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PRESERVATION OF CHERRIES WITH SULPHUR DIOXIDE*

by

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The cherry growing industry on the Pacific Coast is being maintained because of the progress and development of the brined cherry industry. For many years, low tariffs and cheap labor of foreign countries were instrumental in keeping the American growers and manufacturers from going into brining extensively enough to obtain a market for their cherries. Later a 9-1/2 cent per pound tariff placed on all imported, pitted cherries in brine improved the market for domestic stock.

In 1925, methods of brining cherries for use in Maraschino manufacturing were developed by Wiegand and Bullis ¹ and ² with the cooperation of The Dalles Cooperative Growers. These methods are now widely used and have been an important factor in developing the brined cherry industry of Oregon, Washington, and other states of the Union.

It is evident that the increase in tariff was instrumental in changing the trend of buying of brined cherries. From Table 1 it can be seen that cherry importations gradually declined after 1930, due to the increased tariff rate on pitted stock. While there are still some importations, the quantity has been materially reduced and is no longer a real factor in the industry.

Imports Decline

The present favorable market situation will continue only as long as our present tariff remains. Changes in the tariff legislation will not only upset our markets by bringing in cheaper products, but force our cherry growers out of business.

The accompanying table shows the trend of importations of cherries in brine. These figures have been obtained from the U. S. Tariff Commission, Washington, D. C., and picture the situation quite clearly.

* The original investigations covering this subject were carried on with the cooperation of the Agricultural Chemistry Department and The Dalles Cooperative Growers Association

1 Experiment Station Circular of Information No. 32

2 Oregon Agricultural Experiment Station Bulletin No. 275, D. E. Bullis and E. H. Wiegand

(These publications are now out-of-print).

Table 1
Cherries Imported into the United States
1929-30 to 1939

Year <u>a/</u>	Natural, sulphured, brined		Sulphured or in brine	
	Quantity (Pounds)	Value (Dollars)	Quantity (Pounds)	Value (Dollars)
1929-30	22,362,000	N R	<u>b/</u>	N R
1930-31	7,926,000	N R	<u>b/</u>	N R
1931-32	5,943,000	N R	<u>b/</u>	N R
1932-33	1,702,000	N R	<u>b/</u>	N R
1933-34	1,684,000	95,000	<u>b/</u>	N R
1934-35	1,492,000	130,000	<u>b/</u>	N R
1935-36	1,544,000	108,000	145,000 <u>c/</u>	14,000 <u>c/</u>
1936-37	902,000	63,000	159,000	15,000
1937-38	1,831,464	156,317	1,313,645	120,705
1938-39	1,107,359	91,135	421,074	37,232

a/ Year ended June 30
b/ Not separately classified
c/ January 1 to June 30
N R Not reported

Sources: United States Department of Agriculture, Agricultural Statistics, 1938. Foreign Crops and Markets, Dec. 2, 1935, Nov. 9, 1936, Monthly Summary Foreign Commerce of the United States, United States Department of Commerce.

Tabulated by Oregon State College Extension Service, Office of Economic Statistical Information.

CHERRIES

Table 2

Total Pack of Brined Cherries in California and the Northwest

YEAR	CALIFORNIA		NORTHWEST*	
	<u>Barrels Packed (250 lbs.)</u>	<u>Tons Barreled</u>	<u>Barrels Packed (250 lbs.)</u>	<u>Tons Barreled</u>
1925	8,000	1,000	7,400	925
1926	8,000	1,000	9,208	1,151
1927	8,000	1,000	10,560	1,320
1928	9,360	1,170	8,680	1,085
1929	10,576	1,322	9,280	1,160
1930	17,360	2,170	11,600	1,450
1931	27,960	3,495	18,176	2,272
1932	25,528	3,191	34,184	4,273
1933	40,000	5,000	55,888	6,986
1934	32,000	4,000	32,000	4,000
1935	40,000	5,000	47,133	5,900
1936	55,000	6,875	61,920	7,740
1937	46,136	5,767	71,865	8,893
1938	42,072	5,259	78,207	9,776

