THINK INDIA JOURNAL ISSN: 0971-1260

Vol-22-NO-30 Special Issue-December-2019

An Assessment on Stability Studies of Herbal Products

Manjari Mukhopadhyay[1], Amit Mittal[*], Pankaj Wadhwa[1], Sanjeev Sahu[1], Bhupinder Kapoor[1]

[1]Lovely School of Pharmaceutical Sciences, Lovely Professional University, Phagwara (Punjab)-144401, India

* Corresponding Author.

Dr. Amit Mittal

School of Pharmaceutical Science, Lovely Professional University, Jalandhar - Delhi G.T. Road, Phagwara, Punjab (India)-144411

Tel.: +919023900379. E-mail address: amit.13145 lpu.co.in

Abstract

The present review is an attempt to compile information related to importance of herbal product`s stability. The increasing number of metabolites of herbals as active constituent stimulates us to report their formed degradation products at various environmental conditions. Many studies have done earlier to find out the properties of obtained degraded properties. In present studies, we focused on mainly three herbals such as curcumin analogues and many more. This study will help to understand about the importance of stability of herbals.

Keywords: Curcumin, pH, Environmental Factors and Stability Studies

Introduction

Herbal drugs have been used since ancient times for curing various diseases. These herbals are usually obtained from the natural sources and referred safer drugs for treating primary health problems [1]. Their less popularity is due to unavailability of their detailed information about degraded products and stability related issues. Now days, information about study of stability testing along with storage conditions are two major obligatory requirement to 'register ' the product as per directions of statutory bodies [2]. The stability testing of herbal drugs should be done in order to ensure public health [3]. In present study we summarized the reported data of few herbals on their stability study as well as the storage conditions, which is usually evaluated by exposing the herbal product under some extreme conditions. The quality

of the herbal drug is checked thereby, whether it has degraded under extreme climatic conditions or it was able to retain its quality [4].

General need for stability testing of herbal products: All herbal medicines cannot be kept for a longer duration due to various possible reasons for degradation of herbal medicines, such as "oxidation, water evaporation, caking or creaming of drugs, altered bioavailability, texture change in drugs, microbiological activity and appearance of hazardous compounds" , respectively [5-6].

Figure 1: Factors affecting stability of herbal drugs

Table 1: Conditions stated for stability of herbal products [7]

Parameters under study	**Conditions stated for storage**	**Minimum time period interval for storage (months)**	**Testing frequency(months)**
Long term	25+- 2^0C /60+-5% relative humidity (RH)/ 30+- 2^0C /65+-5% relative humidity or 30+-	12	0,3,6,9,12,18,24 and then annually.

	2^0C /75+-5% relative humidity		
Intermediate	30+-2^0C /65+- 5% RH	6	0, 6, 9 and 12.
Accelerated	40+- 2^0C /75+- 5% RH	6	0, 3 and 6.

DEGRADATION STUDIES OF HERBAL DRUGS

a) **Degradation studies of curcumin:** Curcumin is obtained from Curcuma longa which is a polyphenolic phytochemical constituent. Curcumin is soluble in methanol, dichloromethane, methanol and acetone; although in water it was found to be insoluble. Curcumin undergoes degradation at a time period of thirty minutes at neutral pH to ferulic aldehyde, trans 6-(4′-hydroxy-3′-methoxyphenyl)-2,4-dioxo-5-hexanal, vanilin and feruloylmethan [8-10].

Figure 2: Main constituents of curcumin [11]

Table 2: Data on degradation studies of Curcumin [12-14]

Curcuminoids	Degradation	Results and discussions

	parameters	
Curcuminoids (CUR), Bis-demothoxy curcuminoids (BDMC), Demethoxycurcuminoids (DMC)	**Oxidative degradation:** 3% hydrogen peroxide at 80 degrees celsius in water bath for 2 hours	The chromatograms reported: Degradation% of pure CUR- 89.12%; Degradation% of combination CUR - 79.82%; Degradation% of combination DMC - 68.52%.; Degradation% of pure DMC - 65.86% and BDMC exhibited more stability than the other two curcuminoids.
Curcuminoids (CUR), Bis-demothoxy curcuminoids (BDMC), Demethoxycurcuminoids (DMC)	**Photolytic degradation:** 3% hydrogen peroxide at 80 degrees celsius in water bath for 6 hours	Curcumin degrades into ferulic acid and vanilic acid.
Curcuminoids	**pH factors:** pH-1.2	Degradation was 1% at the time of 6 hours.
	pH-7.4	Degradation was more than 90% at neutral basic conditions.
Curcuminoids	**Thin layer chromatographic studies were performed on standard solutions of curcumin for 60 minutes:** At pH- 1, 1.2	It shows three peaks:- Retention factor (R_f) values of: CUR (0.39); DMC (0.35) and BDMC (0.32). The above information indicates that little degradation has occurred.
	At pH- 6.8	Identification of two spots whose R_f values were calculated as 0.31 and 0.34.

