1936

Crushed fruits and syrups

William Fenton Robertson

University of Massachusetts Amherst

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CRUSHED FRUITS AND SYRUPS

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CRUSHED FRUITS AND SYRUPS

William Fenton Robertson

Thesis submitted for
the degree of
Master of Science

Massachusetts State College, Amherst
June 1, 1936
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I. INTRODUCTION

Ten years of experience in the crushed fruits and syrups field have given the author an opportunity to visit many plants engaged in the business, throughout a large part of the United States. Lack of specific information relative to many of the products has made it necessary to do much experimental work. This work consisted of gathering together innumerable formulas, testing out the products on a factory scale, and determining the sales value of the finished goods. Because experimental work, technical development and research are extremely expensive, manufacturers are prone to continue as they are rather than change. In practically every case in the development of new products, new procedures and new materials, the manufacturer has been forced into the development by pressure from the retail trade. The results of this experience are presented in this thesis in order that there might be a record for those who wish to develop and expand this field scientifically. This record is in the language of the trade, because there is no other way to put over the true simplicity of this material and yet show in some way the difficulties and limitation of the present knowledge.
II. GENERAL DISCUSSION OF PRODUCTS, TYPES AND TERMS AS USED IN THE TRADE.

The crushed fruit and syrup trade throughout the United States has a general language of its own, and in order that interested parties might gather full benefit from any discourse on this subject, it will be necessary to use that language, and to give explanations where they are necessary to make the text clear.

The term "crushed fruits and syrups" is used hit or miss and may be found to mean different things in different localities. Through parts of the middle west this term will include everything used to make sundaes and sodas at a fountain, whereas, in the South the common expression is "crushed fruits, syrups and sauces." Here in the Eastern United States, in general, "crushed fruit" refers to all products put up in wide-mouthed jars for soda fountain use. Thus the following are accepted as crushed fruits:

<table>
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| Fudges |

It is obvious that some of the above listed products have no connection with fruits but come under one heading by common usage.
The term "syrups" throughout the country generally is applied to all products that are commonly marketed in narrow necked bottles or jugs and that will flow readily, such as, all fruit syrups, chocolate and cocoa syrup, and all flavored syrups such as coffee, vanilla, etc.

There are a few, perhaps twelve to fifteen, large manufacturers of crushed fruits and syrups, and thousands of small ones. The competition in this field is very great, and prices are now such that manufacturers must be efficient and careful in order to succeed, whereas, but a few years ago a wide margin gave a large profit to those thus engaged. The present situation has been developed by the customary method of secret formulae manufacturing. Each company has a formula book kept carefully under lock and key and accessible only to the foreman and "coster". In this book has been transcribed all the formulae ever used and all that could be gathered from hither and yon. As a general rule, the books are well thumbed and contain much obsolete as well as borrowed and stolen information. No cost was considered too great nor any means too low to gather a competitor's information. Many of these books have been written in a code of the writer supposedly not legible to anyone else. For instance, sodium benzoate
might be written as B/S, Benz, Soda, Benny, Keeper, or in many other different ways. In spite of all this secrecy each house claims to employ at least one man capable of duplicating any other manufacturer's goods in a day or two, so that much of the secrecy relative to formulas and manufacturing methods is absurd.

There is a standard list of products that might be copied from any price list and runs very close to the following, this being a composite of seven of the country's best manufacturers:

<table>
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The above lists of products are those to be generally considered and do not include the so-called specials. Every manufacturer puts out one or more
"specials" which he considers himself exceptionally qualified or situated to produce, and lists them as such.

Pure Products

According to law and general acceptance, "pure" products are those made of pure fruits without extracts or fillers, fillers being considered as excessive sugar, pectin, Japanese Gelatin (Agar), inferior fruits, cocoa for chocolate and corn syrup.

Pure Flavored Products

"Pure flavored products," according to law and general use, are those products made up in almost any fashion but which derive their flavor from the same materials as pure products. These flavored products contain such materials as true fruit extracts; the various essential oils such as orange, lemon and lime; and cocoa and other products which may contain pure juices or flavors but in small quantities, that is, less than the required thirty-three and one third per cent.

Imitation Products

This classification is given to any product made up without the use of fruit or fruit juice, or which contains imitation flavors rather than true flavors.
Types of Products

Fountain products regardless of purity may be readily divided into a few types, i.e., crushed fruits, fruit syrups, sauces, flavored syrups and toppings.