* Northwest figures cover Washington, Oregon and Idaho

CHERRIES

Table 3

Total Production* of Cherries in Far Western States, 1921-1938

Crop Year	States listed, total	Pacific Coast +	California	Pacific Northwest				Utah	
	1			2	3	Total	Oregon		Washington
	1	2	3	4	5	6	7	8	
				Tons					
1921	26,580	25,580	13,000	12,580	3,500	7,000	2,080	1,000	
1922	38,560	33,560	17,000	16,560	6,000	7,000	3,560	5,000	
1923	46,500	41,000	19,000	22,000	9,000	9,500	3,500	5,500	
1924	34,200	30,400	13,500	16,900	10,400	4,800	1,700	3,800	
1925	35,530	30,030	12,000	18,030	7,200	8,400	2,430	5,500	
1926	54,500	49,200	20,000	29,200	15,100	10,500	3,600	5,300	
1927	32,500	28,700	12,000	16,700	11,300	4,100	1,300	3,800	
1928	45,960	41,360	16,600	24,760	11,500	9,700	3,560	4,600	
1929	46,990*	43,790*	16,300	27,490*	9,000	15,500*	2,990	3,200	
1930	52,500*	48,800*	17,500	31,300*	12,600*	15,500*	3,200	3,700	
1931	47,300*	45,300*	23,000*	22,300*	9,000*	10,500*	2,800	2,000	
1932	55,780*	52,280*	18,500*	33,780*	14,000*	16,500*	3,280	3,500	
1933	64,940*	62,660*	25,300*	37,360*	16,000*	18,500*	2,860	2,280	
1934	53,320*	50,920*	17,000	33,920*	13,000*	18,000*	2,920	2,400	
1935	51,950*	49,750*	15,000	34,750*	15,800*	16,000*	2,950	2,200	
1936	61,890	58,490	23,000	35,490	15,600	18,000	1,890	3,400	
1937	52,600	50,500	21,600	28,900	13,800	13,500	1,600	2,100	
1938#	82,460*	78,190*	28,800*	49,390	21,400	25,500	2,490	4,270	

* Includes unharvested tonnage for California estimated as: 1931, 3,000 tons; 1932, 2,500 tons; 1933, 400 tons; and 1938, 4,800 tons; for Oregon: 1930, 400 tons; 1931, 2,000 tons; 1932, 2,000 tons; 1933, 700 tons; 1934, 1,000 tons; 1935, 800 tons; for Washington: 1929, 2,000 tons; 1930, 1,500 tons; 1931, 2,500 tons; 1932, 4,000 tons; 1933, 2,500 tons; 1934, 2,500 tons; and 1935, 1,000 tons.

+ Pacific Coast includes California, Oregon, Washington and Idaho.

Preliminary estimates.

Sources of data:

Compiled by S. W. Shear, Giannini Foundation of Agricultural Economics, University of California. 1921-1935: From U. S. Dept. Agr. Bur. Agr. Econ., Revised Production of Apples, Peaches, Pears, Grapes, and Cherries, 1919-1935. (Mimeo). June 28, 1937, except 1921-1923: California, Oregon, Washington, and Utah are estimates by S. W. Shear. 1936-1938: United States and California Crop Reports.

As the cherries produced in the Pacific Northwest are much the same as the European, they offer the manufacturer a product which will meet his manufacturing requirements. It has been said, however, that our cherry is not as small and the grower can not supply a sufficient quantity of the smaller sizes. That may be true, but the quality offered in this western stock is far superior, and the sizes offered by the packer can be adapted to the trade if the manufacturer is interested. This has been shown in recent years by the tremendous business done by our western briners.

Trade Requirements

The preserving trade requirements for the various sized cherries range from the dipping sizes of 10 to 14 millimeters diameter to the large sizes of 22 to 26 millimeters diameter. They are roughly divided into 10-14 mm., 14-18 mm., 18-22 mm., and 22-26 mm.

