



BIODETERIORATION OF CHEMICAL CONSTITUENTS IN FRESH AND MARKET ROOTS OF DRUG *URARIA PICTA* DC. UNDER STORAGE

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ABSTRACT

In the present investigation the fresh and market roots of drug *Uraria picta* DC. were selected. Root samples were stored under different 30, 50, 75, 96 and 100 % relative humidity and different incubation days 15, 30, 45 and 60 days. Quantitative estimation of sugars (total sugars, reducing sugar), proteins, phenols and glycosides in fresh and in market condition was done. The results revealed that biodeterioration of selected chemical constituents were observed under high relative humidities 75, 96 and 100% RH and with the length of incubation days 45 and 60 days. More deterioration of chemical constituents recorded in case of market samples as compared to genuine samples. Analysis of variance also showed that the effect of relative humidity and incubation days on biodeterioration of total alkaloid amount were significant.

Key words: Deterioration, relative humidity, incubation days, *Uraria picta*



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INTRODUCTION

The herbal drug *Uraria picta* DC commonly named "Pithavan" or "Debra" belongs to family Leguminosae sub Family Fabaceae. Kirtikar and Basu (5) expressed that in traditional system of medicine, this plant is used as an antidote to the venom of a dangerous Indian snake, aches carinata. This plant belongs to Dashmoola and a well established Ayurvedic drug for treating general fatigue, oral sores and several gynaecological disorders, their roots are very useful and in different system of medicine have been used, because of their medicinal properties, most of the time roots of this herbal drug collect and store for long times, if harvesting, handling, collecting and storage of medicinal roots are not properly there may be possibility of contamination of different organism such as fungi, bacteria, pests etc. and their growth association with roots as a source of nutrition increase and these microorganisms growth are responsible for the deterioration and reduction of chemical constituents. Therefore, it is necessary to study the changes in chemical constituents in roots of this drug. So that, fresh and market roots of this plant stored at various relative humidity 30, 50, 75, 96 and 100% RH for different incubation periods 15, 30, 45, 60, 75 and 90 days. The effect of various relative humidity and incubation days on changes in chemical constituents studied.

MATERIALS AND METHODS

The fresh root of drug *Uraria picta* were collected in healthy, flowering and fruiting conditions from different localities. Market survey has also been carried out for the collection of the market roots from various Shopkeepers and Kashthaushadhi. Collected roots were brought to the laboratory in polyethylene bag to avoid aerial contamination. In order to evaluate the chemical constituents changes, organ form of roots cut to small pieces and were stored in small muslin clothes bags under different level of RH i.e. 30, 50, 75, 96

and 100 % RH for 90 days and at $28 \pm 3^{\circ}\text{C}$ temperature (6). At an interval of 15 days, root samples were taken out and thoroughly washed with distilled water and were dried in oven for chemical analysis. Chemical analysis were estimated by the procedure described by Lowry *et al.* (2) for total protein, Singh *et al.* (4) for total phenols and Kokate *et al.* (1) for glycosides. Anthrone methods for Total sugars (TS) and Dinitrosalicylic acid (DNSA) method for Reducing sugar (RS) amount (3) were also followed. Simple correlation were run between selected parameters using Statistical Package for Social Science (SPSS) software in which statistical significance was determined at 0.05 % probability levels.

RESULTS

The genuine roots of *U. picta* contained 75.82 and 11.31% TS and RS at the first day but deterioration of sugar amounts started after 15 days of incubation under 50 % RH 57.61 and 10.85, under 75, 96 and 100% RH, TS and RS values showed 52.23, 10.40%; 56.98, 9.95% and 56.35, 9.049%. These amounts of TS and RS deteriorated while after 90 days all value showed 54.20, 7.23%; 54.16, 7.335; 52.60, 4.97% 51.22, 4.52% and 49.15, 4.43% at 30, 50, 96 and 100% RH (Table 1). Market sample of this drug showed more deterioration in sugar amounts, in case of 30, 50 and 75 % RH after 15 days of storage value of TS and RS observed 55.08, 7.23%; 54.88, 7.23% and 54.75, 6.33%, these amounts decreased up to 52.48, 4.97; 51.052, 4.52 and 50.42% after 90 days of storage, In cases of 96 and 100 % RH. After 15 to 90 days of incubation from 54.58, 6.33% and 53.99, 9.049% TS and RS amounts deteriorated to 48.35, 4.072% and 46.2, 4.037%, respectively (Table 2).