Terms Used in Fountain Supply Trade and Their Explanation

There is a special trade vocabulary of terms which might lead to considerable confusion if not explained. Some terms are defined below:

Fruit generally refers to fresh fruit, canned fruit drained, the solid material from cold pack or frozen fruit, raisins, citron or dried fruit.

Syrup means any sugar and juice of liquid nature above 12 degrees Beaumé.

Juice refers to any fruit juice or syrup under 12 degrees Beaumé.

Sugar is considered to be fruit fine granulated sugar.

Benzoate usually signifies a solution made by dissolving two pounds of sodium benzoate in water and making it up to one gallon with water. Sometimes it may mean dry sodium benzoate.
Keeper, benz., soda, benny are synonymous terms for benzoate of soda, either as a liquid or dry.

Rock Candy syrup designates a syrup composed of pure sugar and water, often benzoated, but always of 36 degree Beaumé, most frequently made up cold.

Simple syrup means a syrup composed of pure sugar and water, often benzoated, but of the same Beaumé as is the general factory practise. It is usually made up hot. Some plants have all syrups 34 degrees Beaumé, some 35 degrees Beaumé and some still use 36 degrees Beaumé.

Seven Pound syrup is a syrup composed of seven pounds of sugar and water to make a gallon.

Fruit acid usually refers to a solution made by dissolving three pounds of citric acid in water and making up to a gallon.

Glass while usually meaning a thermometer may often refer to a Beaumé hydrometer and the term is sometimes used for both in the same plant.

Egg is usually prime hen egg albumen dissolved in water in the amount of four pounds to a gallon. Sometimes it means fresh egg whites.

Yolks refers to fresh egg yolks.

G. F. X. is used to designate a genuine fruit extract.
Cut is used to designate the amount of simple syrup that may be added to one part of concentrated syrup or crushed fruit. Generally syrups are cut three to one and fruits one to one.

Sulfured refers to materials preserved with sulfur dioxide.

Shelf life is the length of time goods may be expected to keep in good marketable condition in a jobber's warehouse or on a retailer's shelf.

Alcohol means pure distilled 95 per cent C₂H₅OH.

Ade is the term commonly used to designate a single strength syrup and is usually simply a concentrated syrup cut with simple syrup and containing added color, acid and flavor.

The term "X" used with reference to extracts usually means "times legal strength". Thus a legal vanilla has 13.6 ounces vanilla bean extractives in one gallon of 50 per cent alcohol, and a 10X extract would have extractives from 136 ounces of vanilla beans in one gallon of 50 per cent alcohol.

Frozen fruits are classified as one-plus-one, two-plus-one, three-plus-one, four-plus-one, and straight. Straight means fruit frozen without sugar; one-plus-one means one pound of fruit mixed with one pound of sugar
and then frozen; two-plus-one means two pounds of fruit to one pound of sugar; three-plus-one means three pounds of fruit to one pound of sugar; and four-plus-one means four pounds of fruit to one pound of sugar and frozen.

Kettle refers to a copper, tin lined, steam jacketed kettle.

Lead is a product manufactured to develop more business and may actually be sold for less than cost.

III. DISCUSSION OF MATERIALS AND SOURCE OF SUPPLY.

The materials used in the manufacture of a simple line of crushed fruits and syrups come from all parts of the world. A great effort is made to furnish the manufacturer with any grade of product he wishes, and this supplies business for a whole list of brokers.

A knowledge of the more common materials used, their sources and relative merits, is essential to the production of these products whether the objective is quality or price.

1. FRUITS.

There are comparatively few fruits used in the soda fountain crushed fruit and syrup trade, and these come from comparatively few localities. In general, it might be said that there is one best source for each material and one or more other sources of different grades which are usually sold at a lesser price. The secondary
sources are used to lower the price without regard for quality.

Cherries. All cherries used are of the so-called "Maraschino" type, red or green. Perhaps the best of these are from Oregon and New York State. The Royal Ann cherry properly picked, packed in barrels, sulfured, and later washed, colored and flavored, is the best. Other cherries come from all sections of the country where cherries are grown and are not classified as to variety. These are generally less uniform in size and shape and contain a softer pulp. In processing, the soft pulp has a tendency to wash out and cause the skin to shrivel and the cherries to lose weight.

