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PECTIN EXTRACTION FROM ROSELLE SEPALS

Effect on the Quality of Pectin During Storage of Dehydrated Sepals

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Roselle (*Habiscus sabdariffa* L.) thrives well in our conditions. In this investigation the effects on recovery and quality of pectin extracted from dehydrated sepals of Roselle during six month's storage at ambient temperature are studied.

There is a great need for surveying economical and stable sources of pectic materials. One of the cheap and rich sources of pectin is sepals of roselle. The fresh sepals, which are highly perishable, if used for production of pectin, can be utilized only during the season. Different processing and storage treatments have varied effect on the quality and stability of pectin extracted from plant tissues. In order to save such material from deterioration, dehydration is one of the methods for preserving pectic substances. Keeping the importance of pectin in view, roselle sepals were dehydrated by Riaz and Rahman.[6] The dried sepals were stored at ambient temperature to see the effect on quality of pectin during subsequent extractions.

In a study made by Shepherd and Graham[7] it was found that dried citrus peel was stable when stored at 70°F but degraded at an elevated storage temperature of 100°F. While illustrating the various factors affecting the grade of apple pomace, Dryden *et al.*[2] observed that as the drying temperature decreased from 230 to 194°F, the grade of dried pomace increased. Pomace, which was allowed to stand at room temperature before drying, lost 40% grade after 1 day, about 50% after 2 days and more than 60% after 3 days.

There occurred a very little change in pectin recovery as well as quality of dehydrated guavas stored at 57°F for 4 months as observed by Pruthi, Mookerji and Lal.[5] Much higher loss occurred in quality of pectin in the dehydrated product stored at 37°C during storage period.

Chaliha, Barua and Siddappa[1] investigated the effect of time and temperature of storage on recovery and quality of pectin from dried peel and pomace of the Assam lemon. It has been reported that on storage of 6 months at 35°F and 85°F, the recovery and quality of pectin were not affected. During storage, there was a decrease in methoxyl content and the jelly grade of pectin extracted from the dried materials when stored at 98°F.

Kertesz *et al.*[4] studied storage behaviour of powdered dehydrated cranberries for its jelly forming ability. The storage stability was measured by sag measurements made on the jelly under standardized conditions. In powdered cranberries containing less than 4% moisture, there was little deterioration in the jelly forming ability and jelly firmness within one year's storage at 90°F. The increase in the moisture content above 4% or the storage temperature above 100°F resulted in rapid deterioration within much shorter time.

Experimental

Roselle (*Hibiscus sabdariffa* L.) grown at the Experimental Farm in the Plant Breeding and Genetics Department, West Pakistan Agricultural University, Lyallpur for introduction of a new fibre crop in Pakistan was used for this study.

Fully mature sepals of roselle after blanching in steam at 180°F for 0, 2 and 4 min respectively were dehydrated in the cabinet type dehydrator at a starting temperature of 180°F and finishing temperature of 140°F. The dried sepals were packed in polyethylene bags and stored in friction top tin containers at room temperature. The methods described by Riaz and Rahman[6] were followed for the chemical characterization of total pectic substances in the tissues, yield and quality of pectin extracted from dehydrated sepals at different intervals during six months storage at room temperature.

Results and Discussion

Effect on Marc Quality

During a six months storage period room temperature varied with the season. At different intervals during storage marc (alcohol insoluble solids—AIS) was prepared from dried sepals and was evaluated for yield, anhydrouronic acid (AUA), percent esterification and acetyl contents (Table 1.).

The yield of marc prepared from sepals dehydrated by blanching in steam for various periods

increased as compared to the yield from the product dehydrated without blanching. During storage, a slight decrease under each treatment in the yield of AIS has been observed. The treatments differed significantly while storage intervals are non-significant.

A deteriorative effect on AUA content of marc under all treatments has been observed due to storage and a loss of about 43% of AUA occurred. The AUA contents were better retained in the marc prepared from the material dehydrated after 4 min steam blanching. It has been observed that during a storage period of first 90 days, a rapid decrease in AUA content occurred under all the three treatments while there was a slow decrease after this period of storage. Statistical analysis of the results showed significant effect of storage intervals.

The percentage esterification in the marc prepared from the material dehydrated by 4 min steam blanching was higher as compared to the other treatments. A gradual decrease in percentage esterification under all treatments has been observed. The material prepared without blanching has initially 44.61% esterification value while it decreased to 34.33% after 180 days of storage. The effect of storage intervals on the quality of the marc was highly significant.

The acetyl content of marc prepared from dehydrated materials under various treatments also decreased during storage. The acetyl contents after dehydration have been observed to be less than 1% and it decreased further during the storage period. For better jelly formation it is indicated that acetyl values should be less than 2% as described by Kertesz.[3] The results given in Table 1 indicate an occurrence of rapid decrease in acetyl contents during 90 days of storage while it showed a minor decrease after 180 days of storage. It is evident that period of storage significantly affected acctyl contents while the results of the treatments were nonsignificant.