Table 1
Deterioration of Total sugars (TS) and Reducing sugars (RS) content (mg/100mg)
in root of *Uraria picta* (Fresh sample) at different relative humidities

Incubation days	Control		30%		50%		75%		96%		100%	
	TS	RS	TS	RS	TS	RS	TS	RS	TS	RS	TS	RS
1 day	57.82 ±0.25	11.31 ±0.45	57.82 ±0.25	11.31 ±0.45	57.82 ±0.25	11.31 ±0.45	57.82 ±0.25	11.31 ±0.45	57.82 ±0.25	11.31 ±0.45	57.82 ±0.25	11.31 ±0.45
15 days	57.82 ±0.25 ^d	11.31 ±0.45 ^d	57.82 ±0.21 ^d	10.85 ±0.26 ^d	57.61 ±0.26 ^{cd}	10.85 ±0.52 ^{cd}	57.23 ±0.44 ^{bc}	10.40 ±0.42 ^{bc}	56.98 ±0.14 ^b	9.95 ±0.69 ^b	56.35 ±0.26 ^a	9.049 ±0.26 ^a
30 days	57.82 ±0.12 ^d	11.31 ±0.26 ^d	57.61±0.072 ^d	10.40 ±0.45 ^d	57.23 ±0.29 ^{cd}	10.40 ±0.45 ^{cd}	56.81 ±0.25 ^{bc}	9.049 ±0.26 ^c	55.97 ±0.52 ^{ab}	8.14 ±10.45 ^b	55.13 ±0.52 ^a	7.23 ±0.45 ^a
45 days	57.87 ±0.64 ^d	11.31 ±0.67 ^d	57.02 ±0.19 ^d	9.95 ±0.45 ^d	56.64 ±0.14 ^c	9.50 ±0.45 ^c	55.76 ±0.40 ^b	8.14 ±0.45 ^b	54.54 ±0.57 ^a	7.69 ±0.26 ^a	53.74 ±0.62 ^a	6.33 ±0.45 ^a
60 days	57.70 ±0.25 ^e	11.31 ±0.45 ^{de}	56.10±0.64 ^{ed}	9.049 ±0.26 ^{ed}	55.21 ±0.31 ^{cd}	8.14 ±0.42 ^{cd}	54.46 ±0.14 ^c	7.69 ±0.69 ^c	53.19 ±0.64 ^b	7.23 ±0.45 ^{ab}	52.39 ±0.37 ^a	6.78 ±0.26 ^a
75 days	57.65 ±0.72 ^e	11.31 ±0.78 ^e	55.47 ±0.26 ^d	8.14 ±0.26 ^d	54.92 ±0.63 ^d	7.69 ±0.26 ^d	53.66 ±0.55 ^c	6.33 ±0.26 ^c	52.23 ±0.52 ^b	5.88 ±0.45 ^{ab}	50.46 ±0.31 ^a	5.42 ±0.45 ^a
90 days	57.65 ±0.44 ^c	11.31 ±0.90 ^c	54.20 ±0.26 ^c	7.23 ±0.26 ^c	54.16 ±1.078 ^b	7.33 ±0.45 ^b	52.60 ±0.44 ^{ab}	4.97 ±0.52 ^{ab}	51.22 ±0.64 ^{ab}	4.52 ±0.52 ^{ab}	49.15 ±0.45 ^a	4.43 ±0.45 ^a

Data are the mean of three replicates ± standard deviation. P- Value denoted the significance of differences between the mean by univariate comparison statistics. The value followed by different letters differ significantly by Duncan's multiple rang test at P=Sig= 0.05

Table 2
Deterioration of Total sugars (TS) and Reducing sugars (RS) content (mg/100mg)
in root of *Uraria picta* (Market sample) at different relative humidities

