (ml)- thiosulphate consumed by test (ml). The iodine value of the sample was calculated by applying the following expression-

$$Iodine\ No.of\ fat = \frac{Equivalent\ Wt.of\ Iodine \times Volume\ of\ Na_2S_2O_3\ used \times Normality\ of\ Na_2S_2O_3 \times 100 \times 10^{-3}}{Weight\ of\ fat\ sample\ used\ for\ analysis(g)}$$

4. Saponfication Value: A 1 g of each of the sample was taken in beaker and dissolved in 3 mL of ethanol. Quantitatively the contents of the beaker were transferred by washing successively three times with 7 mL of solvent. A 25 mL of 0.5N alcoholic KOH was also added, mixed well and attached to a reflux condenser. Other reflux condenser set was also used for the blank prepared as above in which all the reagents were added except the fatty material. These flasks were placed in a boiling water bath for 30 min. afterwards; these were cooled down at room temperature and phenolphthalein indicator was added. The contents of the flasks were titrated with 0.5 N HCl. The endpoint of sample and the blank were noted down and the difference between the blank and test readings provided the number of milliliters of 0.5N KOH required to saponify the fatty material.[8]The weight of potassium hydroxide (mg) consumed by 1g of fatty sample indicated the saponifiaction value of the sample.

5. Peroxide Value: A 2g of the sample was taken into a 100 ml glass stoppered Erlenmeyer flask and to it; 12 mL of the acetic acid- chloroform solution was added. The contents of the flask were agitated vigorously until the sample was dissolve d completely. To the flask, about 0.2 mL of saturated potassium iodide solution was added. The contents of flask were swirled for one minute. Afterwards, 12 mL of the distilled water was added and mixed homogenously to liberate the iodine from chloroform layer. The solution of the flask was titrated with 0.1 N sodium thiosulphate solutions taken in a burette. The titrant was added slowly to the flak until the colour of the titrand was turned into light colour. [9] With help of the dispenser, 1 mL of starch indicator was added. The titration was continued until the deep grey colour was disappeared from the upper aqueous layer. The peroxide value of the sample was determined by following expression-

$$\text{Peroxide value} = ((S - B) \times \text{normality of sodium thiosulphate}) / (\text{weight of the sample}) \times 1000$$

Where, S is the volume of thiosulphate consumed in titration of sample and B the volume of sodium thiosulphate consumed in titration of blank.

6. Stability Study: The study was conducted as per ICH guidelines Q1.A. (R2) for the evaluation of shelf-life of samples of *ghrita*.[10]The storage conditions in humidity cabinet (NSW-1) were set as temperature on 40 ± 2^0C and relative humidity (%RH) on 75±5. The parameters and variables were tested at accelerated stability conditions at 15 days, 1, 3 and 6 month, along with their real time evaluation. The evaluation of degradation during storage at accelerated conditions was studied and 10% changes in properties of the samples were set to extrapolate the stability data. Real time aging factor 5 and 3.3 was used for extrapolation of shelf life for climate Zone I & II countries and climate Zone III & IV countries respectively. As per ICH guidelines, ambient temperature and humidity for Zone I and II countries are 21^0C/45% RH and 250C/60% RH respectively and for Zone III & IV countries 30^0C/35% RH an 30^0C/70% RH respectively. India comes under zone III and IV[11]. The specifications for evaluations of stability study were organoleptic characters like appearance, colour, odour, taste and touch; physicochemical variables such as specific gravity, refractive index, saponification value, iodine value, peroxide value.

At 10% degradation, the months were calculated by the expression given below:

$$\text{Number of months when 10\% degradtion occurs} = \frac{\left[0\ \text{monthassayvalue} - \left\{\frac{0\ \text{monthassayvalue} \times 10}{100}\right\}\right] - \text{intercept}}{\text{slope}}$$

3. RESULTS AND DISCUSSION

In Ayurveda, a drug is meant to test on variables of organoleptic characters that is, appearance, color, odour, taste. The organoleptic characters along with their physicochemical variables were shown in Table no.1. Refractive index is a characteristic feature of oleaginous substances. It is decreased with low molecular weight, low iodine value, high saponification value. Therefore a change in refractive index

