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The Change of Sugars and Non Enzymatic Browning in Grape Pomace Powder during Storage after Drying and Packing

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ABSTRACT

Fresh grape pomace was pretreated with T_1 (KMS 1% + $CaCl_2$ 1%) and T_2 (Citric acid 1% + KMS 0.5%) and dehydrated. The pomace powder thus obtained were packed in two packaging material viz., P_1-Low density polyethylene (LDPE), P_2- Metallised polyester (MP), and compared with control P_3- without any packing. The samples were kept at ambient conditions (27±1°C and 60 70 per cent RH) for storage studies. The stored samples were analyzed initially and at monthly intervals for their sugars and non enzymatic browning upto 90 days. Among the treatments, interaction of Citric acid 1% + KMS 0.5% (T_2) and metallised polyester (MP) had retained good quality pomace powder.

Key words: *Grape, Pomace powder, Sugars and Non Enzymatic Browning*

INTRODUCTION

Grape is rich source of phenolic and fiber compounds and intake of grape products such as juice or wine have recognized health benefits[1]. About 80% of the world production is utilized for wine making, 10% for table purpose and the balance 10% for raisin and juice purpose. It is also known that polyphenols have health-promoting effects and anti-aging properties[2] there by prevent risk factors related to metabolic syndrome and several chronic diseases in aging humans[3]. These biological properties of polyphenols are attributed mainly to their powerful antioxidant, metal chelating and antiradical activities. In addition to finding, a productive use for a waste product and market demand for natural antioxidants rather than chemical antioxidants has directly increased the demand for novel polyphenolic and fibre containing ingredients, but the information regarding simple technologies for drying/dehydration of this waste (pomace) that can be adopted for small farmers at field level is lacking. So far reported research findings on the efficiency of pre-treatments and packaging materials on quality attributes and storage of grape pomace are very limited.

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MATERIALS AND METHODS

Healthy disease free fruits of Bangalore blue were sorted out separately. Fully matured fruits with firm texture were selected. The TSS was 19-20°Brix at this stage. Juice extraction from fresh grapes resulted pomace (solid waste), the pomace thus obtained was pretreated thoroughly with different chemicals T_1- KMS 1% + $CaCl_2$ 1%, T_2- Citric acid 1% + KMS 0.5% for 5 min and drained. The pretreated and drained pomace was spread evenly on trays and kept in solar dryer for drying. The dehydrated grape pomace powder was stored and analyzed for Sugars, P^H and non enzymatic browning by using standard methods (Ranganna 1991) [4]. All quality characteristics were analyzed in 4 replicates.

Treatment details:

T_1- KMS 1% + $CaCl_2$ 1%

T_2- Citric acid 1% + KMS 0.5%

Packing materials:

P_1-Low density polyethylene (LDPE)

P_2-Metallised polyester (MP)

P_3-Control (without packing)

Treatment combinations:

T_1 – KMS 1% + $CaCl_2$ 1%+ Metallised polyester pouches (MP)

T_2- KMS 1% + $CaCl_2$ 1%+ Low density polyethylene pouches (LDPE)

T_3– Citric acid 1% + KMS 0.5% + Metallised polyester pouches (MP)

T_4– Citric acid 1% + KMS 0.5 %+ Low density polyethylene pouches (LDPE)

T_5- KMS 1% + $CaCl_2$ 1% without packing *i.e.*, Control

T_6- Citric acid 1% + KMS 0.5% without packing *i.e.*, Control

Statistical analysis

To test the significance of variation in the data obtained the analysis of variance technique was adopted as suggested by Fisher[5] for Completely Randomized Design with factorial concept.

RESULTS AND DISCUSSION

Reducing sugars (%)

The data pertaining to reducing sugars of pomace powder packed in different packing materials are presented in **Table 1**. The interaction effects between the packages and treatments were significant upto 90 days of storage. The pomace powders of two treatments (T_1, T_2) packed in metallised polyester (P_2) recorded minimum increase of reducing sugars from 12.72 to 12.94 per cent in T1 (KMS 1% + $CaCl_2$ 1%) and 12.70 to 12.76 per cent in T_2 (Citric acid 1% + KMS 0.5 %). Pomace powder without packing (P_3) recorded maximum increase in reducing sugars content from 12.72 to 13.09 per cent in T_1 (KMS 1% + $CaCl_2$ 1%) and 12.70 to 12.76 per cent in T_2 (Citric acid 1% + KMS 0.5 %). There was more increase in reducing sugars in pomace powder samples during storage which were treated with KMS 1% + $CaCl_2$ 1% (T_1). This could be due to the inversion of non-reducing sugars to reducing sugars caused by acid present in product. Interaction showed that the pomace powder with T_2 (Citric acid 1% + KMS 0.5%) packed in metallised polyester (P_2) (T_2P_2) recorded minimum increase in reducing sugars in the range of 12.70 to 12.76 per cent upto 90 days. The results of the present investigation are in accordance with the findings of Kumar *et al.*[6] in storage studies of ber powder.