Incubation days	Control		30%		50%		75%		96%		100%	
	TS	RS	TS	RS	TS	RS	TS	RS	TS	RS	TS	RS
1 day	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47	55.13 ±1.47
15 days	55.13 ±1.49 ^c	55.13 ±1.13 ^c	55.08 ±1.57 ^c	7.23 ±0.94 ^c	54.88 ±1.47 ^{bc}	7.23 ±0.94 ^{bc}	54.75 ±1.47 ^b	6.33 ±0.78 ^b	54.58 ±1.50 ^{ab}	6.33 ±0.78 ^{ab}	53.99 ±1.36 ^a	9.049 ±0.26 ^a
30 days	55.13 ±1.57 ^c	55.13 ±1.13 ^c	54.84 ±1.71 ^{bc}	6.78 ±0.90 ^{bc}	54.16 ±1.75 ^{bc}	6.78 ±0.78 ^{bc}	54.16 ±1.75 ^{ab}	5.42 ±0.52 ^{ab}	53.74 ±1.57 ^{ab}	5.42 ±10.26 ^{ab}	53.24 ±1.71 ^a	4.97 ±0.45 ^a
45 days	55.13 ±1.46 ^c	55.13 ±1.13 ^c	54.04 ±1.53 ^c	6.33 ±0.90 ^c	53.74 ±1.57 ^{bc}	5.88 ±0.90 ^{bc}	53.45 ±1.50 ^{ab}	4.97 ±0.26 ^{ab}	52.94 ±1.2 ^{ab}	4.52 ±0.26 ^{ab}	52.35 ±0.85 ^a	4.43 ±0.32 ^a
60 days	55.13 ±1.71 ^c	55.13 ±1.38 ^c	53.57 ±1.71 ^{bc}	5.88 ±0.90 ^{bc}	53.32 ±1.60 ^{bc}	5.42 ±0.76 ^{bc}	52.98 ±1.17 ^{abc}	4.52 ±0.32 ^{abc}	51.89 ±1.17 ^{ab}	4.29 ±0.13 ^{ab}	50.67 ±0.37 ^a	4.20 ±0.09 ^a
75 days	55.13 ±1.38 ^c	55.13 ±1.30 ^c	53.28 ±1.65 ^{bc}	5.42 ±0.69 ^{bc}	52.18 ±1.89 ^{bc}	4.52 ±0.054 ^{bc}	52.062 ±0.95 ^{ab}	4.34 ±0.069 ^{ab}	50.38 ±1.75 ^{abc}	4.29 ±0.078 ^{ab}	49.53 ±0.85 ^a	4.20 ±0.078 ^a
90 days	55.13 ±1.71 ^d	55.13 ±0.94 ^d	52.48 ±1.24 ⁼	4.97 ±0.49 ^{cd}	51.052 ±1.80 ^c	4.52 ±0.10 ^c	50.42 ±1.51 ^c	4.25 ±0.026 ^{bc}	48.35 ±0.78 ^{bc}	4.072 ±0.11 ⁼	46.42 ±0.39 ^a	4.037 ±0.11 ^a

Data are the mean of three replicates ± standard deviation. P- Value denoted the significance of differences between the mean by univariate comparison statistics. The value followed by different letters differ significantly by Duncan's multiple rang test at P=Sig= 0.05

Fresh and market sample of *U. picta* tested under different relative humidity and incubation days for showing changes in total protein values. Fresh and market samples contained 31.52 and 29.16 %. Minimum reduction in total protein amounts showed after 15 days of incubation days and under 30 and 50 % RH, 31.52% and 29.02, 28.75% in fresh and market sample, respectively, at the end of 90 days in both samples, values of protein amounts reduced to 26.66, 25.83% and 25.27, 24.02%. In

case of 75% RH after 15 days of storage to 90 days from 31.52% (fresh sample) and 28.47% (market sample) reduced to 25.13 and 23.61%. Under 96 and 100% RH maximum deterioration observed, while after 15 days total amount of proteins in fresh and market sample were 31.25, 30.55%; 28.47, 28.33%, after 90 days of incubation period deterioration showed 23.12, 22.56% and 22.22, 22.52%, respectively (Table 3).

