THE EFFECT OF HEAT ON QUALIVY OF PECTIN IN MANGO JUICE

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Mango juice was hot packed at 180°, 200°, and 212°F as well as after filling in tincans, exhausting and sealing was processed for 30 minutes, 20 minutes and 15 minutes at 212°F Lacquerred tin cans A2 were used for this purpose. Effect of these treatments and of storage on pectin quality has been studied Acetyl value decreased progressively in all the products during storage. There was a gradual decrease in AUA contents and per cent esterification in the marc (AIS) of all the products during storage. In the produts hot packed at 180°F, the decrease in the values was less as compared to other heat treatments.

In Pakistan, mango juice in the form of ready-to-drink beverage is now avilable in bottles, but it maintains its quality for 6-8 weeks, after which deterioration starts. This may be due to certain changes in various constituents during storage. Pectin is one of the important constituents which is responsible for maintaining the colloidal nature of the processed juices. With the degradation of pectin, the quality, of the juice deterioratees. The pectin degradation may be either enzymatic or through some chemical reactions. The changes in pectin can be determined either by extraction with solvents or in the marc prepared as alcohol insoluble solids (AIS). The former method of extraction accounts for only 70% of the total pectin. The quality of pectin is affected by different factors which may include the variety, handling, processing treatments as well as storage of the processed products.

Pruthi *et al* (1960) dehydrated guavas at 130°, 140°, 150°, 160° and 170°F to 4 per cent final moisture content for determining the critical temperature of dehydration for maintaining higher peetin quality. The grade of pectin in apple pomace increased by decreasing the drying temperature from 110°C to 90°C as reported by Dryden *et at* (1952). By blanching citrus peel for 30 minutes at 200°F Shefered and Graham (1952) observed lesser losses of pectin quality, but as the drying temperature increased, pectin

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quality decreased. The effect of the time and storage temperature of dried peel and pomace of Assam lemon, on recovery and pectin quality have been reported by Ghaliha *et al* (1963). During dehydration of blanched roselle sepals, Riaz and Rahman (1968), observed decrease in pectin quality as determined by AUA contents and esterification value. A considerable degradation in pectin quality occurred during storage at room temperature.

The present study has therefore been undertaken to see the effect of different heat processing treatments and of storage on the quality of pectin in canned mango juice.

MATERIALS AND METHODS

Processing of Juice

Mango fruit (sucking type) was obtained in two batches and the juice extracted from each batch was divided into three lots. The lots A, B and C were hot packed in lacquered A2 cans at 180°, 200° and 212°F, respectively and cans sealed. While the lots D, E and F after filling in lacquerred A2 cans and exhausting for 5 minutes were processed for 30 , 20 and 15 minutes at 212°F, respectively. The products after cooling were stored at room temperature and during storage various constituents were determined at 0, 15, 30, 60, 90, 120 and 180 days intervals.

Chemical Characterization of marc

For characterization of pectic substances in fresh as well as canned mango juice, marc (alcohol insoluble solids) was prepared. The procedure of Mildred, McComb and McCready (1958) were followed for the preparation of marc and chemical characterization of total pectic substances in the marc of fresh and canned juice processed by the above treatments. Acetyl values were determined by the method of Owens *et al* (1952). The following determination were made :

1. *Free acidity* Free carboxyl groups = Normality (N) X Vol of alkali (ML)

2. *Total Esters*—Esters saponified per gram of neutralised marc worked out by the following formula :

Ester saponified per gm of marc = N X Vol of alkali used (ML).

3. *Acetyl Value :* Acetyl values were calculated as acetic acid by the following formula :-

$$\text{Percent acetyl } (-OOCH_3) = \frac{\text{N X Vol of akali (ML) X 4.0}}{\text{Wt. of sample in aliquot (gm)}}$$

4. *Anhydrouronic acid and Esterification* :— These values were calculated by the following formula using the figures from above determinations by reducing all measurements to milliequivlents per gram of marc.

Anhydrouronic acid equivalent — 176

Esterified uronic acid carboxyls — Ester less acetyl.

Total uronic acid carboxyls (free and combined) — Free acid plus esterified uronic carboxyls

Per cent anhydrouronic acid (AUA) — $\frac{176 \times 100 \times \text{Total uronic acid carboxyls}}{1000}$

Per cent esterification — $\frac{\text{Esterified uronic acid carboxyls} \times 100}{\text{Total uronic acid carboxyls.}}$

RESULTS AND DISCUSSION

Per cent Anhydrouronic acid (Per cent AUA)

The AUA contents of the marc (AIS) during storage period of 180 days is given in Table 1. The marc prepared from fresh mango juice had 32.91 per cent AUA contents which decreased during processing, the value ranged between 30.00 and 32.12 per cent. During storage a gradual decrease has been observed in the contents. In the product processed for 30 minutes at 212°F after 180 days storage, the value decreased to 11.70 per cent, while in the case of the product prepared by hot packing at 180°F, the value was observed to be 19.62 per cent.