Total sugars (%)

The results pertaining to total sugars of pomace powder packed in different packing materials are presented in **Table 2**. With the advancement of storage period, there was slight decrease in total sugars in all the treatments. The total sugars of pomace powder differed significantly among the treatments from 0 days to 90 days of storage. On the first day of storage, the pomace powder with T_1 (KMS 1% + $CaCl_2$ 1%) recorded maximum total sugars of 16.58 per cent while minimum total sugars of 16.56 per cent was recorded in T_2 (Citric acid 1% + KMS 0.5%). During storage upto 90 days, maximum decrease was recorded in T_1 from 16.58 to 16.17 per cent and minimum decrease was recorded in T_2 from 16.56 to 16.29 per cent.

The total sugars of pomace powder differed significantly with package type. Although, no significant difference was observed initially (0 days of storage) with advancement of storage period significant changes were recorded in different packing materials from 30 to 90 days of storage. Total sugars of pomace powder packed in (P_3) control without packing showed maximum decrease trend during storage period from 16.57 to 16.04 per cent followed by LDPE (P_1) packed powder from 16.57 to 16.23 per cent during stored period of 90 days. The minimum decrease of total sugars was recorded in pomace powder packed in metallised polyester (P_2) from 16.57 to 16.42 per cent upto 90 days of storage.

The interaction effects were no significant between packing and treatments. This shows that irrespective of packing materials the total sugars decreased in all the treatments. Decrease in total sugars might be attributed to utilization of acids for converting them to other compounds. Besides, metallised polyester film blocks this conversion of acid to other compounds and hence was able to retain maximum total sugars. The present findings are in accordance with the findings of Sharma *et al.*[7] in storage of anardana arils under ambient condition and Mozumder *et al*.[8] in storage of tomato powder.

Non-enzymatic Browning (Absorbance 420)

The data pertaining to browning index of pomace powder packed in different packing materials are presented in **Table 3**. Interactions between the packing and treatments were not significant on non-enzymatic browning at initial days of storage and significant difference was observed with increasing in storage period. During storage upto 90 days, pomace powder of two best treatments (T_1, T_2) kept under control i.e. without packing (P_3) recorded maximum increase of non-enzymatic browning from 0.65 to 1.09 in T_1 (KMS 1% + $CaCl_2$ 1%) and from 0.62 to 0.87 in T_2 (Citric acid 1% + KMS 0.5%) followed by LDPE (P_1) packed powder 0.65 to 0.87 in T_1 (KMS 1% + $CaCl_2$ 1%) and from 0.62 to 0.79 in T_2 (Citric acid 1% + KMS 0.5%). The pomace powder packed in metallised polyester (MP) P_2 recorded minimum increase in non-enzymatic browning from 0.65 to 0.77 in T_1 (KMS 1% + $CaCl_2$ 1%) and from 0.62 to 0.68 in T_2 (Citric acid 1% + KMS 0.5%) during entire storage period of 90 days. Interactions showed that pomace powder with T_2 (Citric acid 1% + KMS 0.5%) packed in metallised polyester (P_2) had recorded minimum increase of non-enzymatic browning from 0.62 to 0.68 even at 90 days of storage. The combination of citric acid along with KMS was more effective than either of the two used individually and provides extension of shelf life in acceptable condition for 3 months. Similar pattern was reported by Quitral *et al.*[9] in apple varieties. Less permeability of metallised polyester films (MP) regarding to the light and oxygen may be considered for retention of higher quality.

