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A RAPID PROCEDURE FOR EXTRACTION OF NARINGIN FROM GRAPEFRUIT RIND

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INTRODUCTION

The extraction of naringin, the principal flavanoid of grapefruit rind, as described by Kesterson and Hendrickson (3), is a long procedure. A rapid Soxhlet extraction is described which saves considerable time in routine analyses. When extracts from the two procedures were compared, the percent of naringin extracted was almost identical. The Soxhlet extraction requires 3 hours, the other procedure, 20 hours. The Soxhlet extraction requires fewer steps and is thus less subject to error.

EXPERIMENTAL METHODS

Samples of grapefruit rind were removed with a cork borer; 40.0 grams were ground in a Waring Blendor with 100 ml of ethyl alcohol for 1 minute. The mixture was filtered, and filtrate and residue were each divided into two equal portions. To insure equal portions, the filtrate was made up to 200 ml before division; the residue was air dried to remove alcohol and was weighed into equal portions.

The two extraction procedures were compared in seven separate tests:

A—*Soxhlet extraction*. One portion of the residue was placed in an extraction thimble; one portion of the filtrate was placed in an extraction flask with 50 ml of ethyl alcohol, and the extraction was carried out for 3 hours. The filtrate in the flask was then made up to 250 ml and then diluted 1 to 100 for analysis.

B—*Kesterson-Hendrickson extraction*. The other portions of the filtrate and residue were combined and allowed to stand for 16 hours with

occasional stirring. The residue was further extracted for 2 hours with water containing calcium oxide and then with water heated to 95° C immediately and allowed to stand for 2 hours. The three filtrates were combined, made up to 500 ml, and diluted 1 to 50 for analysis.

The Davis (1) method of analysis depends upon the production of a yellow color on the addition of alkali in the presence of diethylene glycol. A Bausch and Lomb Spectronic 20 Spectrophotometer was used to measure color development. Although small amounts of materials other than naringin, which form a yellow color under these conditions (4), may be present, this method has been found suitable for routine assay of citrus flavanoids (2).

In each test, two aliquots of each diluted extract were taken, and measurements of color development were averaged.

RESULTS AND DISCUSSION

Separate analyses of extracts from each step in the Kesterson-Hendrickson procedure showed that about 72% of the naringin was extracted in the first extraction (alcohol); 18% in the second (water-calcium oxide); and 10% in the third extraction (water).

When extracts from the two procedures were compared, naringin contents were almost identical (Table 1). The slightly higher naringin content of the Soxhlet extract probably indicates more complete extraction. The Soxhlet extraction requires 3 hours, the other procedure, 20 hours. The Soxhlet extraction requires fewer steps and is thus less subject to error.

For routine analyses, samples of rind are weighed, ground for 1 minute in alcohol, transferred to a Soxhlet apparatus, and extracted for

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Table 1. Naringin in grapefruit rind

(Percent of fresh weight extracted by two methods)

Method of extraction	
<u>Soxhlet</u>	<u>Kesterson-Hendrickson</u>
%	%
0.93	0.88
0.92	0.90
0.89	0.89
1.05	1.00
0.87	0.83
0.88	0.82
0.90	0.84

3 hours; the filtrate is diluted and color developed and measured.

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EFFECT OF CALCIUM SALTS ON THE FIRMNESS OF CANNED GRAPEFRUIT SECTIONS^{1,2}

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INTRODUCTION

Canned grapefruit sections are one of the major grapefruit products processed in Florida. During the 1964-65 season, over 2.5 million boxes of seedy grapefruit were used in the production of canned grapefruit sections. Any improvement in quality, together with possible lower costs due to automatic peeling machines and mechanized sectioning and packing equipment, could result in greater consumer demand for this product.

Calcium salts have been used for a long time for firming certain food products. However, most of the literature concerning firming has been related to tomato products, such as described by Hanson (2) and Hall and Dennison (1). Other published reports, including that by Kertesz (3), showed the effect of calcium on the firmness of plant tissue. The only published report on the use of calcium salts to firm canned grapefruit sections is that by Singleton (5). He showed that calcium cyclamate would give favorable results depending upon the date of packing. As a result of this limited data, it was decided to investigate more fully the firming

ABSTRACT

A series of packs of canned grapefruit sections was prepared during four citrus seasons to determine the effect of added calcium salts on the firmness of the sections. The commercial syrup packs had 63% firm sections as compared to 86% when calcium lactate was added. Calcium chloride imparted a bitter flavor to sections and did not firm them as well as the calcium lactate. The dietetic packs containing water and calcium cyclamate had 40% firm sections and a better flavor than the pack with water only which contained only 27% firm sections. The addition of calcium lactate to the cyclamate pack increased the firm sections to over 50%.

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