Pineapple. The best pineapple, of the highest color, best flavor, most uniform size and quality, and free from eyes and specks, comes from Hawaii in No. 10 tins packed in its own juice. A secondary source is the West Indies. West Indian pineapple is a dull greyish color and has a tendency to darken during processing or during storage in jars.

Raspberries. All good raspberry fruit products are made from West Coast straight Cuthbert raspberries which have a bright red color and a clear cut raspberry
A smaller number of Columbians and Blacks are used. The Columbian is a purple raspberry with a tendency to develop an acid or loganberry flavor on aging. Black raspberries are generally used for their tremendous color-strength and flavor-tone, which is better than the plain cooked Cuthbert flavor.

Strawberries. The best source of strawberries is, like raspberries, the west coast. Marshall is probably the leading variety, and graded two-plus-one West Coast Marshalls set the price for all other strawberries. Through the early part of the season three-plus-one fruit may be safely used but as the season advances the two-plus-one berry gives a better product with more whole fruit. Frozen strawberries packed in sugar, whole or sliced, come from the South, around Norfolk, Virginia and Baltimore, Maryland. The leading variety from this source is the Blakemore. This berry has a tendency to a more pronounced seed and a duller color turning to brownish as its shelf life lengthens. The flavor of these berries is neither as strong nor as pleasing as the West Coast Marshall. Some cold pack strawberries also come from the Southern states, such as Florida and Louisiana, and some from the South-west. These are primarily used when a shortage occurs in the other regions.
2. SYRUPS AND JUICES.

The various juices that are manufactured into syrups are, to a great measure, of undetermined origin. There is quite a list of these and all are pure, heat extracted juices, pressed from the fruit and canned in five gallon cans, or made as a by-product of some other process.

Cherry. Practically no cherry juice is used.

Grape. The common grape juice, such as that prepared for the beverage trade, is generally used in pure syrups. Imitations are sometimes made from a heat extracted juice from dried grape skins.

Lemon. Some plants still buy fresh lemons and extract the juice fresh for each batch, but many manufacturers are turning to pure frozen lemon juice from Florida or California. There is little choice between the two sources.

Orange. The same as lemon.

Pineapple. The pineapple juice used in making pineapple syrup is a waste product from the manufacture of crushed pineapple or, as it is often called, pineapple fruit. Most companies have this juice in such excessive quantities that the greater proportion of it is thrown away.
Raspberry, red. Raspberry juice is partly the excess juice taken from raspberries used in making crushed raspberries but by far the greater proportion is purchased as such. Most of this purchased juice is heat extracted from ripe fruit, where it is grown, and sterilized in five gallon cans. The west coast and "up-state" New York are the two principal good sources.

Raspberry, black. The principal source of this juice is a hot extraction from straight frozen black raspberries or three-plus-one frozen fruit.

Strawberry. Whenever whole strawberries, whole and broken strawberries, or crushed strawberries are made, frozen two-plus-one or three-plus-one fruit is used, and the fruit kept separate from the juice. Under normal conditions a barrel of two-plus-one fruit contains from sixteen to twenty gallons of fruit and the remainder is juice. In making any of the above fruit products, three to five gallons of this juice are used with the berries and the remainder is used to make strawberry syrup or in other products. As strawberries are considered a leading product there is always an excess of this juice or syrup, and it is of good color and flavor. The concentration is about 21 degrees Beaumé.
3. COLORS.

All coloring material used is of the certified coal tar dye type. There are four companies in the United States that manufacture certified coal tar dyes for use in foods. These firms supply essentially the same primary government certified colors at approximately the same price. Each house has certain blends that are highly desirable for certain products. One can duplicate any given color by using a combination of these certified dyes.

4. FLAVORS.

Every company manufacturing extracts and oils, makes true as well as imitation fruit flavors, and no one company can be considered best in every item. One firm makes the best raspberry, another the best strawberry and a third, by far, the best peach, and so on through the entire list of flavors.

5. OTHER INGREDIENTS.

The principal other ingredients are sugar, citric acid, benzoate of soda, essential oils, pectin, corn syrup, corn sugar, gums, cocoa, chocolate, egg albumen and various chemicals.

The present uniform purity of these products and the standardization of manufacturing and sales methods makes them of equal value from any source. The
types used will of necessity be determined by individual choice of the manufacturer or demand of the customer to produce or maintain desired standards.