Table 1.—Storage Effect on the Quality of Marc Prepared from Dehydrated Roselle Sepals.

Per cent	Blanching time (min)	Storage period (days) at room temperature 0	30	60	90	180
Yield	0	48.02	49.09	48.02	48.02	46.95
	2	53.02	53.02	56.20	55.14	53.02
	4	53.40	52.35	53.40	53.40	52.35
AUA	0	28.50	26.20	22.63	19.84	16.14
	2	28.36	27.33	24.67	20.33	17.09
	4	30.34	29.72	42.10	23.20	18.98
Esterification	0	44.61	44.10	42.10	37.85	30.93
	2	47.61	46.54	44.36	41.36	33.43
	4	52.57	54.19	48.94	43.63	34.33
Acetyl	0	00.70	00.57	00.69	00.51	00.46
	2	00.59	00.58	00.49	00.45	00.40
	4	00.58	00.58	00.46	00.46	00.37

All determinations are expressed on moisture-free basis.

Effect on Pectin Quality

The dried sepals under various steam blanching treatments were stored at room temperature. Pectin after various intervals was extracted and analysed physicochemically:

(a) *Pectin Recovery and Jelly Grade.*—Pectin recovery from the dehydrated sepals under various treatments has been shown in Fig. 1. During storage period of 180 days the yeild of pectin decreased very slightly. The treatments have been observed to be significant.

The producers are concerned with recovery of pectin as well as its jelly grade, the consumers are mainly concerned with the quality of pectin as determined by the jelly grade. The jelly grade of pectin extracted during storage from the sepals dehydrated under various treatments decreased considerably. The results in Fig. 2 show a gradual decrease in jelly grade during first 90 days of storage, while it decreased very rapidly under all treatments afterwards. The treatments and storage intervals have been observed to be significant factors.

The deterioration in jelly grade as well as the quality of pectic substances determined by percentage esterification and AUA content can be attributed to an increase in the room temperature during the storage as well as high moisture conent of dehydrated sepals. The loss in jelly grade under each treatment is in good correlation with the changes in percentage esterification and AUA contents of pectic substances in the marc (AIS). In order to ensure extended storage life, better means of dehydration processes, relatively low moisture content as well as controlled low temperature for storage of dehydrated materials are necessary.

(b) *Chemical Characteristics.*—Pectin extracted from roselle sepals dehydrated after steam blanching for various periods was chemically characterized after various intervals during storage period of 6 months. The results have been discussed in the following paragraphs:

(i) Acetyl: There has been no significant change during six months storage period in acetyl contents as shown in Table 2.

(ii) Esterification: The percentage esterification of pectin increased by blanching process while a considerable decrease has been observed during the storage period. The percentage esterification of pectin extracted from the material dehydrated after 4 min blanching has been observed to be 66.30% while during the storage period it decreased to 53.89%. From Fig. 3 it is also

observed that percentage esterification of pectin extracted from the materials under all the treatments decreased gradually during the storage. The final values were 53.89–50.91% after 6 months of storage under these treatments. The statistical analysis indicated highly significant differences in the values for storage.

(iii) Anhydrouronic Acid: The data illustrated in Fig. 4 indicate an increase in percentage AUA of pectin extracted from material dehydrated after steam blanching for different periods. The pectin from the material dehydrated without any treatment contained 52.30% AUA while the AUA contents increased to 54.4% in the pectin extracted from the material dehydrated after 4 min blanching.

A 20% decrease has been observed in the AUA contents of pectin extracted from the dehydrated sepals under all treatments after 6 months storage of roselle sepals at room temperature. A gradual decrease in the AUA content of pectin under all treatments during storage has been illustrated in Fig. 4. The statistical analysis of the data indicates highly significant values for treatments and intervals during storage.

(iv) Methoxyl Content: The methoxyl contents of pectin as calculated from percentage esterification under all the treatments during storage have been shown in Fig. 5. The methoxyl contents of pectin extracted from the material after dehydration under various treatments showed a slight increase during the blanching treatments. About 20% decrease in the methoxyl content of pectin occurred as observed after 6 months of storage of dehydrated roselle sepals. The data given in above figure indicate a gradual decrease in methoxyl content of pectin. Statistically analysed

TABLE 2.—STORAGE EFFECT ON ACETYL CONTENT OF PECTIN PREPARED FROM DEHYDRATED ROSELLE SEPALS.

Blanching time (min)	Per cent acetyl (moisture–free basis) Storage period (days) at room temperature				
	0	30	60	90	180
0	00.26	00.26	00.26	00.25	00.25
2	00.26	00.26	00.26	00.25	00.25
4	00.26	00.26	00.26	00.26	00.26

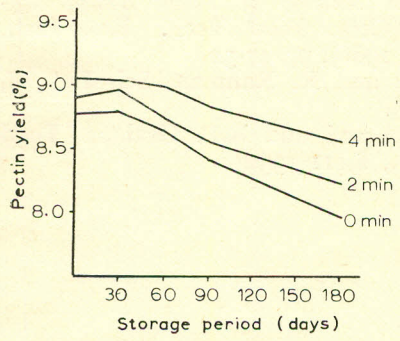

Fig. 1. — Storage effect on yield of pectin extracted from steam blanched dehydrated roselle sepals.