implies chemical changes. Refractive index are shown in Table 2. The specific gravity is a unique feature of every formulation. With passage of time, solid changes into liquid and vice a versa producing changes in specific gravity of pharmaceutical product. These changes have impact on shelf life of the product. The changes in specific gravity is shown in Table 3. Iodine value measures the degree of unsaturation of an oil, fat or wax. More iodine value indicates susceptibility towards oxidation (chemical phenomena that destabilizes oil) and rancidity related to unpleasant taste and odor. Table no.4 shows the variation at 0, 15, 30, 90 & 180 days. The degradation profile of fatty materials in all *ghrita* preparations was not different statistically with one another ($p<0.05$). The iodine values of preparations at different time intervals were also found within the recommended range. Peroxide value is a deteriorative change depends on level of unsaturation, packaging material and storage condition. It increases on storing ghee at room temperature as well as on increasing temperature. Other than the formation of off-flavors and odors, another reason to avoid hydrolytic rancidity is that the reactions of hydrolysis supply free oleic, linoleic, and linolenic acids that could then undergo further oxidative rancidity. Table no.5 shows peroxide value. Depending on the fatty acid, saponification value is expressed by potassium hydroxide in mg required to saponify one gram of fat. This parameter is indicator of free acidic groups available in the fatty matter. The saponification values of all the samples during stability analysis are shown in table no.6. The shelf-life of the product can be defined as the length of time under specific environmental conditions of storage under which the product remains within specific prescribed limits of all its important characteristics (Connors, 1979). As per ICH guidelines countries which fall in climatic zone I, II, III and IV have climatic conditions of 21^0C/45%RH, 25^0C/60% RH, 30 °C/35 % RH and 30 °C/70% RH respectively. In the study, samples of *arjuna ghrita* were maintained at temperature 40 ± 2^0C and relative humidity (RH%) at 75±5% for 6 months which were studied at time interval of 0, 15, 30, 60, 90 & 180 days. The shelf life of sample 1,2 & 3 are shown in Table no.7 respectively. Shelf-life estimation of the three samples of Arjuna Ghrita is shown in table 7, table 8 and table 9.

4. CONCLUSION

In the present study, it was found that the organoleptic characters of Arjuna ghrita remains the same but the physicochemical variables shows a degree of changes at each interval of 15, 30, 60, 90 & 180 days.for climatic zone I and II, all samples shows the shelf life of more than 2 years but for climatic zone III and IV it is less than 2 years.The estimated shelf life for prepared *Arjuna Ghrita* sample 1, 2 and 3 are 1.7434, 1.980 and 1.6154 year respectively which falls under the recommended shelf-life of *Ghrita* preparations mentioned in various *Ayurvedic* literatures that is from 6 month to 2 year. The difference in shelf life of three samples is may be due to some of little changes in basic configuration of different brand's cow's ghee used in the preparation of samples.

Table 1: Organoleptic characters and physicochemical variables of *Arjuna Ghrita*

Physicochemical Variables	Samples of *Arjuna Ghrita* at day 0 of the study					
	R1	R2	R3	S1	S2	S3
Organoleptic characters: Appearance, Colour,odour, Touch & Taste	Viscous soft mass, yellow, Characterstic bitter, Unctuous, Slightly bitter	Viscous soft mass, yellow, Characterstic bitter, Unctuous, Slightly bitter	Viscous soft mass, yellow, Characterstic bitter, Unctuous, Slightly bitter	Viscous soft mass, yellow, Characterstic bitter, Unctuous, Slightly bitter	Viscous soft mass, yellow, Characterstic bitter, Unctuous, Slightly bitter	Viscous soft mass, yellow, Characterstic bitter, Unctuous, Slightly bitter
Spcific Gravity	.8945	.9447	.9153	.8945	.9447	.9153
Refractive Index	1.4576	1.4587	1.4543	1.4576	1.4587	1.4543
Iodine Value	30.456	31.3443	31.28085	30.456	31.3443	31.28085
Saponification Value	129.03	133.95	130.4325	129.03	133.95	130.4325
Peroxide Value	1	1.5	2	1	1.5	2

Table 2: Refractive Indices of the samples

Samples code	Testing time (in days) during stability study				
	0	15	30	90	180
R1	1.4576	1.4574	1.4668	1.4676	1.4746
R2	1.4587	1.4578	1.4576	1.4673	1.4632
R3	1.4543	1.4578	1.4667	1.4669	1.4743
S1	1.4576	1.4591	1.4665	1.4677	1.4724
S2	1.4587	1.4583	1.4668	1.4745	1.4793
S3	1.4543	1.4574	1.4667	1.4676	1.4698

Table No.3: Specific Gravity of the samples

Samples code	Testing time (in days) during stability study				
	0	15	30	90	180
R1	.8945	.8987	.9214	.9470	0.9354
R2	.9447	.9572	.9353	.9568	0.9197
R3	.9153	.9152	.9532	.9215	0.9217
S1	.8945	.8973	.9473	.9392	0.9060
S2	.9153	.9354	.9572	.9490	0.9117
S3	.9153	.9293	.9304	.9627	0.9158

Table no.4 Iodine value during course of study

Samples code	Testing time (in days) during stability study				
	0	15	30	90	180
R1	30.456	31.91535	33.83154	35.2782	35.84925
R2	31.3443	33.31125	34.56756	36.10305	37.4355
R3	31.28085	32.7402	35.37972	36.20457	37.5624

