Vol 4 Issue 11 may 2015 ISSN No :2231-5063

International Multidisciplinary Research Journal

Golden Research Thoughts

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RNI MAHMUL/2011/38595 **ISSN No.2231-5063**

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International Recognized Double-Blind Peer Reviewed Multidisciplinary Research Journal
Golden Research Thoughts
ISSN 2231-5063 Impact Factor :3.4052(UIF)
Volume - 4 | Issue - 11 | May - 2015 Available online at www.aygrt.isrj.org

STUDIES ON STORAGE OF BOTTLE GOURD JUICE PREPARED FROM DIFFERENT MATURITY STAGES OF FRUITS

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Short Profile

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ABSTRACT:
Bottle gourd (Lagenaria siceraria Mol.Standl.) is a delicious vegetable,capable for delivering health benefits besides fulfilling physiological needs. The juice was prepared from immature to over mature fruits of bottle gourd fruits of 65, 70, 75 and 80 days after sowing. The physico-chemical, sensory characteristics and microbiological safety of bottle gourd juice in glass and PET bottles were evaluated for 3 months at room and cold temperature. There was continuous increase in TSS, reducing sugars and pH while, acidity and chlorophyll decreased in bottle gourd juice with advancement of storage period.The score for sensory parameters likes colour, flavour, taste and overall acceptability of the bottle gourd juice decreased with advancement of storage period. The juiceof bottle gourd fruits harvested at 65 days after sowing with pasteurization + 600 ppm Sodium benzoate and stored in glass bottles at cold storage temperature was acceptable for 3 month and microbiologically safe during kharif and summer season.

KEYWORDS
Bottle gourd, physico-chemical,microbiologicalandsensory.

INTRODUCTION :

Bottle gourd (Lagenaria siceraria Mol.Standl.) is an important vegetable crop belongs to family Cucurbitaceae and genus Lagenaria. Bottle gourd has its origin in Africa and is cultivated all over the world. It has medicinal value hence used in some Ayurvedic medicines. It has a cooling effect on the human body and is also useful in prevention of constipation. White pulp of bottle gourd useful is emetic, purgative, diuretic and anti-bilious.

Anti-oxidant in vegetables play a big/ major role in minimizing cell damage by combining with and neutralizing free radicles.Bottle gourd plant was cultivated through the year in different places in different seasons. Hence supply is not uniform through the year in one particular place and step should be taken to preserve them to make available for consumption in off season as well. This could be achieved by extending the shelf life in fresh form or processed form (Deore, et al., 2012). Keeping this in view, the current study was focused on assessing shelf stability of the processed bottle gourd juice prepared at different maturity stages of fruit.

Materials and Methods:

Raw materials

The study was conducted in the Department of Horticulture, MPKV, Rahuri during kharif -2011. Bottle gourd fruits at different maturity stages 65, 70, 75 and 80 days after sowing was procured from Instruction cum Research Farm, Department of Horticulture, MPKV, Rahuri on 'Samrat' variety of bottle gourd.

Extraction process of bottle gourd juice

Fresh bottle gourd fruits washed thoroughly and cut off in to small pieces and were not peeled. These pieces were immediately blanched at 80°C in hot water for 3-4 min. The bottle gourd juice was extracted in a screw type juice extractor. The extracted juice was filtered through two layers of muslin cloth and centrifuged at 5000 rpm for 10 min. The filtered juice was pasteurized at 85^{O}C for 30 min. The preservative @ 600 ppm sodium benzoate was added during pasteurization of juice. Immediately after pasteurization, hot juice filled in sterilized glass and PET bottles. The juice was stored at ambient temperature and cold temperature (5 ± 2°C) was analyzed for chemical constituents and sensory parameters at intervals of 15 days up to 90 days of storage.

Physico-chemical analysis

Bottle gourd juices were analyzed at regular interval of 15 days for the parameters like TSS, reducing sugars, non-reducing sugar, pH, acidity, and chlorophyll. TS.S was taken using Digital Refractrometer. The pH of the pulp was determined by using standard solutions of pH 4.0 and 7.0 as reference to calibrate by using pH meter. Reducing sugars, non-reducing sugars, titrable acidity and chlorophyll by the Ranganna(2005).

Sensory analysis

The sensory evaluation of juice was carried out initially and at interval of 15 days on 9 point hedonic scale according to the method reported by Amerineet al.(1965).

Microbiological analysis: Total bacterial count was recorded by using Standard Plate count (SPC) method. Microbial tests of the prepared bottle gourd juice carried out at initially and at an interval of 15days. Total microbial count were detected by procedures described in USFDA (BAM) IS 5401 : 2002, 5402 : 2002 (Anonymous, 2011).