IV. MANUFACTURING PROCEDURE AND GENERAL AND SPECIFIC FORMULAS.

The history of soda fountain products, the sales propaganda, and the taste or flavor of the various types of the same product lead to the conclusion that there are many ways to make each product, and that a retail dispenser must do considerable shopping about to procure for himself a line that will receive customer acceptance to such a degree as to continually increase his sales. This is not the case, however, and any merchant may buy according to the price he feels he wishes to pay, and the good, the bad, and the indifferent may all be made by one manufacturer and sold at different price levels.

All fountain products, then, may be divided into three classes and a general formula for each class will cover the entire list if enough variations are used.

1. Fruits, crushed fruits, or fruit sauces.
2. Fruit syrups.
3. Flavored syrups.

Under the classification of fruits or crushed fruits come such products as fruit salad, fruit sundaes,
crushed peaches, crushed pineapple, orange pineapple, mint pineapple, crushed raspberries, crushed strawberries, whole strawberries, and whole and broken strawberries. All can be developed from one formula such as follows. These formulas have been worked out by the writer during his ten years commercial experience and constitute the main original part of this thesis.

**General Fruit Formula**

100 pounds of fruit, or fruit mixture freed from excess juice
100 to 125 pounds sugar
3 to 5 gallons juice (all it will take for the sake of reducing cost)
Color to suit product and give an attractive appearance after cutting
Flavor to stand cutting
Acid to mask excess sugar
One tenth of one per cent sodium benzoate

**Specific Formula - Strawberry**

Drained and weighed fruit from one barrel two-plus-one strawberries
One pound sugar to each pound of fruit
8 ounces of strawberry red color liquid
Heat to 180 degrees F. to insure complete solution of the sugar
Add
16 ounces fruit acid
2 gallons of juice
1/2 pound of benzoate of soda in two quarts of water
16 ounces of true fruit extract
Mix thoroughly.

Specific Formula - Pineapple

60 No. 10 tins crushed pineapple packed in its own juice. Each can has a net weight of 6 pounds, 10 ounces.

Drain off 23 gallons of juice.
To the drained fruit add
8 ounces fruit acid
1/2 pound benzoate of soda in two quarts of water
300 pounds of sugar
Heat with stirring to 180 degrees F. to dissolve sugar.

The yield is 30 gallons.

Crushed pineapple manufactured under a somewhat different formula is the only product which at present has been successfully manufactured for soda fountain use under reduced pressure. A formula for this product is as follows:

210 No. 10 tins of pineapple
1 1/4 pounds benzoate of soda in one gallon of water
12 ounces fruit acid
1425 pounds sugar

25 gallons water

16 ounces pineapple G.F.X.

Concentrate to 68 per cent total solids (Abbe Refractometer).

The yield is 315 gallons.

The procedure under reduced pressure varies somewhat from open kettle work. Of necessity, the No. 10 tins must be opened and the entire contents dumped into barrels. This facilitates getting this material into the vacuum pan. A vacuum is developed within a vacuum pan, and the inlet hose put directly into the pineapple will take this fruit into the pan. Benzoate of soda and fruit acid are thrown into the fruit. The sugar in a dry form will also go through the inlet hose. The 25 gallons of water is used to dissolve the sugar that clings to the inside of the hose and to regulate the length of cook, thus insuring complete solution of the sugar. The G.F.X. is introduced to the finished product through the vacuum break.

Under the classification of fruit syrups come such products as grape syrup, lemon syrup, lemon and lime, orange, pineapple, raspberry and strawberry syrups.
General Fruit Syrup Formula

Fruit juice is made up to 35 or 36 degrees Beaumé with sugar.

Sufficient flavor, color and acid are added to stand cutting.

Add one tenth of one per cent sodium benzoate.

Specific Formula - Strawberry

39 gallons of strawberry from two-plus-one fruit at 23 degrees Beaumé

300 pounds of sugar

3 pints ponceau color solution (4 ounces ponceau, made up to one gallon with water)

1/2 pound sodium benzoate in two quarts water

1 gallon strawberry true fruit extract

Specific Formula - Pineapple

100 gallons pineapple juice

1380 pounds sugar

2 pounds benzoate of soda in two quarts water

400 ounces pineapple B.F.X.

Under the classification of flavored syrups come such products as birch beer, cherry, wild cherry, coffee, ginger, ginger ale, maple, sarsaparilla, vanilla, banana and root beer. These syrups are all alike
except in flavor and are made by adding to a certain
amount of extract or flavor enough simple syrup to make
one gallon.