Federal grade standards for the purchase of cherries have been developed and are now in use. Inspection and sale are based on these standards. The grade standards formerly used were promulgated by the Oregon State Inspection Department, but through the co-operation of the packers, these were changed and Federal grades were adopted and are now in force. These are listed below and constitute the basis for sale of products of this type throughout the United States.

OREGON AND UNITED STATES DEPARTMENT OF AGRICULTURE STANDARDS FOR UNPITTED SULPHURED CHERRIES

These grades are approved by the United States Department of Agriculture as standard federal grades for sulphured cherries.

Definition

Sulphured cherries are prepared from properly ripened, stemmed or unstemmed, pitted or unpitted, cherries packed in a solution containing sulphur dioxide of sufficient strength to preserve the product, with or without the addition of benzoate of soda and/or hardening agents.

These standards for grades are so framed as to exclude substances not mentioned in the text, imply that the product is sound and in compliance with the requirements of all applicable federal and state food and drug laws and the regulations thereunder.

Types of Sulphured Cherries

There are two types of sulphured cherries:

UNPITTED sulphured cherries are sulphured cherries packed whole with or without stems.

PITTED sulphured cherries are sulphured cherries from which the pits and stems have been removed.

Grades

U. S. No. 1 shall consist of properly matured cherries of similar varietal characteristics that are clean, firm, and are well bleached to a light straw color, and if declared to be graded for size, conform to the size claimed for the cherries. The cherries shall be free from damage, caused by rain cracks, solution checks, solution cracks or pockets, bird pecks, limb rubs, hail marks, sunburn, surface discoloration, doubles, insect or mechanical injuries or other means.

In order to allow for variations incident to proper preparation, grading and handling, not more than 10 per cent by weight of any lot may be below the requirements of this grade.

U. S. No. 2 shall consist of properly matured cherries of similar varietal characteristics that are clean, fairly firm, and bleached to a light straw color. The cherries shall be free from serious damage caused by rain cracks, solution checks, solution cracks or pockets, bird pecks, limb rubs, hail marks, sunburn, surface discoloration, doubles, insect or mechanical injuries, or other means.

In order to allow for variations incident to proper preparation, grading and handling, not more than 10 per cent by weight of any lot may be below the requirements of this grade.

SAMPLE grade shall consist of cherries which fail to meet the requirements of the above grades.

Explanation of Terms

"Properly matured" means that stage of ripeness in which the fruit is fully developed, but is firm and not overripe.

"Clean" means that the product is practically free from leaves, fruit spurs, bark, twigs, dirt, or foreign material.

"Firm" means not overripe, soft or shriveled.

"Damage" means any injury or defect which materially affects the appearance or market quality of the product. The following shall be considered "damage":

- (a) Rain cracks exceeding 1/4-inch in length.
- (b) Solution checks which materially affect the appearance of the cherry.
- (c) Solution checks or pockets of such size as may cause the cherry to become torn more than one-fourth of the distance from the stem end to the apex during the process of proper pitting. The seriousness of a solution check or pocket is usually determined by its size, its proximity to the stem end, and whether or not it is translucent in appearance.
- (d) Over two slight hail marks, or hail marks affecting a total area exceeding that of a circle 1/8-inch in diameter.
- (e) Surface discoloration which is light in color and affects more than 15 per cent of the surface in the aggregate, or any dark discoloration which affects the appearance of the

cherry to a greater extent than the 15 per cent of light discoloration permitted.

"Serious damage" means any injury which seriously affects the appearance or market quality of the product. The following shall be considered "serious damage":

- (a) Rain cracks over 1/2-inch in length.
- (b) Solution checks which seriously affect the appearance of the cherry.
- (c) Solution cracks or pockets of such size as may cause the cherry to become torn more than one-half of the distance from the stem end to the apex.
- (d) Surface discoloration which is light in color and affects more than 75 per cent of the surface in the aggregate, or any dark discoloration which affects the appearance of the cherry to a greater extent than the 75 per cent of light discoloration permitted.