S1	30.456	31.9788	35.7858	36.0429	37.69565
S2	31.3443	34.0092	34.45335	36.73755	34.96095
S3	31.28085	32.8671	33.5016	36.9279	36.35685

Table No.5:Peroxide value of the samples

Samples code	Testing time (in days) during stability study				
	0	**15**	**30**	**90**	**180**
R1	1	2.5	3.1	4.5	5.5
R2	1.5	3	4	5.5	6
R3	2	2.5	4	5	6.5
S1	1	3	4	5	6
S2	1.5	3.5	4.5	5.5	6.5
S3	2	4	4	4.5	6.5

Table 6: Saponification value of the samples

Samples code	Testing time (in days) during stability study				
	0	**15**	**30**	**90**	**180**
R1	129.03	130.4325	144.738	162.69	175.3125
R2	133.95	133.2375	146.982	166.8975	182.325
R3	130.4325	134.64	150.909	155.1165	171.105
S1	129.03	145.86	159.885	166.1963	181.6238
S2	133.95	137.445	157.08	166.8975	169.7025
S3	130.4325	137.445	151.47	157.08	158.4825

Table 7: Sample I

Parameter	**Results at initial month**	**Intercept**	**Slope**	**Results at 10% degradation**	**Months at 10%degradation**
Saponification value	131.835	132.63	0.0166	842.078	28.069
Peroxide value	3.5	3.588	0.0015	292	9.733
Iodine value	38.496	39.063	0.016	270.957	9.0319
Specific gravity	0.991	0.991	0.001	99.3	3.31
Refractive index	1.462	1.462	0.001	146.279	4.875
Mean months at accelerated conditions					6.339 (0.528 Year)
Climate Zone I & II					31.696 (2.641 Year)
Climate Zone III & IV					20.919 (1.743 Year)

Table 8.Sample II

Parameter	**Results at initial month**	**Intercept**	**Slope**	**Results at 10% degradation**	**Months at 10%degradation**
Saponification value	126.225	127.798	0.0618	229.571	7.652
Peroxide value	3.6	3.688	0.0015	298.667	9.955
Iodine value	35.58	36.093	0.0204	345.147	11.504
Specific gravity	0.99	0.9902	0.002	49.6	1.653
Refractive index	1.463	1.4631	0.001	145.379	4.845
Mean months at accelerated conditions					7.2005 (0.600 Year)
Climate Zone I & II					36.0025 (3.00 Year)
Climate Zone III & IV					23.76165 (1.980 Year)

Table 9: Sample III

Parameter	**Results at initial month**	**Intercept**	**Slope**	**Results at 10% degradation**	**Months at 10%degradation**
Saponification value	129.03	129.22	0.0508	257.7362	8.591
Peroxide value	3.5	3.6021	0.0025	180.84	6.028
Iodine value	38.681	39.31	0.0153	228.242	7.608
Specific gravity	0.991	0.9905	0.006	16.433	0.547
Refractive index	1.466	1.4666	0.001	146.588	4.886
Mean months at accelerated conditions					5.875 (0.489 Year)
Climate Zone I & II					29.378 (2.44 Year)
Climate Zone III & IV					19.389 (1.615 Year)

REFERENCES

[1] Pt. Kashinath Pandey & Dr.Gorakhnath Chaturvedi, Chraka Samhita Hindi Commentary (Choukhamba Bharti Acadmey, Varanasi), 2008, 67.

[2] Dr. Brahmanand Tripathi, Sharangdhar Samhita Hindi Commentary (Choukhamba Subharti Prakashan, Varanasi), 2012, 218.

[3] K Karthikeyan et al, Cardioprotective effect of the alcoholic extract of *Terminalia arjuna* bark in an in vivo model of myocardial ischemic reperfusion injury, Life Sciences, Vol. 73(21): 2727-2739

[4] Chinnadurai et al, High conjugated linoleic acid enriched ghee (clarified butter) increases the antioxidant and antiatherogenic potency in female Wistar rats, Lipids in Health and Disease, 2013
[5] Dr.Indradev Tripathi, Chakradutta(Choukhamba Sanskrit Bhavan), 2014, 204
[6]Ayoade GW, Amoo IA, Akpambang VOE. Int J Sci Technol 2015; 4(5):230-234.
[7] Bankoti K, Rana MS, Bharadwaj MK. IOSR J Pharm 2012; 2(5):1-6.
[8] Cannors KA, Amidon GL, Kennon L. Chemical Stability of Pharmaceuticals-A handbook of Pharmacists. John Wiley & Sons, New York, 1979.
[9] Danbature WL, Yirankinyuki FF, Magaji B, Mela Y. Int Interdis J Scientific Res 2015; 2(1): 1-7.
[10] Anonymous. Ayurvedic Pharmacopoeia of India (API). Part I, Vol.1, 1st Ed. Govt. of India, Ministry of Health and Family Welfare, Dept. of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy, New Delhi, 2001.