Table 1: Interaction effect of packing materials on reducing sugars (%) of grape pomace powder stored at ambient condition

Packing material (P)	**Storage period (days)**											
	Initial (0 days)			**30DAS**			**60DAS**			**90DAS**		
	T1	**T2**	**Package Mean(P)**	**T1**	**T2**	**Package Mean(P)**	**T1**	**T2**	**Package Mean(P)**	**T1**	**T2**	**Package Mean(P)**
P_1 - Low density polyethylene	12.72	12.70	12.71	12.79	12.74	12.76	12.89	12.79	12.84	13.01	12.87	12.94
P_2 - Metallised polyester	12.72	12.70	12.71	12.76	12.73	12.74	12.84	12.74	12.79	12.94	12.76	12.85
P_3 - Control (without packing)	12.72	12.70	12.71	12.84	12.80	12.82	12.97	12.90	12.93	13.09	12.76	13.09
Mean	12.72	12.70		12.79	12.75		12.90	12.81		13.04	12.88	

	S.Em±	CD at 5%	S.Em±	CD at 5%	S.Em±	CD at 5%	S.Em±	CD at 5%
Packing material (P)	0.010	N.S.	0.004	0.013	0.011	0.033	0.008	0.026
Treatments (T)	0.008	0.024	0.003	0.011	0.009	0.027	0.007	0.021
Interaction (PXT)	0.014	N.S.	0.006	0.019	0.015	0.047	0.012	0.037

*T_1 (KMS 1% + $CaCl_2$ 1%); T_2 (Citric acid 1% + KMS 0.5%); DAS- days after storage

Table 2: Interaction effect of packing materials on Total sugars (%) of grape pomace powder stored at ambient condition

Packing material (P)	Storage period (days)											
	Initial (0 days)			30DAS			60DAS			90DAS		
	T1	T2	Package Mean(P)	T1	T2	Package Mean(P)	T1	T2	Package Mean(P)	T1	T2	Package Mean(P)
P_1 - Low density polyethylene	16.58	16.56	16.57	16.45	16.48	16.46	16.35	16.38	16.36	16.19	16.28	16.23
P_2 - Metallised polyester	16.58	16.56	16.57	16.52	16.55	16.53	16.44	16.54	16.49	16.34	16.50	16.42
P_3 - Control (without packing)	16.58	16.56	16.57	16.40	16.45	16.42	16.20	16.28	16.24	15.98	16.10	16.04
Mean	16.58	16.56		16.45	16.49		16.33	16.40		16.17	16.29	

	S.Em±	CD at 5%	S.Em±	CD at 5%	S.Em±	CD at 5%	S.Em±	CD at 5%
Packing material (P)	0.006	N.S.	0.013	0.039	0.014	0.041	0.013	0.041
Treatments (T)	0.005	0.015	0.010	0.031	0.011	0.034	0.011	0.033
Interaction (PXT)	0.009	N.S.	0.018	N.S.	0.019	N.S.	0.019	N.S.

*T_1 (KMS 1% + $CaCl_2$ 1%); T_2 (Citric acid 1% + KMS 0.5%); DAS- days after storage

Table 3: Interaction effect of packing materials on Non enzymatic browning (A_{420}) of grape pomace powder stored at ambient condition

Packing material (P)	Storage period (days)											
	Initial (0 days)			30DAS			60DAS			90DAS		
	T_1	T_2	Package Mean(P)	T_1	T_2	Package Mean(P)	T_1	T_2	Package Mean(P)	T_1	T_2	Package Mean(P)
P_1 - Low density polyethylene	0.65	0.62	0.63	0.71	0.66	0.69	0.78	0.72	0.75	0.87	0.79	0.83
P_2 - Metallised polyester	0.65	0.62	0.63	0.67	0.63	0.65	0.71	0.65	0.68	0.77	0.68	0.72
P_3 - Control (without packing)	0.65	0.62	0.63	0.77	0.68	0.73	0.92	0.77	0.84	1.09	0.87	0.98
Mean	0.65	0.62		0.72	0.66		0.80	0.71		0.91	0. 78	

	S.Em±	CD at 5%	S.Em±	CD at 5%	S.Em±	CD at 5%	S.Em±	CD at 5%
Packing material (P)	0.008	N.S.	0.004	0.013	0.011	0.033	0.008	0.026
Treatments (T)	0.006	0.020	0.003	0.011	0.009	0.027	0.007	0.021
Interaction (PXT)	0.011	N.S.	0.006	0.019	0.015	0.047	0.012	0.037

*T_1 (KMS 1% + $CaCl_2$ 1%); T_2 (Citric acid 1% + KMS 0.5%); DAS- days after storage

CONCLUSION

The study revealed that pomace powder pre-treated with Citric acid 1% + KMS 0.5% (T_2) and packed in metallised polyester (P_2) (T_2P_2), recorded minimum increase in reducing sugar, non-enzymatic browning and minimum decrease of total sugars.

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