The following sizes shall be considered as standard for these grades:

Small	14 to 18 mm.
Medium	18 to 22 mm.
Large	22 mm. and larger

STANDARDS FOR PITTED SULPHURED CHERRIES

Definition

Sulphured cherries are prepared from properly ripened, stemmed or unstemmed, pitted or unpitted, cherries packed in a solution containing sulphur dioxide of sufficient strength to preserve the product, with or without the addition of benzoate of soda and/or hardening agents.

These standards for grades are so framed as to exclude substances not mentioned in the text, imply that the product is sound and in compliance with the requirements of all applicable federal and state food and drug laws and the regulations thereunder.

Types of Sulphured Cherries

There are two types of sulphured cherries:

PITTED sulphured cherries are sulphured cherries from which the pits and stems have been removed.

UNPITTED sulphured cherries are sulphured cherries packed whole with or without stems.

Grades

U. S. No. 1 shall consist of properly matured cherries of similar varietal characteristics that are clean, firm, well formed, and are well bleached to a light

straw color, and if declared to be graded for size, conform to the size claimed for the cherries. The cherries shall be free from damage caused by rain cracks, pitting cracks, bird pecks, limb rubs, hail marks, sunburn, surface discoloration, doubles, insect or mechanical injuries or other means.

In order to allow for variations incident to proper preparation, grading and handling, not more than 10 per cent by weight of any lot may be below the requirements of this grade.

U. S. No. 2 shall consist of properly matured cherries of similar varietal characteristics that are clean, fairly firm, fairly well formed, and bleached to a light straw color. The cherries shall be free from serious damage caused by rain cracks, bird pecks, limb rubs, hail marks, sunburn, surface discoloration, doubles, insects or mechanical injuries, or other means.

In order to allow for variations incident to proper preparation, grading and handling, not more than 10 per cent by weight of any lot may be below the requirements of this grade.

SAMPLE GRADE shall consist of cherries which fail to meet the requirements of the above grades.

Machine Pitted Cherries

MACHINE PITTED cherries will be graded on the above grades, but the certificates of grade will carry, in addition to the usual grade statement, the following statement: "Machine Pitted Cherries."

Explanation of Terms

"Pitted" means that unpitted cherries shall not be found in pitted cherries in excess of one pit per each 10 ounces of cherries.

"Properly matured" means that stage of ripeness in which the fruit is fully developed, but is firm and not overripe.

"Clean" means that the product is practically free from stems, leaves, fruit spurs, bark, twigs, dirt, or foreign material.

"Firm" means not overripe, soft or shriveled.

"Damage" means any injury or defect which materially affects the appearance or market quality of the product. The following shall be considered "damage":

- (a) Rain cracks exceeding 1/4-inch in length.
- (b) Pitting cracks or tears, which may be not longer than one-third of the distance from the stem end to the apex, measured on the circumference.
- (c) Over two slight hail marks, or hail marks affecting a total area exceeding that of a circle 1/8-inch in diameter.
- (d) Surface discoloration which is light in color and affects more than 15 per cent of the surface in the aggregate, or any dark discoloration which affects the appearance of the cherry to a greater extent than the 15 per cent of light discoloration permitted.

"Serious damage" means any injury which seriously affects the appearance or market quality of the product. The following shall be considered "serious damage":

- (a) Rain cracks over 1/2-inch in length.
- (b) Pitting cracks or tears which are longer than one-half of the distance from the stem end to the apex, measured on the circumference.
- (c) Surface discoloration which is light in color and affects more than 75 per cent of the surface in the aggregate, or any dark discoloration which affects the appearance of the cherry to a greater extent than the 75 per cent of light discoloration permitted.

The following sizes shall be considered as standard for these grades:

Approximate

Small	14 to 18 mm. (21/32 to 23/32-in.)
Medium	18 to 22 mm. (23/32 to 25/32-in.)
Large	22 mm. and larger (over 25/32-in.)