In addition to the above general method, the
following specific formulas are, with some variations,
in general use. Certain formulas used for compar-
ison with general method are not repeated.

Banana Extract, Imitation

6 ounces Baker's Analyzed amyl acetate
1/2 gallon grain alcohol
1/2 gallon water
2 drams yellow color liquid

The yield is one gallon.

These ingredients are simply mixed together,
usually the amyl acetate is mixed with the alcohol, and
the color with the water. The two resulting solutions
are then combined.

Banana Syrup, Imitation

10 gallons simple or pineapple syrup
80 fluid ounces banana extract, imitation
5 ounces yellow color liquid
1 1/2 ounces dry sodium benzoate

The yield is 10.5 gallons.
This formula shows the use of an excess product to little advantage. When the extract is added it is so strong that the pineapple is not tasted and yet a body or texture might be given to the syrup that otherwise might be lacking.

**Birch Beer Extract, Imitation**

- 108 fluid ounces methyl salicylate
- 18 fluid ounces oil sassafras
- 13 gallons grain alcohol (190 proof)
- 7 gallons water
- 2 gallons sugar color
- 5 ounces amaranth color liquid

The yield is 23 gallons.

**Birch Beer Syrup, Imitation**

- 12 ounces birch beer extract
- 1/2 ounce sugar color

Make up to one gallon with benzoated simple syrup.

**Cherry Syrup, Imitation**

- 20 gallons strawberry syrup from cold pack fruit (28 degrees Beaumé)
- 105 pounds sugar
- 1/4 pound sodium benzoate (dry)
- 8 ounces raspberry red
- 30 ounces guinea green
- 35 ounces strawberry red
- 1 pound citric acid dissolved in one quart of water
Heat until solution is complete, not over 150 degrees F.

Add
52 ounces true fruit cherry extract
80 cc. ben zaldehyde in 4 ounces of alcohol
Put together in order indicated.

The yield is 30 gallons.

Chocolate Flavored Syrup

198 pounds cocoa
500 pounds sugar
Mix to aid dispersion.
376 pounds sugar
63 gallons water
5$\frac{1}{2}$ ounces vanillin
50 cc. cou marin solution *
2$\frac{3}{4}$ pounds salt
1 pound 10$\frac{1}{2}$ ounces benzoate of soda

The yield is 206 No. 10 cans.

Part of sugar and cocoa are mixed together and thrown on top of the heated water. The other ingredients are added in rotation and brought to boiling.

* 2 ounces coumarin made up to a quart with 190 proof alcohol.

Chocolate Flavored Syrup, Double Strength
Double cocoa and flavors. (See chocolate flavor syrup formula)
Coffee Syrup

17 gallons water
1 gallon corn syrup
1 gallon glycerine
300 pounds sugar
1/2 pound benzoate of soda
1 quart sugar color
168 ounces coffee extract

The yield is 42 gallons.

This syrup is a flavored simple syrup containing corn syrup to produce oiliness or body. All coffee extracts and syrups contain glycerine. There seems to be no proof that glycerine is a preservative or has any other desirable effect, but it is very generally used.

Ginger Syrup

60 ounces water
7 pounds sugar
4 ounces ginger extract
5 grams benzoate of soda (dry)
6 cc. sugar color

This is a flavored simple syrup.
Grape Syrup

10½ gallons grape juice
150 pounds sugar
1/4 pound benzoate of soda in one quart of water
1 gallon corn syrup
4 ounces raspberry red
42 ounces grape G.F.X.

Lemon Syrup, I.

4 crates of lemons (300 count)
Peel 2 crates
Extract juice from all fruit
Add 20 gallons of water to the pulp and again extract

To the combined juices add sugar to 35 degrees Beaumé.

Grind the peel previously removed
Add 3 gallons of alcohol and let stand overnight
Press the peel and add the liquid to the syrup
Color with tartrazine and make total mix again to 35 degrees Beaumé concentration with sugar.

Lemon Syrup, II

47 gallons burred lemon juice
55 gallons water
1700 pounds sugar
2 pounds benzoate of soda dissolved in one gallon water
1 quart yellow color
Emulsify the materials listed below and add to the above syrup
10 pints oil lemon
10 pounds gum arabic
20 pints water
The yield is 240 gallons.
Two formulas are given here because lemon is considered a very important syrup and these are the two principal methods used. Each method has advantages and disadvantages. Number I is expensive of time and has a short shelf life but is a superior syrup when fresh. Number II is less expensive and has a long shelf life but never is as good as Number I when freshly made.