	At pH- 7.4	R_f value of 0.54, which indicates that maximum of curcumin has degraded, indicating the presence of other compounds.

b) Degradation of Berberine and Tinospora cordifolia extract: Berberine is taken orally for high levels of cholesterol, diabetes, high blood pressure and hyper lipidemia; found in plants like Goldenseal and Phellodendron. *Tinospora cordifolia*, commonly known as heart-leaved-moonseed, belongs to the family Memispermaceae and is native to India, Bangladesh and Myanmar [14-15].

Figure 3: Chemical structure of Berberine [14]

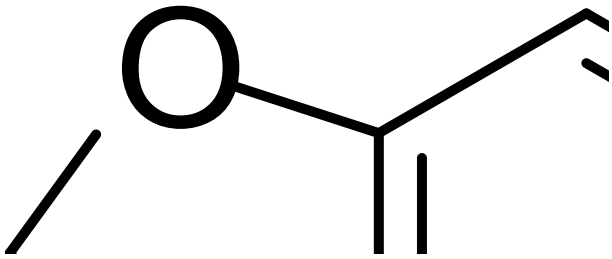

Figure 4: Bioactive compounds from Tinospora cordifolia [16].

Table 3: Degradation studies of standard Berberine at different parameters [17]

S. No.	Sample	Parameters	Condition	Time	Retention factor (R_f) value of standard berberine before degradation	R_f value of standard berberine after degradation
1.	Berberine standard	Oxidative stress degradation	3% hydrogen peroxide at 80^0celsius in water bath.	2 hrs	0.61	0.66
2.	Berberine standard	Photolytic degradation	Photolytic expose to	6 hrs	0.61	0.65

			UV			

Table 4: Degradation study of *Tinospora cordofolia* extract at different parameters [17]

S.No	Sample	Parameters	Conditions	Time	R_f value of berberine present in extract of *Tinospora cordifolia* before degradation parameters	R_f value of berberine present in extract of *Tinospora cordifolia* after degradation parameter
1.	Extract of *Tinospora cordifolia*	Oxidative stress degradation	3% hydrogen peroxide at 80 degrees Celsius in water bath.	2 hours	0.65	No peak found.
2.	Extract of *Tinospora cordifolia*	Photolytic degradation	Photolytic expose to UV	6 hours	0.65	No peak found.

c) Stability studies of the medicinal plant Bidens pilosa L. using its spray dried extract:

Bidens pilosa L.belonging to family Asteraceae is native to South America, but it is now found all over the world, predominantly in the tropical and subtropical zones. The medicinal plant is used as an antimicrobial, as anti-oxidants, and as anti-malarias, due to the presence of flavonoids in it [17]. The spray dried compositions of Bidens pilosa was subjected to stability studies under various storage conditions as depicted in Table 5. In this, 1 g of the dried product was placed in aluminium sachets or glass containers having 2 cm diameter and 4 cm height [18].

Figure 5: Luteolin, one of the flavonoids isolated from *Bidens.*

Table 6: Degradation studies of Bidens Pilosa L. Extract [19]:

Concentration of marker compounds in Bidens pilosa L.	**Degradation parameters**	**Results and discussions**
Rutin, Hyperoside, Polyacetylene	**Type of containers:** The samples were stored in open containers The samples were stored in sealed containers	A marked decrease in the marker compounds concentrations was reported. Less decrease in concentration as compared to that in open containers.
Polyacetylene (marker compound)	**Effect of temperature:** Stored at 40^0C Stored at 14^0C, and at 25^0C into sealed sachets	Polyacetylene suffers higher degradation as compared to other marker compounds. Product remains stable for 1 year.

Sample extract	**Colour variation:** Placed in open containers	Samples turned dark (browning is observed) as a function of storage time.