Harvesting Important

While it is possible to brine cherries at almost any stage of ripeness, the fact still remains that best quality is obtained at only certain stages of maturity. If the fruit is harvested too early, it will tend to be tough and have more seed in proportion to the amount of flesh. If harvested when too ripe, there will be a tendency toward blemishes which reduces the amount of fruit suitable for U. S. No. 1 grade. Optimum maturity of the Royal Anne cherry lies within those stages of ripeness when the soluble solids of the fruit range between 16 and 20 degrees Balling. If harvesting is confined to this stage, it will be found that a greater percentage of the fruit will be available for the upper grades.

Care should be used in picking to obtain the fruit free from blemishes through bruising. Often in rough handling at the orchard, and delayed barreling, brown spots will tend to develop. These are more or less permanent and care should be exercised to see that these do not occur. Speed of handling and proper filling of the containers will minimize crushing, bruising and oxidization.

Processing Operations

Usually there is a centralized barreling place established. This is arranged so that solutions can be made up easily. Proper facilities are provided for filling and handling of the stock. As sorting is not necessary as a preliminary step, the fruit can be filled directly into 52 gallon paraffin-lined fir barrels. The filling weight should not exceed 250 pounds of fruit. It is characteristic for this fruit to expand when covered with bleach solution in the barrel. Increase in filling weight above that recommended will tend to injure cherries by expansion. It has likewise been found that by increasing the in-going weight of cherries the final shrinkage of the fruit will exceed that usually obtained by packing in the manner recommended above.

Proper Solution for Brining

For bleaching cherries, there are many strengths of solutions that might be used. However, we have found by extensive experimentation that the following are suitable for brining cherries:

Sulphur Dioxide (SO ₂) Solution	Hydrated Lime or Calcium Carbonate
1 %	5 lbs. per 100 gallons
1-1/4 %	6-1/4 lbs. per 100 gallons
1-1/2 %	7-1/2 lbs. per 100 gallons

A solution with 1-1/2 per cent sulphur dioxide and 7-1/2 pounds of hydrated lime will be found satisfactory, although weaker solutions are just as effective and are used more extensively. The use of whiting (calcium carbonate) instead of hydrated lime (calcium hydroxide) is recommended because of its ease of handling and the possibilities of obtaining a pure product. Calcium carbonate can be purchased in the form of whiting from most plaster supply houses. A pure product should be purchased; hydrated lime should contain at least 98 to 99 per cent calcium hydrate, and whiting, practically 100 per cent calcium carbonate.

When purchasing whiting the fineness as well as the calcium carbonate content is important. Coarser grades contain the most impurities; however, an excess of calcium carbonate is not nearly as dangerous in a solution as an excess of hydrated lime because it does not give an alkaline reaction.

Hydrated lime should be fresh so air slaking will not have taken place. Check on the purity and the content of hydrate and magnesium it contains.

Cracking and Water Pockets

Cracking of the fruit during the first stages of brining indicates first that the sulfurous acid is too strong for the tissue; and second that the lime content is too low. When cracking is noticed soon after barreling, it is wise to increase the lime content of the solution. Do this carefully, however, using not over one-fourth pound of lime per 100 gallons of solution, if this is not sufficient, slight additions can be made. This increase in lime will often reduce water pocketing and varying the quantity of lime in solution is recommended as a means of stopping this condition.

Care in all operations of brining are necessary. The haphazard use of lime will bring trouble. Always keep in mind that there must be a quantity of free sulphurous acid, otherwise the product will spoil. Tying up all the sulphurous acid with lime should, by all means, be avoided. Slow bleaching is an indication of low sulphur dioxide content. Watch the barrels constantly for a few days following brining.