Lemon and Lime Syrup
10 gallons burred lemon juice
15 gallons lime juice
29 gallons water
850 pounds sugar
$\frac{1}{4}$ pounds benzoate of soda
Emulsify the materials listed below and add to the above syrup
5 ounces oil lime
3 pints oil lemon
6 pints 10 ounces water

The yield is 120 gallons

Lemon and lime is often sold colored green, in which case green and yellow color is added to the above syrup.

Orange

11 gallons concentrated orange juice (6 to 1)
90 gallons water
2 pounds benzoate of soda
1650 pounds of sugar
2 gallons sunset yellow liquid (4 ounces dry sunset yellow made up to one gallon with water)

Emulsify the materials listed below and add to the above syrup

8 pints oil orange
8 pounds gum arabic
16 pints water

The yield is 240 gallons.

Orangeade

15 gallons concentrated orange
90 gallons water
17 pounds citric acid dissolved in 5 gallons of water
2½ pounds benzoate of soda dissolved in one gallon water
1650 pounds sugar
1 gallon sunset yellow liquid
Emulsify the materials listed below and add to the above syrup:
4 pints oil orange
4 pounds gum arabic
8 pints water

The yield is 240 gallons.

Orangeade being one of the best sellers a formula is here included to show the difference between an ade and a syrup.

**Pineapple Syrup**

100 gallons pineapple juice
1380 pounds sugar
2 pounds benzoate of soda
400 ounces pineapple G.F.X.

The yield is 200 gallons.

**Raspberry Syrup**

Take two parts red raspberry juice to one part of black raspberry juice and make up to 36 degrees Beaumé with sugar and add coloring.
Another formula for raspberry syrup is as follows:

20 gallons pure red raspberry juice
5 gallons loganberry juice
15 gallons strawberry juice
16 ounces strawberry red
12 ounces raspberry red
1/2 pound benzoate of soda in one quart of water
425 pounds sugar
1 gallon raspberry G.F.X.

**Root Beer Syrup**

340 pounds sugar

3 ½ gallons sugar color
5 grams vanillin in one pint water

19 ½ gallons water

Heat to 180 degrees F.

Emulsify the materials listed below and add to the above syrup:

20 ounces oil sassafras
9 ounces methyl salicylate
1 ½ ounces oil cassia
4 ounces ginger extract
8 ounces tincture gentian
3 ounces gum arabic
60 ounces water
Cool somewhat and homogenize.

A true herb extract, of course, makes a finer syrup, but the average fountain supply house uses this type or buys and resells "Hires" root beer. Usually this is a slow seller except for a few houses that specialize in root beer.

Strawberry Syrup

39 gallons strawberry syrup (two-plus-one)
23 degrees Beaumé
300 pounds sugar
3 pints ponceau liquid color
1/3 pound benzoate of soda dissolved in one quart of water
Heat to put the sugar into solution, not over 150 degrees F.
Cool and add
1 gallon strawberry G.F.X.
*Strawberry syrup is greatly improved by adding 5 gallons blackberry syrup to 100 gallons of the above.
*Reference - Cruess & Christie
Vanilla Syrup

44 gallons simple syrup
8 ounces sugar color
3 gallons 10X vanilla extract

In the following group of formulae there are many possible variations and substitutions. There would be no way of putting them all here. In each case, however, a tried and marketed formula is presented.

Butterscotch

6 gallons water
20 gallons corn syrup
10 pounds corn starch
10 pounds butter
3 quarts vinegar
200 pounds sugar
2 ounces sugar color

The yield is 40 gallons.

Cold water is put into a kettle and corn starch thoroughly mixed with it. Corn syrup and sugar are then added and the mixture heated to boiling. When boiling, add butter, color, and vinegar. Heat to 234 degrees F., cool somewhat and homogenize at 3000 pounds pressure.
Caramel Fudge

5 gallons water
20 gallons corn syrup
10 pounds corn starch
10 pounds butter
24 ounces gelatin soaked 1/3 hour in one gallon warm water
200 pounds sugar
2 1/2 ounces sugar color

Cold water is put into a kettle and corn starch thoroughly mixed with it. Corn syrup and sugar are then added and the batch is heated. When boiling add butter, gelatine and color. Heat to 328 degrees F. Cool somewhat and add 4 grams vanillin and 2 grams salt. Homogenize at 2500 pounds pressure.