Statistical analysis

The experiment for juice preparation was planned by Factorial Completely Randomized Design with three replications. The data chemical composition and sensory evaluation were analysed for statistical significance as per the procedure given by Panse and Sukhatme (1976).

Result and Discussion:

The samples were studied for the effect of different maturity stages of fruits on physicochemical parameters of bottle gourd juice for the storage period of 3 month.

1.Physicochemical qualities of bottle gourd juice

Juice recovery and pomace per cent

The table.1 given the data on juice recovery percent and pomace per cent of bottle gourd fruit.The result shows that there was decrease in juice percent and increase in pomace per cent of bottle gourd fruit with advancement of maturity stages. The highest juice recovery and lowest pomace per cent was recorded in M1 stage of maturity i.e. 65 days after sowing

Table 1.Juice recovery and pomace content of bottlegourd fruits at different maturity stages

Treatment	Juice (%)		Pomace (%)	
	Kharif	Summer	*Kharif*	Summer
M1	62.83	62.80	37.18	37.20
M2	62.51	62.49	37.49	37.51
M3	62.21	62.20	37.79	37.80
M4	62.18	62.16	37.83	37.84
G. mean	62.43	62.41	37.57	37.59
S.E.±	0.004	0.005	0.01	0.01
C.D.at 5%	0.014	0.014	0.02	0.02

Total soluble solids:

The table 2indicated that, there was significant increase in T.S.S. content of bottle gourd juice during storage period.

Table 2.Changes in TSS (OBrix) of bottle gourd juice during storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	3.327	3.334	3.353	3.356	3.384	3.390	3.418	3.423	3.446	3.453	3.472	3.480	3.477	3.489
M_2	3.347	3.353	3.373	3.377	3.406	3.411	3.436	3.443	3.472	3.477	3.502	3.509	3.498	3.511
M_3	3.360	3.363	3.385	3.389	3.423	3.431	3.463	3.473	3.503	3.518	3.538	3.544	3.526	3.533
M_4	3.373	3.377	3.401	3.406	3.438	3.446	3.485	3.493	3.521	3.529	3.552	3.558	3.540	3.548
SE (±)	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	3.477	3.489
CD @ 5%	0.004	0.004	0.004	0.004	0.005	0.005	0.004	0.004	0.005	0.005	0.004	0.004	3.498	3.511

Note: Data shown average of three replications DAS- days after storage
M1- 65 days after sowing, M2- 70days after sowing,M3- 75 days after sowing, M4- 80 days after sowing

Increase in TSS content of bottle gourd juice may be due to partial hydrolysis of complex carbohydrates, polysaccharides and sugars etc. into simple sugar. These results are in agreement with Deore (2012) in bottle gourd juice.

Reducing sugars:

The result indicated that, there was increase in reducing sugars significantly in bottle gourd juice with advancement of storage period (Table.3). Increase in reducing sugars may be due to continues hydrolysis of polysaccharides. Similar findings were recorded by Padvi and Pagar (2007) and Mujumdar et al. (2010) in bottle gourd juice.

Table 3.Changes in reducing sugars (%) of bottle gourd juice during storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	3.699	3.695	3.728	3.710	3.735	3.724	3.748	3.739	3.772	3.757	3.778	3.762	3.781	3.769
M_2	3.658	3.654	3.681	3.667	3.697	3.680	3.713	3.704	3.733	3.721	3.736	3.728	3.747	3.730
M_3	3.458	3.453	3.478	3.455	3.498	3.478	3.517	3.510	3.538	3.519	3.558	3.539	3.569	3.558
M_4	3.383	3.377	3.410	3.393	3.426	3.413	3.455	3.445	3.474	3.466	3.484	3.474	3.493	3.486
SE (±)	0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	-	-
CD @ 5%	0.005	0.005	0.006	0.006	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.005	-	-

Non-reducing sugars:

Table 4. shows that, there was decrease in non-reducing sugarswith the advancement of storage in bottle gourd juice.The decrease in non-reducing sugars during storage may be due to sucrose inversion in juice. Similar results were reported by Padvi and Pagar (2007) in bottle gourd juice and Mujumdaret al. (2010) in bottle gourd-basil leaves juice.