Equipment for Making Standard Solutions

Use large tanks holding 500 to 1,000 gallons each for storage of the sulphur dioxide solution. These tanks can be fitted with coils of brass or lead tubing perforated every eighteen inches with holes one-sixteenth to one-thirty-second inch in diameter. The coils are placed at the bottom of the tanks and are

a means of conducting the gas into the water for making up standardized solutions. Floating wood lids are desirable, as they tend to keep the bubbles from breaking on the surface. Gas is obtained in a liquefied form in large cylinders; these are placed on a scale so the loss in weight can be measured after being connected to the coil. In this way it is possible to prevent over-stepping the strength desired. (CARE SHOULD BE TAKEN TO SEE THAT NO IRON COMES IN CONTACT WITH THE SOLUTION, AS IT WILL CAUSE DISCOLORATION TO APPEAR IN THE CHERRIES DURING PROCESSING).

Barrels packed with 240-250 pounds of fruit require approximately 25 gallons of sulphurous acid solution to fill the container properly.

Testing the Bleach Solution

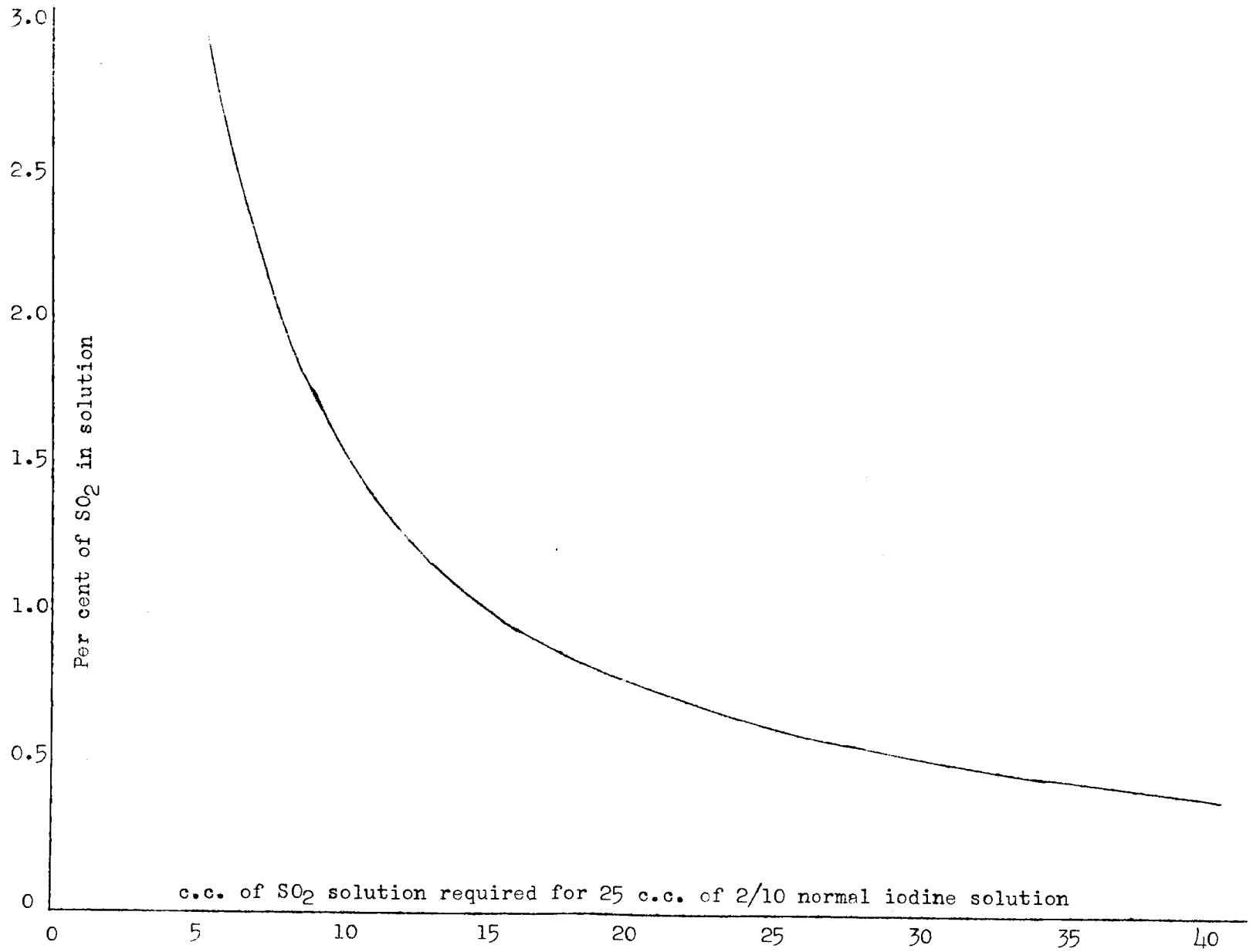
While it is true that the approximate percentage strength can be determined by weight, yet for final strength it is necessary that the end point be accurate. To determine when this is reached, the iodine test method is necessary.