Cherries, Whole, Whole and Broken, Crushed.

As a general rule washing, coloring and flavoring cherries that have been sulfured is a separate business and the crushed fruit manufacturer usually buys these in bulk and packs them under his own label.

Frozen Pudding

38 gallons crushed pineapple (returned goods or that made up as crushed pineapple, not the product taken from tins)
5 cases No. 10 tins pineapple wedges, 16ths
125 pounds broken cherries
30 pounds cut citron
125 pounds black raisins
75 pounds white raisins
50 pounds shredded orange and lemon peel
20 ounces red color (liquid)

There seems to be no standard or required procedure, the ingredients are simply mixed together.

Chocolate Fudge
32 pounds corn syrup
40 pounds sugar

1\(\frac{1}{2}\) gallons water
1/8 ounce salt

Heat to 210 degrees F.
Then put in beater and add slowly:
24 pounds melted chocolate liquor

Cool by beating and add:
6 pounds salt butter
3 quarts heavy cream

Instead of the procedure as given, all the ingredients may be mixed together and then homogenized.
**Ginger Glacé**

This product is simply ground cargo ginger with or without simple syrup added.

**Marshmallow**

20 pounds corn syrup
20 pounds sugar

Heat to 230 degrees F. This heated mixture is commonly called "bob" syrup.

Put into the beater 70 pounds corn syrup and then add hot "bob" syrup

Start the beater and add:

1 pound egg albumen soaked in 1 quart of water

8 ounces vanilla extract

Beat until the product has a density of 5 pounds to the gallon.

**Crushed Raspberries, Raspberry Fruit**

Put 1 barrel of (two-plus-one) raspberries in a kettle and heat to 180 degrees F.

Allow to stand 10-15 minutes and heat again with stirring to 200 degrees F.

Let stand 1 hour and drain off juice from bottom of kettle (Use for syrup)

Weigh the balance in kettle and add 0.7 pound sugar to each pound of fruit.

Add: 10 ounces raspberry red color
1/2 pound benzoate of soda in 1 pint water
Heat to 180 degrees F. and then cool.
Add: 2 gallons corn syrup
8 ounces fruit acid.

Walnuts in Syrup

Walnuts are picked over to remove shells, hair or any foreign substance and chopped to the desired size. Two and one quarter pounds of chopped nut meats just fill a two quart jar. The nut meats are then covered with a syrup that ranges all the way from simple syrup through the imitations and reconstructed pure maple, to pure maple syrup. Perhaps the best for Manchurian nut meats is simple syrup with a small amount of colorless imitation flavor. These nuts soon darken any syrup and impart a bitter flavor. As the grade of nut improves so may the syrup, until a Chabert nut meat from France will take a true maple flavor. If softening of the nut is experienced a small quantity of alcohol in the syrup seems to stop this trouble.

In practically all syrups that are flavored with oils the custom has been to emulsify the oils with gums. There are available several prepared gum mix-
tures for this purpose and all make good emulsions. As the shelf life of a syrup, in which a gum emulsion has been used, lengthens, the gums dyed with the coloring matter float to the surface and form a ring that does not readily shake loose and never again mixes with the syrup by shaking. In order to eliminate this trouble some manufacturers have turned to alcohol to cut the flavoring oil. Because of the expense of alcohol the general use of pectin emulsions has been resorted to lately. The formula of this emulsion follows.

**Pectin Emulsion**

- 8 pints flavoring oil
- 2 pounds emulsifying pectin (usually citrus pectin)
- 4 gallons water
- 15 ounces glycerine

Put oil and pectin into a beater and while beating violently add glycerine and water mixed. Mix for five minutes and allow to stand five minutes. Homogenize at 2500 pounds and bottle.

V. ARTIFICIAL COLORS USED IN CRUSHED FRUIT PRODUCTS

Colors for these products can be made up in any
number of ways. The majority of manufacturers seem to be adopting a standard of four ounces of dry color made up to one gallon with water in all cases except green, where five grams is sufficient for one gallon of water.

Strawberry red is ponceau.
Raspberry red is amaranth.
Yellow color is tartrazine.