Table3
Deterioration of proteins content (mg/100mg) in root of *Uraria picta*
(Fresh and market samples) at different relative humidities

Incubation days	control	30%	50%	75%	96%	100%
1 day	31.52±1.87	31.52±1.87	31.52±1.87	31.52±1.87	31.52±1.87	31.52±1.87
15days	31.52±1.87 ^d	31.52±1.80 ^c	31.52±1.73 ^c	31.52±1.74 ^{ab}	31.25±1.74 ^a	30.55±1.18 ^a
30days	31.52±1.94 ^d	31.38±1.80 ^d	30.55±2.12 ^c	29.86±2.04 ^b	29.16±2.12 ^a	29.027±2.24 ^a
45 days	31.38±1.27 ^d	30.55±1.77 ^d	30.13±2.03 ^c	29.027±1.39 ^b	27.77±2.34 ^a	27.61±2.084 ^a
60 days	31.52±2.53 ^d	30.13±1.84 ^d	29.58±2.45 ^c	27.77±1.78 ^b	26.38±2.72 ^a	25±2.40 ^a
75 days	31.38±2.74 ^d	28.19±1.49 ^{cd}	27.77±0.48 ^c	27.32±2.40 ^b	25.13±0.19 ^a	24.02±0.39 ^a
90 days	31.18±2.45 ^c	26.66±2.83 ^c	25.83±2.13 ^c	25.13±2.56 ^b	23.12±2.56 ^a	22.56±0.098 ^a

Incubation days	control	30%	50%	75%	96%	100%
1 day	29.16±2.12	29.16±2.12	29.16±2.12	29.16±2.12	29.16±2.12	29.16±2.12
15days	29.16±2.12 ^d	29.027±2.13 ^d	28.75±2.17 ^a	28.47±1.68 ^a	28.47±1.62 ^a	28.33±1.80 ^a
30days	29.16±2.12 ^b	28.47±1.83 ^b	28.47±1.69 ^a	27.77±1.78 ^a	27.63±1.90 ^a	27.50±0.97 ^a
45 days	29.16±2.12 ^b	26.94±2.26 ^{ab}	26.80±2.10 ^{ab}	26.38±2.18 ^{ab}	25.69±2.54 ^{ab}	25±1.004 ^a
60 days	29.16±2.12 ^b	26.66±2.36 ^{ab}	26.38±2.31 ^{ab}	25.13±2.60 ^{ab}	24.30±2.13 ^{ab}	23.61±1.92 ^a
75 days	29.16±2.12 ^b	26.38±1.25 ^b	24.30±2.13 ^a	24.72±2.29 ^a	23.61±1.92 ^a	23.33±1.078 ^a
90 days	29.16±2.12 ^b	25.27±0.89 ^b	24.02±0.78 ^{ab}	23.61±2.89 ^{ab}	22.22±2.18 ^{ab}	22.52±1.042 ^a

Data in table are the mean of three replicates ± standard deviation. P- Value denoted the significance of differences between the mean by univariate comparison statistics. The value followed by different letters differ significantly by Duncan's multiple rang test at P=Sig= 0.05

The fresh roots of *U. picta* contained 2.95% at the first day but deterioration of total phenols amount started after 15 days of incubation under 75% RH 2.75% at 96 and 100% RH, total phenols value showed increasing in phenol amounts to 2.95% and 3.14%. This amount deteriorated, while after 90 days all value showed 2.16, 1.96, 1.88, 1.83% and 1.71% under 30, 50, 96 and 100% RH. Market sample of this drug showed more deterioration

in total phenols amount, in case of 30, 50 and 75 % RH after 15 days of storage value of phenols observed 2.75, 2.55 and 2.55%, these amounts decreased to 1.81, 1.77 and 1.71% after 90 days of storage, under 96 % RH after 15 to 90 days of incubation from 2.36% deteriorated to 1.65 %. In case of 100%RH after 15 days in storage increased to 2.75% but deterioration gradually observed to the end of 90 days to 1.59 % (Table 4).

Table 4
Deterioration of total phenols content (mg/100mg) in root of *Uraria picta*
(Fresh and market samples) at different relative humidities

Incubation days	Control	30%	50%	75%	96%	100%
1 day	2.95±0.30	2.95±0.30	2.95±0.30	2.95±0.30	2.95±0.30	2.95±0.30
15days	2.95±0.30 ^d	2.95±0.30 ^a	2.95±0.03 ^a	2.75±0.36 ^a	2.95±0.034 ^a	3.14±0.34 ^a
30days	2.95±0.30 ^c	2.95±0.30 ^c	2.75±0.30 ^{ab}	2.75±0.30 ^{ab}	2.55±0.22 ^{ab}	2.75±0.32 ^a
45 days	2.95±0.30 ^c	2.75±0.34 ^c	2.63±0.11 ^{ab}	2.55±0.30 ^{ab}	2.36±0.19 ^a	2.16±0.40 ^a
60 days	2.95±0.30 ^c	2.55±0.39 ^{bc}	2.16±0.09 ^{ab}	1.96±0.22 ^a	1.90±0.040 ^a	1.87±0.039 ^a
75 days	2.95±0.30 ^c	2.36±0.11 ^b	1.96±0.045 ^a	1.92±0.011 ^a	1.88±0.011 ^a	1.85±0.034 ^a
90 days	2.95±0.30 ^c	2.16±0.14 ^d	1.96±0.11 ^{ab}	1.88±0.030 ^a	1.83±0.030 ^a	1.71±0.040 ^a