Take a 500-cc. Erlenmeyer flask or a 1 pint milk bottle and fill one-fourth to one-half distilled water, then fill a 25-cc. pipette by suction with standard iodine solution (.2 normal) to slightly above the mark. Quickly place the fingertip over the pipette stem before the liquid drops to the line; then by raising the finger, slightly, allow the iodine solution to drop slowly to the point where the bottom or curved liquid surface is just even with the mark. Now transfer the pipette to the Erlenmeyer flask and allow the iodine to drain into it. As soon as the iodine has run down, touch the tip of the pipette to the side of the flask to remove the drop on the tip.

Next, prepare a starch solution which can be made up by adding to one-half pint of cold water as much corn starch as can be heaped on a dime. Place on a hot plate or stove and heat to boiling with constant stirring to prevent lumping of the starch. This solution may be kept in a bottle but should be made fresh every few days, as it may mold and become unfit for use.

When the above is prepared, add one-half teaspoon of the solution to the iodine. Next fill a 10-cc. measuring pipette with the bleach solution and bring the level of the liquid to the zero mark. Then allow the bleaching solution to run slowly from the pipette into the flask containing the iodine solution. Mix the two liquids by a rotating motion. As the reaction nears completion, the color of the iodine solution becomes purple. At this point, add the bleaching solution very slowly and at the point where one drop dispels the color from the iodine solution, place the finger tip tightly on the stem to stop the flow. Read the volume used. (CAUTION: Always read to bottom of the curved surface of the solution in the pipette.)

Now, refer to the chart to obtain the strength of the bleach solution. Move your pencil point to the right from the zero on the base line of the chart until the number of cubic centimeters (cc) of bleach solution used in the test is reached. Then move upward from the bottom of the chart until the curve is met. From this point of intersection, move the pencil point horizontally to the left edge of the chart; then read the strength of the bleach solution from the vertical reference line at the left edge of the chart.



Method of Mixing

When the sulphur dioxide solution has been made up and tested, add the hydrated lime or calcium carbonate in the amount indicated in the table. This can be done in a separate tank so that the original tank can be kept clean. Keep the solution well mixed when filling into the barrels.

Fill the fruit into the barrels by weight. The head is usually removed for this purpose. After filling, replace the head and fill the barrel through the bung with the prepared liquid. The barrel is then stored on its side for further observation and care. The only additional attention the barrels need have is to roll them once or twice and fill up the barrel after standing. The slight amount of absorption of liquid by the fruit should be replaced. Keeping the barrel full will keep the fruit under the solution and assist bleaching and preserving.

Firms Supplying Materials for Brining

Barrels:

Western Cooperage Company
American Bank Building
Portland, Oregon

North Western Wooden Ware Company
Tacoma, Washington

Sulphur Dioxide:

Van Waters and Rogers
646 North Thompson
Portland, Oregon

Virginia Smelting Company
West Norfolk, Virginia
551 Sherlock Building
Portland, Oregon

Calcium Carbonate and Hydrated Lime:

Miller Products Company
Foot of S. W. Lincoln
Portland, Oregon

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