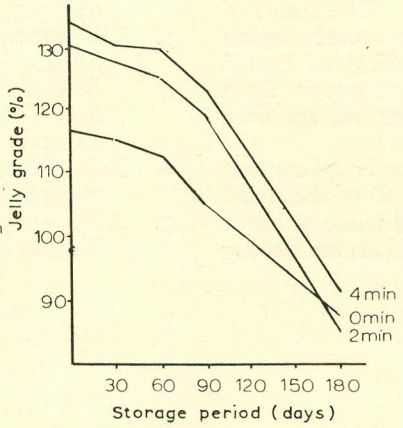

Fig. 2. — Storage effect on jelly grade of pectin extracted from steam blanched dehydrated roselle sepals.

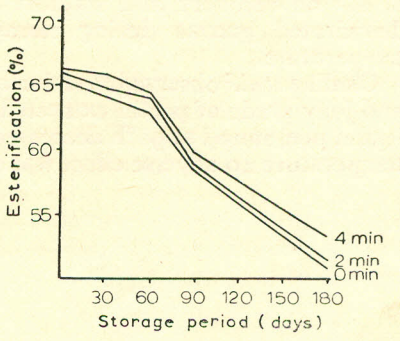

Fig. 3. — Storage effect on percentage esterification of pectin extracted from steam blanched dehydrated roselle sepals.

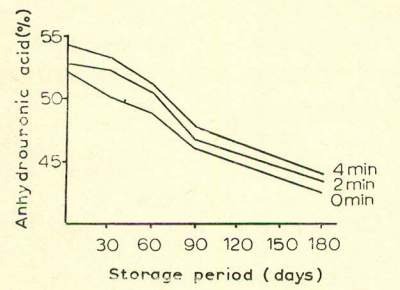

Fig. 4. — Storage effect on anhydrouronic acid content of pectin extracted from steam blanched dehydrated roselle sepals.

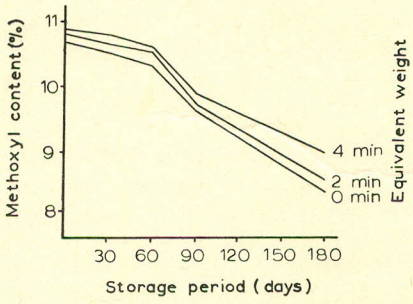

Fig. 5. — Storage effect on methoxyl content of pectin extrad ted from steam blanched dehydrated roselle sepals.

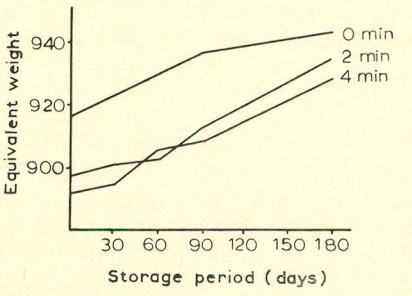

Fig. 6. — Storage effect on equivalent weight of pectin extracted from steam blanched dehydrated roselle sepals.

data showed significant differences in the value during various treatments and storage intervals.

(v) Equivalent Weight: The equivalent weights of pectin extracted from the sepals dehydrated after steam blanching during storage of 6 months have been given in Fig. 6. A considerable increase in these values has been observed. The statistical analyse of the data showed highly significant effect of treatments and storage intervals.

The decrease in percentage esterification, AUA content, and methoxyl content indicated a deterioration in pectin quality, during storage at room temperature of the dehydrated roselle sepals. The factors responsible for unstability of pectin in the dehydrated sepals seems to be high storage temperature, high moisture contents, as well as high acidity of the product. As fresh sepals were highly acidic. the degradation of pectin could be due to the hydrolysis by organic acid present in the sepals.

The chemical characterization of pectin has correlation with the jelly grade of pectin extracted from roselle sepals dehydrated by various treatments, illustrating the fact that as the percentage esterification and AUA contents of pectin decreased, the jelly grade also decreased. The trend of the results of present investigation on roselle sepals is quite in agreement with the findings of Pruthi *et al.*[5] on recovery and stability of pectin from dehydrated guavas during storage at ambient temperature.

Chaliha *et al.*[1] observed that the methoxyl content and jelly grade of pectin extracted from the dried lemon peel stored at 90°F decreased while at lower temperature no adverse effect was observed during a period of 6 months of storage. The AUA content in the dried lemon peel has been observed to be higher than the values in the present study of roselle sepals. The jelly grade in case of lemon peel and pomace during various storage intervals was also higher.

It is, therefore, necessary that a further study to establish conditions for dehydration, moisture content of dehydrated material, methods of extraction of pectin, storage of the dehydrated material, and packaging treatments should be made to obtain a pectin of good quality and high stability from the roselle sepals.

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