Incubation days	Control	30%	50%	75%	96%	100%
1 day	2.75±0.19	2.75±0.19	2.75±0.19	2.75±0.19	2.75±0.19	2.75±0.19
15days	2.75±0.19 ^c	2.75±0.30 ^b	2.55±0.30 ^a	2.55±0.19 ^a	2.36±0.11 ^a	2.75±0.11 ^a
30days	2.75±0.11 ^c	2.55±0.30 ^{bc}	2.36±0.22 ^{bc}	2.16±0.11 ^{ab}	1.96±0.11 ^a	1.88±0.030 ^a
45 days	2.75±0.22 ^c	2.36±0.39 ^b	2.36±0.11 ^b	1.96±0.33 ^{ab}	1.90±0.022 ^a	1.83±0.059 ^a
60 days	2.75±0.123 ^c	2.16±0.19 ^d	1.90±0.17 ^{ab}	1.85±0.099 ^a	1.77±0.09 ^a	1.71±0.10 ^a
75 days	2.75±0.09 ^c	1.90±0.16 ^d	1.81±0.090 ^{ab}	1.73±0.079 ^{ab}	1.69±0.099 ^a	1.67±0.056 ^a
90 days	2.75±0.54 ^d	1.81±0.10 ^d	1.77±0.17 ^a	1.71±0.11 ^a	1.65±0.098 ^a	1.59±0.099 ^a

Data in table are the mean of three replicates ± standard deviation. P- Value denoted the significance of differences between the mean by univariate comparison statistics. The value followed by different letters differ significantly by Duncan's multiple rang test at P=Sig= 0.05

The roots of *U picta* in fresh condition contained 7.62% total glycosides (Table 5). These roots stored at various relative humidity for 90 days. Interval of 15 days all control and treated samples were taken out and changes in total glycosides studied. After 15 days of incubation, under 30, 50, 75 % RH, total glycosides amount didn't change, but under 96 and 100 % RH reduced to 7.60 and 7.59 %, After 30 days of incubation under all tested relative humidity total glycosides showed 7.62, 7.61, 7.59, 7.57, 7.55%. After 60 and 90 days

of incubation period, total glycosides deteriorated to 7.49, 7.44, 7.42, 7.37, 7.26% and 7.34, 7.26, 7.22, 7.063, 6.95%. In case of market samples, control contained 7.47% but deterioration of glycosides amount started after 15 days of incubation under 75 % RH with 7.46% total glycosides and at 96 and 100% RH they decreased to 7.43, 7.40%, total glycosides value gradually after 30, 45, 60, 75 deteriorated while after 90 days all value showed 7.10, 7.043, 7.24, 6.86, 6.79% under 30, 50, 75, 96 and 90 days of storage.

Table 5
Deterioration of total glycosides content (mg/100mg) in root of *Uraria picta* (Fresh and market samples) at different relative humidities

Incubation days	Control	30%	50%	75%	96%	100%
1 day	7.62±0.45	7.62±0.45	7.62±0.45	7.62±0.45	7.62±0.45	7.62±0.45
15days	7.62±0.45 ^d	7.62±0.14 ^c	7.62±0.44 ^d	7.62±0.44 ^d	7.60±0.10 ^a	7.59±0.01 ^a
30days	7.62±0.47 ^d	7.62±0.43 ^c	7.61±0.21 ^{bc}	7.59±0.43 ^{ab}	7.57±0.40 ^{ab}	7.55±0.11 ^a
45 days	7.61±0.046 ^d	7.56±0.36 ^c	7.52±0.45 ^{bc}	7.50±0.042 ^b	7.46±0.40 ^a	7.42±0.11 ^a
60 days	7.56±0.49 ^d	7.49±0.48 ^c	7.44±0.44 ^c	7.42±0.45 ^{ab}	7.37±0.19 ^a	7.26±0.23 ^a
75 days	7.55±0.49 ^d	7.45±0.14 ^c	7.37±0.90 ^{bc}	7.34±0.46 ^{ab}	7.27±0.45 ^a	7.15±0.20 ^a
90 days	7.54±0.48 ^c	7.34±0.47 ^c	7.26±0.25 ^{bc}	7.22±0.54 ^{ab}	7.063±0.50 ^a	6.95±0.75 ^a