Grape shade for use in syrup containing pure grape juice is made as follows:

- 2 ounces ponceau
- 1 ounce amaranth
- 1 ounce indigo disulfoacid
- 1/4 ounce guinea green B
- 1/4 ounce tartrazine

Make up to one gallon with water.

Maraschino cherry shade is made by mixing 82 parts ponceau S.X. with 18 parts amaranth.

Lime green is prepared by mixing 9 parts tartrazine with 1 part fast green F.C.F.

VI. SUGGESTIONS TO REMEDY DIFFICULTIES ENCOUNTERED IN GENERAL FACTORY PRACTICE.

Crushed fruits and syrups are mostly of an acid
nature and of high sugar content, therefore, when manufactured with one tenth of one per cent of benzoate of soda there is very little spoilage. However, most factories have considerable dampness from steam and wash water, breaks in concrete floors and leaky valves which mean water is present all the time. With this moisture and the heat from steam jacketed kettles, fruits, fruit juices and sugar, conditions are ideal for mold and yeast growth, so that every precaution must be taken. A pool of apparently clear water on the floor at night will have a scum and all signs of active fermentation on it in the morning. A bit of food or unsweetened fruit will be covered with mold over night and in two or three days will show black and green and often red and yellow growths of molds. A miscalculation as to the amount of preservative will quickly show up on the surface of the contents of jars and jugs as mold. Products such as cherries and often mixed fruits or materials which may be made for ice cream manufacturers and, therefore, low in sugar content have a tendency to rapid fermentation. In manufacturing processes it may not always be convenient to utilize pineapple, raspberry, strawberry or other juice the day it is taken from the fruit, and unless great care is used yeasts will make it unfit for use over night.
Products manufactured and sold to retailers are often stored without covers and more often in dirty damp places, and later are returned to the factory. The returned products must be carefully sorted so that the factory does not become contaminated. Mice, rats and water bugs are also prevalent sources of contamination. A war must be continually waged against yeasts and molds which seem to be on everything ready to grow if given even a slight chance.

Products commonly sold in No. 10 tins almost universally carry the customary one tenth of one per cent benzoate of soda. Manufacturers are gradually learning the limitations of this preservative and more and more goods with a pH greater than 3.5, or goods with low sugar content, are being processed in tin cans. This has led to the introduction of smaller cans than the No.10 tin in order that the ultimate consumer will use the entire contents of a can to fill a fountain pump or make one batch of ice cream. These smaller cans, although slightly more expensive, eliminate spoilage that would occur even with the benzoate of soda unless the preservative was used in greater amounts than permissible by law.

Bacteria seem to cause but very little trouble. In fifteen years experience one case of putrefaction due
to bacteria has been witnessed and this was quickly eradicated.

The mechanical difficulties encountered have a way of showing up when most annoying. A splinter of wood from a barrel, a piece of a bung, the string from a sugar bag, paper from a sugar barrel, an ugly piece of dirt, a broken piece of glass, or whatever may get into a batch, will appear when a deal is about to be closed with a good customer who has been hard to sell.

VII. CONCLUSION.

An effort has been made to portray in word picture the general crushed-fruit-and-syrup business as it is today. The research effort that has been applied to this subject, other than here contained, has been practically entirely done by individual plant chemists and these have kept this information to themselves.

There is no way of writing any set of formulae and considering the proposition settled because of the nature of the materials handled. A variation of a few per cent total solids, considerable variation in fat content of some products, and a comparatively wide variation in soluble or insoluble solids do not change the product or its nature, and may give individuality to one
manufacturer's products when compared with another's. Therefore there is the necessity of always considering the information given as an aid rather than a rule for the manufacture of soda fountain products.
VIII. BIBLIOGRAPHY.

1. Campbell, Clyde H.
   1939 "Campbell's Book"
   Canning Age, New York, New York.

2. Chenoweth, W. W.
   1930 "Food Preservation"

3. Cruess, W. V.
   1924 "Commercial Fruit and Vegetable Products"

4. Cruess, W. V. & Christie, A. W.
   1933 "Laboratory Manual of Fruit and Vegetable Products"

5. Dubelle, G. H.
   1917 "Soda Fountain Beverages"
   Spon & Chamberlain, New York, N.Y.

6. Sherman, Henry C.
   1923 "Food Products"
   The MacMillan Co., New York, N.Y.

7. Trade Journals
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