References

[1] G. Bansal, N. Suthar, J. Kaur *et al.*, "Stability testing of herbal drugs: Challenges, regulatory compliance and perspectives," *Phytotherapy Research,* vol. 30, no. 7, pp. 1046-1058, 2016.

[2**]** S. Kruse, "Stability Testing of Herbal Medicinal Products–Bridging Science to Industry," *Planta Medica,* vol. 79, no. 13, pp. PK15, 2013.

[3] G. C. Lopes, R. Longhini, P. V. P. Dos Santos *et al.*, "Preliminary assessment of the chemical stability of dried extracts from Guazuma ulmifolia Lam.(Sterculiaceae)," *International journal of analytical chemistry,* vol. 2012, 2012.

[4] A. K. Sachan, and A. Kumar, "Stability testing of herbal products," *Journal of Chemical and Pharmaceutical Research,* vol. 7, no. 12, pp. 511-514, 2015.

[5] N. Z. Msomi, and M. B. Simelane, "Herbal Medicine," *Herbal Medicine*: IntechOpen, 2018.

[6] S. Basar, S. Rani, and R. Zaman, "Review on stability studies of unani formulations," *Journal of pharmaceutical and scientific innovation,* vol. 2, no. 4, pp. 1-8, 2013.

[7] S. Kumavat, Y. Chaudhari, P. Borole *et al.*, "Degradation studies of curcumin," *Int. J. Pharm. Rev. Res,* vol. 3, no. 2, pp. 50-55, 2013.
[8] V. Sueth-Santiago, J. de BB Moraes, E. S. S. Alves *et al.*, "The effectiveness of natural diarylheptanoids against Trypanosoma cruzi: cytotoxicity, ultrastructural alterations and molecular modeling studies," *PloS one,* vol. 11, no. 9, pp. e0162926, 2016.
[9] M. R. Peram, S. S. Jalalpure, M. B. Palkar *et al.*, "Stability studies of pure and mixture form of curcuminoids by reverse phase-HPLC method under various experimental stress conditions," *Food science and biotechnology,* vol. 26, no. 3, pp. 591-602, 2017.
[10] Y.-J. Wang, M.-H. Pan, A.-L. Cheng *et al.*, "Stability of curcumin in buffer solutions and characterization of its degradation products," *Journal of pharmaceutical and biomedical analysis,* vol. 15, no. 12, pp. 1867-1876, 1997.
[11] S. Kumavat, Y. Chaudhari, P. Borole *et al.*, "Degradation studies of curcumin," *Int. J. Pharm. Rev. Res,* vol. 3, no. 2, pp. 50-55, 2013.
[12] H. Tønnesen, J. Karlsen, and G. van Henegouwen, "Photochemical stability of curcumin: studies on curcumin and curcuminoids VIII," *Z Lebensm Unters Forsch,* vol. 183, no. 2, pp. 116-22, 1986.
[13] J. Yin, H. Xing, and J. Ye, "Efficacy of berberine in patients with type 2 diabetes mellitus," *Metabolism,* vol. 57, no. 5, pp. 712-717, 2008.
[14] P. Sharma, B. P. Dwivedee, D. Bisht *et al.*, "The chemical constituents and diverse pharmacological importance of Tinospora cordifolia," *Heliyon,* vol. 5, no. 9, pp. e02437, 2019.
[15] N. Reddy, and R. Reddy, "Tinospora cordifolia chemical constituents and medicinal properties: a review," *Sch Acad J Pharm,* vol. 4, no. 8, pp. 364-369, 2015.
[16] C. Garg, S. Satija, M. Mehta *et al.*, "Force degradation studies of bioactive berberine and Tinospora cordifolia extract."

[17] A. P. Bartolome, I. M. Villaseñor, and W.-C. Yang, "Bidens pilosa L.(Asteraceae): botanical properties, traditional uses, phytochemistry, and pharmacology," *Evidence-based complementary and alternative medicine,* vol. 2013, 2013.

[18] S. Dharmananda, "A Popular Remedy Ecapes Notice of Western Practitioners. 2013," 2013.

[19] D. Cortes-Rojas, C. Souza, and W. Oliveira, "Assessment of stability of a spray dried extract from the medicinal plant Bidens pilosa L," *Journal of King Saud University-Engineering Sciences,* vol. 28, no. 2, pp. 141-146, 2016.