Incubation days	Control	30%	50%	75%	96%	100%
1 day	7.47±0.34	7.47±0.34	7.47±0.34	7.47±0.34	7.47±0.34	7.47±0.34
15days	7.47±0.36 ^c	7.47±0.33 ^c	7.47±0.44 ^b	7.46±0.34 ^a	7.43±0.35 ^a	7.40±0.39 ^a
30days	7.47±0.35 ^d	7.47±0.34 ^c	7.44±0.20 ^{bc}	7.38±0.36 ^{ab}	7.30±0.39 ^{ab}	7.25±0.31 ^a
45 days	7.46±0.034 ^d	7.40±0.34 ^c	7.32±0.35 ^{bc}	7.26±0.032 ^{ab}	7.19±0.30 ^a	7.15±0.34 ^a
60 days	7.45±0.35 ^d	7.35±0.37 ^c	7.26±0.34 ^b	7.19±0.45 ^b	7.09±0.19 ^a	6.99±0.23 ^a
75 days	7.44±0.36 ^d	7.20±0.14 ^c	7.11±0.40 ^b	7.05±0.38 ^b	6.93±0.45 ^{ab}	6.91±0.41 ^a
90 days	7.41±0.40 ^c	7.10±0.36 ^c	7.043±0.42 ^b	7.24±0.70 ^{ab}	6.86±0.44 ^a	6.79±0.40 ^a

Data in table are the mean of three replicates ± standard deviation. P- Value denoted the significance of differences between the mean by univariate comparison statistics. The value followed by different letters differ significantly by Duncan's multiple rang test at P=Sig= 0.05

Analysis of variance revealed that relative humidity and different incubation days showed correlation with deterioration of sugars (total sugars, reducing sugar), proteins, phenols and glycosides value in this drug in fresh and market samples and all data is significant at 5% of significance (P value <0.05).

DISCUSSION

Both wild and cultivated plants are used for drug formulation. However, in many cases cultivation is advisable because of the improved quality of the drug. Careless processing of medicinal plants without considering these points is a major reason for ineffectiveness of some of our traditional medicines. For example root and rhizome drugs maybe collected in early stage of development hence they maybe devoid of therapeutically active chemical constituents (7).

Other factors such as use of fresh or dried plants, season, light exposure, water availability, nutrients period, time of collection, storage, transportation of raw material, age and part of the plant collected, and methods of collecting, drying and packaging can greatly affect the quality and consequently the therapeutic value of herbal medicines deteriorates. These factors also account for variability of individual constituents in herbal preparations. Unscientific drying, storage

methods and good environmental conditions favour association of various microbes with stored products. During storage, the fungal organisms thrive on drug plants by utilizing various components including the active ingredients and changes in therapeutically active content such as carbohydrates, alkaloids, phenols, glycosides and proteins of plant parts like roots, barks, stems, fruits and seeds are influenced both by fungi as well as physical factors (8, 9). Several factors are to be considered for the detrimental effects on the stored products. Several environmental factors relating to storage e.g. light, humidity, oxygen, temperature etc. can produce detrimental effects on stored products, but more deterioration usually results from a combination of these factors, which leads to the development of living organism including moulds, mites, bacteria etc.

CONCLUSION

The results of this investigation also revealed that high relative humidities 75, 96 and 100% RH showed more effective on reduction of total sugars, proteins, phenols and glycosides amount, increased storage period also is effective on biodeterioration of these chemical constituents. More reduction in market samples of all selected herbal plants as compared to fresh samples is showed.

ACKNOWLEDGMENT

Authors would like to express a sincere thank to Head, Department of Botany, University of Pune, Pune-411 007 for encouragement and necessary laboratory facilities.

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