Table. 4 Changes in non-reducing sugars (%) of bottle gourd juice during storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	6.623	6.613	6.614	6.606	6.598	6.591	6.588	6.578	6.565	6.550	6.533	6.519	6.516	6.509
M_2	6.563	6.553	6.553	6.540	6.539	6.526	6.521	6.510	6.497	6.485	6.463	6.452	6.452	6.446
M_3	6.353	6.344	6.343	6.333	6.328	6.319	6.311	6.303	6.289	6.280	6.258	6.253	6.256	6.244
M_4	6.317	6.313	6.306	6.300	6.294	6.288	6.279	6.270	6.260	6.243	6.228	6.213	6.227	6.211
SE (±)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	-	-
CD @ 5%	0.005	0.005	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	-	-

TitrableAcidity:

Table 5 shows that, there is significant decrease in acidity during storage period in bottle gourd juice. This might be due to chemical interactions between the organic constituents of juice induced by temperature and action of enzymes.These results are in confirmation with the results reported byPadavi and Pagar (2007) and Deore (2012) in bottle gourd juice.

Table 5.Changes in acidity (%) of bottle gourd juice during storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	0.153	0.148	0.147	0.146	0.143	0.142	0.138	0.134	0.130	0.127	0.123	0.120	0.121	0.118
M_2	0.140	0.136	0.136	0.133	0.132	0.128	0.125	0.121	0.119	0.115	0.112	0.109	0.110	0.107
M_3	0.131	0.126	0.126	0.121	0.123	0.117	0.114	0.108	0.105	0.101	0.098	0.095	0.097	0.093
M_4	0.119	0.117	0.118	0.114	0.114	0.111	0.110	0.104	0.103	0.098	0.094	0.092	0.074	0.072
SE (±)	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	-	-
CD @ 5%	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	-	-

pH :The result of present study (Table. 6) showed significant increase in pH during storage period. Similar results were found earlier by Padvi and Pagar (2007) in bottle gourd juice.

Table 6.Changes in pH of bottle gourd juice during storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	5.010	5.013	5.010	5.015	5.029	5.033	5.035	5.040	5.063	5.067	5.067	5.072	5.087	5.092
M_2	5.100	5.103	5.108	5.111	5.137	5.140	5.140	5.144	5.162	5.165	5.165	5.169	5.181	5.186
M_3	5.199	5.203	5.208	5.210	5.238	5.242	5.242	5.245	5.258	5.262	5.262	5.266	5.270	5.274
M_4	5.283	5.290	5.301	5.305	5.326	5.329	5.331	5.335	5.351	5.355	5.354	5.358	5.373	5.378
SE (±)	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	-	-
CD @ 5%	0.009	0.009	0.005	0.005	0.006	0.006	0.005	0.005	0.005	0.005	0.004	0.004	-	-

Chlorophyll content:

The data (Table. 7) on chlorophyll content in bottle gourd juice showed significant decrease in chlorophyll during storage period. The decrease in chlorophyll content might be due to higher storage temperature. These results are in confirmation with the results reported by Padavi and Pagar (2007) and Deore (2012) in bottle gourd juice.

Table 7.Changes in chlorophyll (mg/ml) content of bottle gourd juice during storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	5.173	5.168	5.021	5.015	4.987	4.978	4.925	4.919	4.856	4.851	4.751	4.746	4.732	4.722
M_2	4.867	4.862	4.700	4.697	4.664	4.660	4.623	4.617	4.537	4.533	4.437	4.433	4.434	4.427
M_3	3.866	3.848	3.707	3.701	3.669	3.665	3.631	3.627	3.548	3.543	3.449	3.444	3.438	3.432
M_4	3.762	3.756	3.615	3.609	3.570	3.567	3.510	3.506	3.426	3.423	3.359	3.353	3.344	3.339
SE (±)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	-	-
CD @ 5%	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.006	0.006	-	-

2.Sensory evaluation :

Colour: The data (Table 8) showed that colour score decreased with an

Table 8. Changes in colour score (9 point) of bottle gourd juiceduring storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	7.989	7.963	7.938	7.935	7.915	7.908	7.889	7.884	7.852	7.844	7.830	7.823	7.820	7.819
M_2	7.953	7.940	7.919	7.911	7.888	7.882	7.865	7.857	7.826	7.819	7.793	7.786	7.764	7.759
M_3	7.417	7.393	7.372	7.365	7.351	7.343	7.327	7.320	7.298	7.293	7.269	7.264	7.263	7.258
M_4	7.343	7.330	7.314	7.307	7.283	7.276	7.254	7.246	7.223	7.213	7.185	7.177	7.183	7.175
SE (±)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	-	-
CD @ 5%	0.006	0.006	0.004	0.004	0.004	0.004	0.005	0.005	0.004	0.004	0.005	0.005	-	-

increase in storage period. Deterioration of colour might be due to non-enzymatic browning. This might be due to non-enzymatic reaction, which involves in the interaction between sugars and amino acids. The same results were reported by Kapleshwar (2010) in ash gourd RTS, Deore (2012) in bottle gourd juice.

