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A simple and rapid method for estimating the content of solids in industrialized cashew juice

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Abstract

A simple and rapid method based on the microcentrifugation of cashew juice samples was evaluated for its applicability to the estimation of the soluble, insoluble and total solids contents. The method consisted of the microcentrifugation for 5 min at 15,000 rpm of capillary tubes filled with a sample of juice. The percentage of solids was determined by the ratio of the lengths of the solid phase relative to the total sample. The values were correlated with the soluble, insoluble and total solids contents determined by a gravimetric method and the °Brix obtained by refractometry. The was good correlation between the results of the proposed method and standard assays ($R^2 \geqslant 0.94$). Appropriate equations were used to correct the values for the percentage of solids determined by the proposed method relative to those predicted for the soluble, insoluble and total solids contents of cashew juice. The average errors the estimation of the soluble solids content by the proposed method relative to the °Brix values and for gravimetry were 3.83 and 3.41%, respectively. For the determination of the insoluble and total solids contents, the average errors for the microcentrifugation method relative to the conventional gravimetric method were 3.48 and 3.07%, respectively. The microcentrifugation method provides an excellent alternative to conventional methods for estimation of the contents of soluble, insoluble and total solids.

Keywords: Solid content; Rapid method; Cashew juice

1. Introduction

Although cashew nuts are widely popular, use of the pseudofruit of the cashew tree (*Anacardium occidentale* L.), more commonly known as cashew apple or simply cashew, is still restricted to only a few countries (Cecchi & Rodrigues-Amaya, 1981).

In Brazil, cashews are used to make juice, candies, fruit candies in syrup, crystallised cashew, jam, cashew wine, and brandy (Telles, 1974).

Cashew juice is widely available on the domestic market, but its exportation is still limited. This juice, which is a complex mixture of vitamins, polyphenols, sugar, mineral salts, organic acids and amino acids, is an excellent source of vitamin C (average content of 261 mg/100 ml) since it contains approximately six times more vitamin C than orange juice (Soares & Maia, 1970).

Two types of cashew juice are commercialized, namely, clarified juice and juice which contains solids in suspension, the turbidity of which depends on the amount of solids present. Compared to clarified juice, juice with pulp in suspension retains larger quantities of substances (esters, aldehydes, etc.) associated with the smell and flavour of the pseudofruit (Marvaldi Garcia, 1966).

For this reason, juice with pulp in suspension is a better product to commercialize since it offers the consumer a product with a nicer flavour and colour.

After sometime on the shelf, the pulp of some cashew juices tends to sediment, it giving the product an unappealing appearance. The extent of sedimentation is determined by the amount of solids in suspension and the size of the particles. A knowledge of the concentration of solids present is needed in order to maintain the quality of industrialized cashew juice.

Currently in Brazil, determination of the soluble, insoluble and total solid content of fruit juice is done in

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research and quality control laboratories using precise but tedious methods. For this reason, simpler, cheaper and sufficiently precise methods of quality analysis are being sought.

Microcentrifugation method as an alternative to traditional methods was first used to estimate the lipid content of small quantities of animal milk (Ganguli, Smith & Hanson, 1969) and to determine the fat and energy content of human milk (Lucas, Gibbs, Lyster & Baum, 1978).

The use of microcentrifugation for estimating the lipid content of "in natura" or "pasteurized" cold milk has been shown to be satisfactory, with a correlation of $R^2 = 0.97$ when compared with the standard method of Gerber and a prediction error of less than 5% (Collares, Gonçalves & Ferreira, 1997; Gonçalves & Collares, 1999).

In this study, microcentrifugation was used to evaluate the soluble, insoluble and total solids content of industrialized cashew juice and the results compared it to the standard quality control method used adopted in industrial and research laboratories.

2. Material and methods

Fifty samples of whole cashew juice (Maguary®) or aqueous dilutions of 10, 20, 30, 40, 50, 60, 70, 80 and 90% were analyzed. Four determinations were done for each dilution and 10 for whole juice.