TABLE 1 : *The Effect of Canning and Storage on per cent AUA in Canned Mango Juice under Different Treatments*

Treatments	Fresh juice	Storage Intervals (Days)						
		0	15	30	60	90	120	180
A: Hot packed at 180°F	32.91	32.12	27.99	25.96	23.67	21.91	20.59	19.62
B: Hot packed at 200°F	,,	32.01	27.54	24.21	22.61	19.62	18.53	17.42
C: Hot packed at 212°F	,,	29.73	26.48	24.11	23.32	19.53	17.12	15.84
D: Processed for 30 minutes at 212°F	,,	30.00	26.31	23.93	21.03	16.54	13.37	11.70
E:Processed for 20 minutes at 212°F	,,	30.16	27.10	24.72	21.81	19.62	16.36	15.40
F: Processed for 15 minutes at 212°F	,,	31.15	28.24	24.99	22.67	19.53	17.33	16.37

Per cent Esterification

The percent esterification of the marc (AIS) prepared from the products at different intervals during storage period of 180 days is shown in Table 2. The marc prepared from fresh mango juice had 77.54 per cent esterification which slightly decreased during processing in the products under all treatments. During storage a further gradual decrease occurred in all the products. At end of 180 days of storage lower value was observed in case of the preducts processed for 30 minutes at 212°F. Maximum retention was in the products hot packed at 180°F.

The acetyl values and acidity (data not shown here) per gram of the marc declined slightly during canning, however, during storage a progressive decrease was observed in the products. At the end of 180-day storage, period, minimum retention was observed in the case of the product processed for 30 minutes at 212°F and maximum retention in the product hot packed at 180°F. Total ester per gram of marc also decreased during storage in all the products.

Statistical analysis of the data in Table 3 showed highly significant values for treatments and storage for both characters.

TABLE 2: *The Effect of Canning and Storage on per cent Esterification of Pectin of Canned Mango Juice under Different Treatments*

Treatments	Fresh juice	Storage Intervals (Days)						
		0	15	30	60	90	120	180
A:Hot packed at 180°F	77.54	76.99	76.10	75.59	75.46	75.10	74.36	73.99
B: Hot packed at 200°F	,,	76.91	76.90	75.20	75.09	75.88	74.36	73.63
C:Hot packed at 212°F	,,	76.91	76.74	75.19	75.09	74.74	74.29	73.33
D: Processed for 30 minutes at 212°F.	,,	75.39	76.57	74.26	73.22	72.24	71.05	69.10
E: Processed for 20 minutes at 212°F.	,,	76.10	74.67	74.37	74.11	73.90	73.11	72.57
F: processed for 15 minutes at 212°F.	,,	76.27	75.01	74.64	74.36	73.87	73.60	73.11

TABLE 3. *Analysis of Variance for per cent esterification and AUA Contents in Canned Mango Juice under different treatments*

Due to	F. Ratio	
	Per cent gesterification	Per cent AUA
Treatment	8.11**	14.08**
Storage duration	14.76**	189.90**

** Highly Significant.

Pectic substances are associated with inter-cellular layers of plants; these cannot therefore be extracted completely. These substances control texture of plant material during processing and storage and hence complete characterisation of these substances is necessary. For this purpose, characterisation of these substances in the marc (Alcohol Insoluble solids) is most desirable in order to avoid losses of these substances by other extraction methods. The characteristics, namely, anhydrouronic acid (AUA) contents and percent esterification and acetyl value are employed for determining the effect of various treatments on pectin quality of processed produts. The higher the value of former two factors, the greater the Jellying power of pectin, thereby, maintaining better quality of the product, but with the increase of acetyl value there is decrease in pectin quality.

Pruthi *et al* (1960) observed during dehydration of guavas that blanching before dehydration had a beneficial effect on pectin quality. Dehydration at 150°F was shown to be a safe temperature as AUA content in the material was maximum, but at 130° or 170°F, the contents were lower which might be due to enzymatic degradation at 130°F and heat degradation at 170°F.

Higher dehydration temperature and longer storage period at room temperature had a degrading effect on the pectin quality of dried roselle sepals as determined by Riaz and Rahman (1968). Similarly, a higher storage temperature (98°F) of dried lemon peel affected the quality of pectin as observed by Chaliha *et al* (1963), but this was best retained by a relative higher temperature for a short period.

In the present study, processing temperature and storage period as well as temperature affected percent esterification and AUA contents in the products. When the juice was hot packed at 180°F, there was less decrease in the values as compared to processing at 212°F for 30 minutes both during processing and storage. This affected the pectin quality and the quality of the processed mango juice under various heat treatments. Further study, to minimise loss of quality, is therefore, desirable including such other factors as different storage temperatures, types of containers, processing temperature and time of processing.

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