Flavour:

The mean value of flavour score (Table.9) in bottle gourd juice decreased during 90days of storage period. A decrease in flavour of bottle gourd juice due to heat treatment during processing.Similar results were reported byDeore (2012) in bottle gourd juice

Table 9.Changes in flavour score (9 point) bottle gourd juice during storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	7.663	7.660	7.523	7.513	7.473	7.460	7.404	7.401	7.323	7.306	7.221	7.209	7.177	7.161
M_2	7.652	7.647	7.509	7.503	7.448	7.438	7.378	7.373	7.290	7.280	7.197	7.180	6.989	6.970
M_3	6.523	6.520	6.415	6.405	6.335	6.323	6.268	6.260	6.147	6.138	6.052	6.039	6.000	5.984
M_4	6.507	6.503	6.378	6.366	6.313	6.300	6.246	6.245	6.114	6.104	6.022	6.013	5.974	5.963
SE (±)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	-	-
CD @ 5%	0.005	0.005	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	-	-

Taste :

The data from Table 10 , revealed thattaste score of all the juice samples decreased throughout the storage period.Activities of microbial enzymes responsible for deterioration of flavour might be more and also responsible for degradation of taste.Similar results reported by Kapleshwar (2010) in ash gourd RTS and Deore (2012) in bottle gourd juice.

Table 10. Changes in colour score (9 point) of bottle gourd juiceduring storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	8.811	8.808	8.710	8.698	8.667	8.659	8.550	8.543	8.482	8.475	8.401	8.397	8.368	8.363
M_2	8.781	8.772	8.698	8.485	8.646	8.641	8.531	8.523	8.453	8.446	8.283	8.278	8.229	8.224
M_3	7.685	7.679	7.638	7.616	7.561	7.553	7.458	7.448	7.383	7.374	7.333	7.329	7.318	7.313
M_4	7.637	7.633	7.557	7.530	7.511	7.505	7.413	7.403	7.342	7.336	7.297	7.293	7.229	7.223
SE (±)	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.002	0.002	0.002	-	-
CD @ 5%	0.005	0.005	0.006	0.006	0.007	0.007	0.007	0.007	0.005	0.005	0.007	0.007	-	-

Over all acceptability:

Table 11.Changes in overall acceptability score (9 point) of bottle gourd juice during storage

Treatment	0 DAS		15 DAS		30DAS		45DAS		60DAS		75DAS		90DAS	
	Kharif	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer	*Kharif*	Summer
Maturity Stage														
M_1	8.805	8.801	8.766	8.761	8.708	8.702	8.676	8.671	8.646	8.636	8.592	8.584	8.588	8.573
M_2	8.783	8.779	8.723	8.718	8.668	8.665	8.635	8.632	8.596	8.582	8.537	8.532	8.524	8.520
M_3	7.678	7.673	7.624	7.621	7.592	7.587	7.559	7.555	7.525	7.511	7.463	7.457	7.443	7.436
M_4	7.608	7.603	7.557	7.552	7.509	7.505	7.473	7.468	7.428	7.415	7.370	7.364	7.350	7.340
SE (±)	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.002	-	-
CD @ 5%	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.005	0.005	0.004	0.004	-	-

There was significant decrease in overall acceptability score in bottle gourd juice during storage period (Table 11).This may be due to which increase in rate of biochemical and enzymatic reaction.Similar results were reported byDeore (2012) in bottle gourd juice.

3.Microbiological quality:

Fresh bottle gourd juice was found free from any contamination of bacteria, fungi and yeast. The microbial growth was found the safe limit of microbial count in both kharif and summer season. Similar trend was observed by Deore (2012) in bottle gourd juice with pasteurization and 100 ppm sodium benzoate was found free from microbial growth.

CONCLUSION:

This research work concludes that bottle gourd fruits harvested at different maturity stages, showed the highest juice recovery in M1 stage of maturity i.e. 65 days after sowing and decreased with advancement of maturity stages. The juice of bottle gourd fruits harvested at 65 days after sowing, packed in glass bottle and stored at cold storage was found to be superior over all other treatments in respect of chemical constituents, sensory score and microbiologically safe during kharif and summer season.

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- Digital Journals Database
- Current Index to Scholarly Journals
- Elite Scientific Journal Archive
- Directory Of Academic Resources
- Scholar Journal Index
- Recent Science Index
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