The micro method used consisted of filling capillaries tubes with previously homogenized sample at 20°C followed by sealing of the tubes with a Bunsen flame. The capillaries were than centrifuged (Centrimicro, Fanem, MOD211) for 5 min at 15,000 rpm, and the length of solid phase (SP) measured using a graded magnifying glass. The total quantity of sample (TQ) was measured with an electronic digital pachymeter (Starrett, CAT727). The percentage of solids was calculated using Eq. (1).

$$\% \text{ Solids} = \frac{\text{SP}}{\text{TQ}} \times 100 \tag{1}$$

The levels of solids in cashew juice samples estimated by Eq. (1) were correlated with the values of °Brix obtained by refractometry (Instituto Adolf Lutz, 1985) and with the soluble, insoluble and total solids contents obtained by a gravimetric method (Instituto de Tecnologia de Alimentos, 1984). The latter method involved the filtration of a sample dissolved in hot water. Insoluble solids were retained by the filter paper which was subsequently dried the filtrate, containing the soluble solids was evaporated prior to determining the weight of residual material. The total solids content was calculated as the sum of the percentages of the soluble and insoluble solids. The efficiency of the gravimetric method was improved by adding diatomaceous earth to the sample to increase the filtration.

Twelve replicates were done to estimate the solids contents by microcentrifugation while the soluble solids (refractometry) and the soluble, insoluble and total solids (gravimetry) were determined in duplicate.

In addition, 10 samples were analyzed to determine the precision of the proposed method for estimating the soluble, insoluble and total solids contents of cashew juice.

3. Results and discussion

Fig. 1 shows the relationship between the °Brix contents of cashew juice estimated by refractometry and the percentage of solids obtained by the microcentrifugation method. There was a good linear correlation ($R^2 = 0.97$) between the two methods.

Similarly, there was good correlation ($R^2 \geqslant 0.94$) between the solids contents determined by microcentrifugation and the percentages of soluble, insoluble and total solids obtained by gravimetry (Figs. 2–4, respectively).

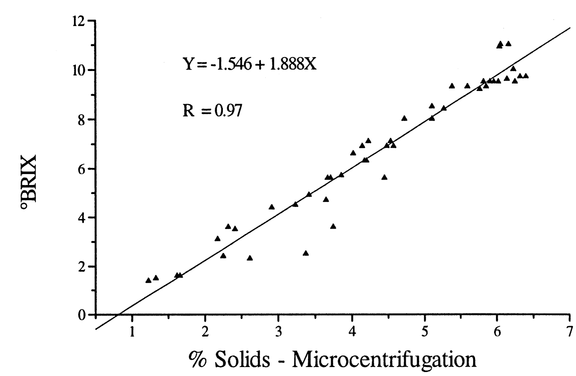

Fig. 1. Correlation between the soluble solids (Brix) contents obtained by refractometry and the percentage of soluble solids determined by microcentrifugation.

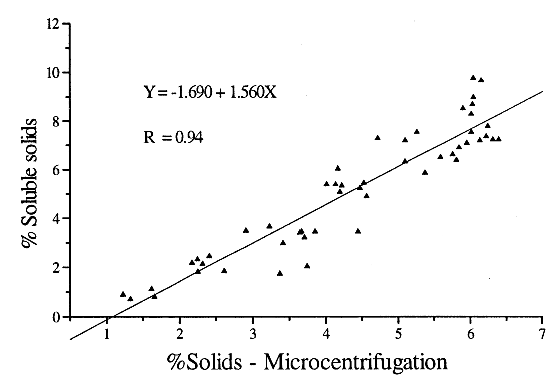

Fig. 2. Correlation between the soluble solids contents obtained by gravimetry and the percentages of solids estimates by microcentrifugation.

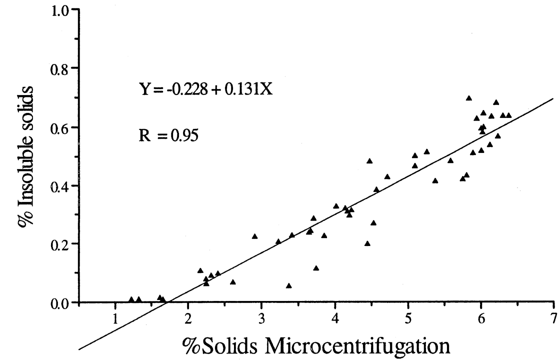

Fig. 3. Correlation between the insoluble solids contents determined by gravimetry and the solids contents obtained by microcentrifugation.

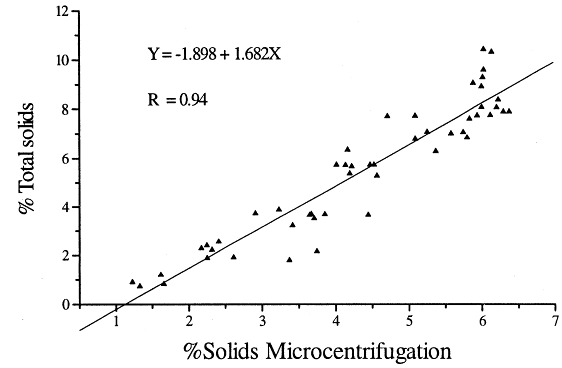

Fig. 4. Correlation between the totals solids contents obtained by gravimetry and the percentages of solids estimated by microcentrifugation.

Table 1
Prediction of cashew juice solids contents by the microcentrifugation method and the estimated error, compared to traditional techniques

A[a]	M[b]	Brix			Soluble solids (%)			Insoluble solids (%)			Total solids (%)		
	Value read	Corrected value[c]	Value obtained[d]	E^e (%)	Corrected value[c]	Value obtained[d]	E^e (%)	Corrected value[c]	Value obtained[d]	E^e (%)	Corrected value[c]	Value obtained[d]	E^e (%)
1	2.56	3.29	3.2	2.8	2.30	2.29	0.6	0.10	0.11	6.55	2.40	2.40	0.03
2	2.35	2.89	3.1	6.7	1.98	1.96	0.8	0.08	0.08	5.62	2.05	2.05	0.10
3	2.37	2.93	2.9	1.0	2.01	1.94	3.5	0.08	0.08	2.37	2.08	2.03	2.54
4	2.46	3.10	3.1	0.0	2.15	2.21	2.8	0.09	0.09	0.22	2.23	2.30	2.92
5	3.60	5.25	5.6	6.2	3.93	4.08	3.8	0.24	0.23	3.48	4.15	4.31	3.76
6	3.87	5.76	5.6	2.9	4.35	4.52	3.8	0.27	0.29	5.83	4.60	4.80	4.13
7	4.04	6.09	5.8	4.9	4.61	4.39	5.1	0.30	0.30	1.60	4.89	4.69	4.20
8	5.13	8.15	7.9	3.1	6.31	6.45	2.1	0.44	0.43	1.60	6.72	6.88	2.35
9	6.34	10.43	11.0	5.2	8.20	7.72	6.2	0.59	0.63	5.68	8.75	8.35	4.80
10	5.92	9.64	10.2	5.5	7.55	7.16	5.4	0.54	0.53	1.81	8.05	7.60	5.86
$E_{average}$ (%)			3.83 ± 2.23			3.41 ± 1.88			3.48 ± 2.26			3.07 ± 1.90	

[a] Number of samples.
[b] Results obtained by the micro method.
[c] Value of solids obtained by the micro method and corrected by the model equation.
[d] Value obtained by a traditional method.
[e] Calculated error between the value obtained with the proposed method and the traditional method.

In the prediction of cashew juice soluble solids contents using the microcentrifugation method (Table 1), the average errors relative to refractometry and gravimetry were 3.86 and 3.41%, respectively.

The average errors for the estimation of the insoluble and total solids contents using the proposed method relative to the gravimetric method, were 3.48 and 3.07%, respectively. Thus, the soluble, insoluble and total solids contents of cashew juice can be estimated by the proposed method to within the 95% confidence limits of standard methods.

The microcentrifugation method thus provides a simple, rapid and inexpensive technique convenient for industrial use in the processing and quality control of cashew juice.

Application of this method to estimation the solids contents of other types of fruit juice should be investigated individually, as should the possible factors that may influence the results obtained.

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